Pseudocode
1995-2019
May/June 1995

Question 10:
A shop sells items each of which has a unique identifying number. When a customer purchases an item, its identifying number is entered at a terminal. A computer looks up this number in a file and returns the description and price of the item. After the last item a '#' is entered and the computer calculates the change.

Part of the file item stocking shown here.

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1276</td>
<td>Pop</td>
<td>65</td>
</tr>
<tr>
<td>1489</td>
<td>Chocolate Bar</td>
<td>85</td>
</tr>
<tr>
<td>2371</td>
<td>Plain Biscuit</td>
<td>80</td>
</tr>
<tr>
<td>2483</td>
<td>Chocolate Biscuit</td>
<td>90</td>
</tr>
<tr>
<td>3514</td>
<td>Cereals</td>
<td>130</td>
</tr>
<tr>
<td>3515</td>
<td>Butter</td>
<td>90</td>
</tr>
<tr>
<td>3760</td>
<td>Eggs</td>
<td>70</td>
</tr>
<tr>
<td>4010</td>
<td>Tin Soup</td>
<td>60</td>
</tr>
<tr>
<td>4127</td>
<td>Tin Fruit</td>
<td>80</td>
</tr>
</tbody>
</table>

(a) Write an algorithm to allow a till receipt to show
   • The name of each article purchased
   • Its price
   • The total cost of purchases
   • The amount the customer offers
   • The change due to the customer.

Test your algorithm with this data.
3514
2371
3760
4010
#
500

(a) total = 0
       read code
       While code <> # Do
       Look up description & price
       Print description & price
       Total = total + price
       Read code
       Endwhile
       Print total cost
       Read amount offered
       Print offered offered
       Catalogue & print change.

Question 13:
The following algorithm is used to award grades in an examination. The examination consists of two papers which are given marks called mark A and mark B.
READ name, mark A, mark B
IF mark A is greater than 70 THEN
    IF mark B is greater than 70 THEN
        Grade is 1
    ELSE
        IF mark B is greater than 40 THEN
            Grade is 2
        ELSE
            Grade is fail
        ENDIF
    ENDIF
ELSE
    IF mark A is greater than 40 THEN
        Grade is 3
    ELSE
        Grade is fail
    ENDIF
ELSE
    Grade is fail
ENDIF
ENDIF
ENDIF
ELSE
    Grade is fail
ENDIF
PRINT name, grade

For each of the following sets of data write down the output.
(a) John Williams, 80, 85 .................................................................
(b) Mary Brown, 45, 60 .................................................................
(c) Ian Ford, 40, 39 ................................................................. [6]

(a) John Williams I
(b) Mary Brown 3
(c) Ian Ford Fail

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May/June 1997:
Question 14:
Wages at Microsoft are paid using $ 20 and $ 10 bank notes.
Write an algorithm which will:
• Input a request for a sum of money
• Only accept a sum of money which is multiple of 10
• Output the number of $20 notes required
• Output the number of $ 10 notes required.
The total number of notes should be minimum
You should explain the meaning of any functions that you use. [6]
Oct/Nov 1997:

Question 11:
Mr Grantham grades his students' examination marks. To do this he needs to know the lowest and highest marks, the range of marks (highest minus lowest) and the average mark, (the total number of marks divided by the number of students). There are 30 students in the class and the marks are out of 100.

(a) Using this design, or otherwise, write an algorithm to read the marks and to print the smallest mark, largest mark, range of marks and average mark [10]

(b) Give two advantages of using top-down design solving such a problem.
Advantage 1...........................................
Advantage 2............................................ [2]
Computer Science 2210

(a) READ mark
    LOWEST = mark
    HIGHEST = mark
    TOTAL = mark
    FOR I: 1 to 30 DO
        READ mark
        IF mark is less than lowest THEN
            Lowest = mark
        ENDIF
        IF mark is greater than highest THEN
            Highest = mark
        ENDIF
        Total = total + mark
    NEXT I
    Range = highest - lowest
    Average = total/30
    PRINT lowest, highest, range, average

(b) Advantage 1: It is easy to write and to modify
    Advantage 2: The main task is split into further tasks so it is easy to understand.

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May/June 1999:
Question 14
Read this algorithm.
Value = 0
Next-value = 0
Input Value
Input Next-value
While Next-value is not equal to zero do
    If Next-value is greater than Value then
        Value is equal to Next-value
    Endif
    Input Next-value
Endwhile
Output Value

(a) What is the output if the following numbers are input.   [2]
(b) Write a modified algorithm to solve the same problem but always end after four, numbers have been input [3]
(a) 8
(b) Value = 0
    Next-value = 0
    Counter = 0
    Input Value
    Input Next-value
    Repeat
        If Next-value is not equal to zero do
            Value is equal to Next-value
        End if
        Input Next-value
    Until Counter is <=4
End while
Output Value
Oct/Nov 1999:
Question 16:
A microprocessor controls an oven used to bake bread.
(a) Describe the input data needed by the microprocessor
(b) Write an algorithm that uses the input data to control the process of baking the bread

(a) The temperature at which the cake has to be baked and the time of the baking process. Also, program number (already stored programs) and weight of the dough could be input.

(b) Select baking on the oven
   Time = 0
   Temperature = 0
   Input time = t
   Input Temperature = p
Switch Heater on
Switch timer on
   If temperature >= p
      Switch Heater off
   If time >= t
      Sound Buzzer
Endif
Endif

Oct/Nov 2000:
Question 17
Using pseudo code or otherwise, write an algorithm which will accept ten numbers and print out the smallest number.

READ number
LOWEST = number
(Process rest of number)
(Loop to read next 9 numbers)
FOR i = 2 to 10 DO
READ mark
   IF number is less than lowest THEN
      Lowest = number
ENDIF
NEXT i
PRINT LOWEST

May/June 2001:
Question 17
An algorithm is needed to input the heights of 15 students in centimeters and print out the height of the tallest student in meters and centimeters.
Write a detailed algorithm to do this.
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READ height
HIGHEST = height
(Loop to read next 14 heights)
FOR i = 2 to 14 DO
    READ height
    IF height is greater than HIGHEST THEN
        HIGHEST = height
    ENDIF
NEXT i
Height in meters = highest/100
PRINT Height in meters, highest

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Oct/Nov 2001:

Question 16:
Employees of a shop are entitled to a discount of 10% on the value of goods bought from the shop. However, if an employee has worked at the shop for five or more years, they are entitled to a discount of 20%. Only employees are allowed discounts. The discount on electrical goods is fixed at only 10%.

Using pseudo code or otherwise, write and algorithm which will determine what discount applies when any person buys them.

Oct/Nov 2002:

Question 19:
Using pseudocode or otherwise, write an algorithm which will input any three different numbers and then print them out in ascending order.

Set a, b, c = 0
Input a, b, c
Max: = a
Min: = a
IF b > max then
    Max: = b
ELSE
    IF b < min then
        Min: = b
ELSE
    IF c > max then
        Max: = c
ELSE
    IF c < min then
        Min: = c
End if
Print min
IF a ≠ max AND a ≠ min then
May/June 2003:
Question 17:
A school wants to monitor the number of hours spent by a class of 30 students on the Internet.
Using pseudo-code or otherwise, write an algorithm which will;
• for each student, record the times logged on and logged off
• calculate the length of time each student spends online
• calculate and output the average length of time per day spent by each student on the Internet.

OCT/NOV 2003:
Question 16:
(a) Write an algorithm, using pseudocode or otherwise which;
• inputs 50 numbers.
• checks whether each number is in the range 1000 to 9999.
• outputs how many of the input numbers were out of range.
• outputs the percentage of input numbers which were out of range. [6]

Question 15
Read this algorithm. The algorithm converts a temperature from degrees Centigrade to degrees Fahrenheit.

\[
\text{Input} \\
C_{\text{temp}} \\
\rightarrow \\
F_{\text{temp}} = (1.8 \times C_{\text{temp}}) + 32 \\
\rightarrow \\
\text{Output} \\
F_{\text{temp}}
\]

(a) Write down the output for each of the following inputs:
(i) 1 [1]
(ii) 5 [1]

(b) Using pseudocode, or otherwise, write an algorithm that will input the hourly temperatures for one day in Centigrade and print out in Fahrenheit
• the maximum temperature
• the minimum temperature
• the average temperature
for that day.
(a) (i) 33.8 . . . . . 
(ii) 41
(b) (i) sum = 0 
min = 100 
max = 0 
count = 1 
while count <= 24 do 
input temp 
F = (temp*1.8) + 32 
sum = sum + F 
if F < min then min = F 
if F > max then max = F 
count = count + 1 
endwhile 
average = sum/24 
print average, min, max
(ii) sum = 0 
min = 100 
max = 0 
count = 1 
repeat 
input temp 
F = (temp*1.8) + 32 
sum = sum + F 
if F < min then min = F 
if F > max then max = F 
count = count + 1 
until count > 24 
average = sum/24 
print average, min, max

OCT/NOV 2004:
Question 19:
The following diagram shows a rail network.
The rail network consists of 10 stations. The fare between each station is $2. There is a 10% discount when 3 or more passengers travel together. Tickets can be purchased at any station using automated terminals.

Using pseudocode, or otherwise, write an algorithm for the automated terminals to:
• input the starting station number, the destination station number and the number of passengers
• calculate the total fare and output the amount to be paid
• calculate the change (if any)
• issue the rail ticket(s) and change [3]

```
repeat
  input start_point
  input end_point
  input number
  cost = abs(start_point - end_point) * number * 2
  if number >= 3 then cost = cost - (cost/10)
  input money
  change = money - cost
  for x = 1 to number
    print ticket
  next x
  output change
until no more customers
```

May/June 2005:
Question 17:
Using pseudocode or otherwise, write an algorithm that will input 25 marks and output the number of DISTINCTION, MERIT, PASS or FAIL grades.
A mark greater than 69 will get a DISTINCTION, a mark between 69 and 60 (inclusive) will get a MERIT and a mark between 59 and 50 (inclusive) will get a PASS.
10 INPUT MARK
20 FOR M = 1 To 25
30 IF MARK > 69
40 PRINT DISTINCTION
50 ELSE IF MARK < 69 AND > 60
60 PRINT MERIT
70 ELSE IF MARK < 59 AND > 50
80 PRINT PASS
90 ELSE PRINT FAIL
100 END IF
110 NEXT M
120 END IF

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OCT/NOV 2005:
Question 17:
A school uses a computer to store student marks obtained in an end of term mathematics exam. There are 150 students doing the exam and the maximum mark is 100. Write an algorithm, using pseudocode or otherwise, which
• inputs the marks for all students
• checks if each mark is in the correct range and, if not, the mark is re-input
• outputs the smallest mark
• outputs the highest mark
• outputs the average mark for the exam.

m1 = 100
m2 = 0
sum = 0
n = 1
while n < 151 do
  repeat
    read mark
  until (mark >= 0 and) mark <101
  if mark < m1 then m1 = mark
  if mark > m2 then m2 = mark
  sum = sum + mark
  n = n + 1
endwhile
average = sum/150
output average, m1, m2

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May/June 2006:
16 (a) Fuel economy for a car is found using the formula:

\[
\text{BMI} = \frac{\text{weight in kilograms}}{(\text{height in metres}) \times (\text{height in metres})}
\]

What would be the Fuel Economy of a car travelling 40 km on 10 litres of fuel? [1]

(b) The Fuel Economy for 1000 cars is to be calculated using the formula in Question 16(a). Write an algorithm, using pseudocode or otherwise, which inputs the Distance Travelled (km) and the Fuel Used (litres) for 1000 cars. The Fuel Economy for each car is then calculated and the following outputs produced:
• Fuel Economy for each car
• average (mean) Fuel Economy for all of the cars input
• the best Fuel Economy (i.e. highest value)
Oct/Nov 2006:

9 A computer program is required which inputs 10 numbers, multiplies them together and finally outputs the answer (the product). The following algorithm has been written to do this.

(a) There are three errors in the algorithm. Locate and describe these errors. [3]
(b) A while ... do loop has been used in the algorithm. State another type of loop that could have been used. [1]

(b) Accept either of the following loop controls:

repeat OR
until count = 10
(accept repeat
until count ≥ 11

if line 1 changed to count = 1)
Temperatures (°C) are being collected in an experiment every hour over a 200-hour period. Write an algorithm, using pseudocode or otherwise, which inputs each temperature and outputs

• How many of the temperatures were above 20°C
• How many of the temperatures were below 10°C
• The lowest temperature that was input

```
count = 0
total1 = 0
total2 = 0
lowest = 1000
while count < 200 do
    input temp
    if temp < 10 then total1 = total1 + 1
    if temp > 20 then total2 = total2 + 1
    if temp < lowest then lowest = temp
    count = count + 1
endwhile
output total1, total2, lowest
```

May/June 2007:
A company has 5000 CDs, DVDs, videos and books in stock. Each item has a unique 5-digit code with the first digit identifying the type of item, i.e.

1 = CD
2 = DVD
3 = video
4 = book

For example, for the code 15642 the 1 identifies that it is a CD, and for the code 30055 the 3 identifies that it is a video.

Write an algorithm, using pseudocode or otherwise, that
• Inputs the codes for all 5000 items
• Validates the input code
• Calculates how many CDs, DVDs, videos and books are in stock
• Outputs the four totals.

Sample program 1:
```
set c, d, v, b = 0: set count = 0
repeat
    input code
    x = code/10000
    y = INT(x)
    if y = 1 then c = c + 1
    else if y = 2 then d = d + 1
    else if y = 3 then v = v + 1
    else if y = 4 then b = b + 1
    else print "error"
    count = count + 1
until count = 5000
print c, d, v, b
```

Sample program 2:
```
set c, d, v, b = 0: set count = 0
repeat
    input code
    if code >= 1000 and code < 2000 then c = c + 1
    else if code >= 2000 and code < 3000 then d = d + 1
    else if code >= 3000 and code < 4000 then y = y + 1
    else if code >= 4000 and code < 5000 then b = b + 1
    else print "error"
    count = count + 1
until count = 5000
print c, d, v, b
```

(Note - OK to use statements such as if code begins with a 1 as code checks)

Oct/Nov 2007:
16 (a) Fuel economy for a car is found using the formula:

\[
\text{Fuel Economy} = \frac{\text{Distance Travelled (km)}}{\text{Fuel Used (litres)}}
\]
What would be the Fuel Economy of a car travelling 40 km on 10 litres of fuel? [1]

(b) The Fuel Economy for 1000 cars is to be calculated using the formula in Question 16(a). Write an algorithm, using pseudocode or otherwise, which inputs the Distance Travelled (km) and the Fuel Used (litres) for 1000 cars. The Fuel Economy for each car is then calculated and the following outputs produced:
- Fuel Economy for each car
- average (mean) Fuel Economy for all of the cars input
- the best Fuel Economy (i.e. highest value)
- the worst Fuel Economy (i.e. lowest value)

(a) \[ \frac{40}{10} = 4 \]
(b) total = 0, count = 0, best = 0, worst = 1000
 repeat
   input litres, distance 
   economy = distance/litres 
   print economy 
   if economy > best then best = economy 
   if economy < worst then worst = economy 
   total = total + economy 
   count = count + 1 
 until count = 1000 
 average = total/1000 
 print average, best, worst 

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May/June 2008:
12 Algorithms and programs use loops to control the number of times a particular procedure is used. Two methods are repeat ... until and for ... to.
(a) Write a procedure using both these loop methods to input 20 numbers into a variable called x.
(i) repeat ... until [2]
(ii) for ... to [2]
(b) Name another loop structure. [1]

(a)(i) 
 count = 0
 repeat
   input x
   count = count + 1
 until count = 20

(ii)
 for count = 1 to 20
   input x
 next count

(b) while...do

Question 16:
The washroom in a hotel uses lights controlled by a computer system. If the washroom is unoccupied for 10 minutes, the lights go out automatically. As soon as someone enters, the lights come on.

(b) Write down a set of instructions which would enable the computer to decide when to turn out the lights?
repeat
  get signal from sensor
  if signal then set timer = 10
  else if timer = 0 then switch light off
  else countdown timer
until system switched off

19 Customers can withdraw cash from an Automatic Teller Machine (ATM).
• withdrawal is refused if amount entered > current balance
• withdrawal is refused if amount entered > daily limit
• if current balance < $100, then a charge of 2% is made
• if current balance $100, no charge is made
Write an algorithm which inputs a request for a sum of money, decides if a withdrawal can be made and calculates any charges. Appropriate output messages should be included. [5]

input amount
  if amount > balance then x = 1
  else if amount > daily limit then x = 1
  else x = 0
  while x = 0
    if balance < 100 then charge = 0.02 * amount
    else charge = 0
  endwhile
if x = 1 then print “Sorry, withdrawal refused”
print charge

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Oct/Nov 2008
19: The manufacturing cost of producing an item depends on its complexity. A company manufactures three different types of item, with costs based on the following calculations:
  • Item type 1: item cost = parts cost * 1.5
  • Item type 2: item cost = parts cost * 2.5
  • Item type 3: item cost = parts cost * 5.0
The company makes 1000 items per day.

Write an algorithm, using pseudocode, flowchart or otherwise, which
• inputs the item type and parts cost of each item
• outputs the item cost for each item
• calculates and outputs the average (mean) item cost per day (based on 1000 items being made). [5]
Computer Science 2210

May/June 2009
18: A small airport handles 400 flights per day from three airlines:
   FASTAIR (code FA)
   SWIFTJET (code SJ)
   KNIGHTAIR (code KA)

Each flight is identified by the airline code and 3 digits. For example, FA 156.
Write an algorithm, using pseudocode or otherwise, which monitors the 400 flights into and out of the airport each day. The following inputs, processing and outputs are all part of the monitoring process:

- input flight identification
- calculate number of flights per day for each of the three airlines
- output the percentage of the total flights per day by each airline
- any validation checks must be included [5]

Oct/Nov 2009. P11
17 (a) A car’s speed is measured between points A and B, which are 200 km apart.

The final speed of the car is calculated using the formula:
What is the final speed of a car if it takes 2 hours to get from A to B? [1]
(b) Write an algorithm, using pseudocode or otherwise, which inputs the times for 500 cars, calculates the final speed of each car using the formula in part (a), and then outputs:
- the final speed for ALL 500 cars
- the slowest (lowest) final speed
- the fastest (highest) final speed
- the average final speed for all the cars. [6]

(a) \( 100 \text{ (km/hr)} \)
(b) \( \begin{align*}
    & \text{total} = 0 \\
    & \text{highest} = 0 \\
    & \text{slowest} = 1000 \\
    & \text{for } n = 1 \text{ to 500} \\
    & \quad \text{input time} \\
    & \quad \text{finalspeed} = \frac{200}{\text{time}} \\
    & \quad \text{print finalspeed} \\
    & \quad \text{total} = \text{total} + \text{finalspeed} \\
    & \quad \text{if finalspeed} > \text{highest} \\
    & \quad \quad \text{then} \text{highest} = \text{finalspeed} \\
    & \quad \text{if finalspeed} < \text{slowest} \\
    & \quad \quad \text{then} \text{slowest} = \text{finalspeed} \\
    & \text{next } n \\
    & \text{average} = \frac{\text{total}}{500} \\
    & \text{print average, highest, slowest}
\end{align*} \)

May/June 2010. P12
16 (a) Write an algorithm, using pseudocode or a flowchart, which:
- inputs 50 numbers
- outputs how many of the numbers were > 100 [3]

(b) Write an algorithm, using pseudocode or a flowchart, which:
- inputs 100 numbers
- finds the average of the input numbers
- outputs the average [3]

(a) \( \text{total} = 0 \)
(b) \( \text{total} = 0 \)
\( \text{for } x = 1 \text{ to 50} \)
\( \text{input number} \)
\( \text{if number} > 100 \text{ then } \text{total} = \text{total} + 1 \)
\( \text{next } x \)
\( \text{output total} \)

(b) \( \text{for } x = 1 \text{ to 100} \)
\( \text{input number} \)
\( \text{total} = \text{total} + \text{number} \)
\( \text{next } x \)
\( \text{average} = \frac{\text{total}}{100} \)
\( \text{output average} \)

May/June 2010. P11
18: A group of students were monitoring the temperature every day over a one-year period. Readings were taken ten times every day (you may assume a year contains 365 days).
Write an algorithm, using pseudocode or flowchart, which
- inputs all the temperatures (ten per day)
- outputs the highest temperature taken over the year
- outputs the lowest temperature taken over the year
outputs the average temperature per day
outputs the average temperature for the whole year

highest = -100; lowest = 100; total_year = 0

for c = 1 to 365
    total_day = 0
    for d = 1 to 10
        read temp
        total_day = total_day + temp
        total_year = total_year + temp
        if temp > highest then highest = temp
        if temp < lowest then lowest = temp
    next d

average_day = total_day/10
print average_day
next c

average_year = total_year/3650
print highest, lowest, average_year

12: A golf course charges $10 for each game of two people. Each additional person incurs a further charge of $2 per game. If they book two or more games in advance, they get a 10% discount on the total charge.

The following program has been written in pseudocode to calculate the charges for a game.

extracost = 0
input numberpeople, numbergames
charge = 10 * numbergames
extrapeople = numberpeople - 2
if numberpeople < 2 then extracost = 2 * extrapeople * numbergames
charge = extracost
if numbergames > 1 then charge = charge * 0.1
print charge

There are three errors in the program. Locate these errors and suggest a correct piece of coding.

- error
  line 5: numberpeople < 2 is incorrect
  correction: numberpeople > 2

- error
  line 6: the formula charge = extracost is incorrect
  correction: charge = extracost + charge

- error
  line 7: discount calculation charge = charge * 0.1 is incorrect,
  correction: charge = charge * 0.9
The following algorithm inputs 20 numbers and outputs how many numbers were positive (\(>0\)) and how many numbers were negative (\(<0\)).

```plaintext
1  negative = 1
2  positive = 1
3  for count = 1 to 20 do
4     input number
5     if number < 0 then negative = negative + 1
6     if number > 0 then positive = positive + 1
7     count = count + 1
8     print negative, positive
9  next count
```

There are three different errors in this algorithm. Locate each error and give the reason why you think it is an error. [6]

- line 1/negative=1 and/or line 2/positive=1
- negative and/or positive should be set to zero
- line 7/count=count+1
- don't need a count within a for .... to next loop
- replace loop with a repeat...until loop
- line 8/print negative, positive or line 9/next count
- outputs should come after the next count statement

A school is doing a check on the heights and weights of all its students. The school has 1000 students. Write an algorithm, using pseudocode or a flowchart, which

- inputs the height and weight of all 1000 students
- outputs the average (mean) height and weight
- includes any necessary error traps for the input of height and weight [5]

```
total1 = 0; total2 = 0
for x = 1 to 1000
   input height, weight
   if height > 2 or height < 0 then print "error": input height
   if weight > 130 or weight < 0 then print "error": input weight
   else total1 = total1 + height; total2 = total2 + weight
next x
average1 = total1/1000
average2 = total2/1000
print average1, average2
```

Write an algorithm, using pseudocode or a flowchart, which

- inputs a set of positive numbers (which end with -1)
- outputs the average (mean) value of the input numbers
- outputs the value of the largest (highest) number input [4]

Write an algorithm, using pseudocode or a flowchart, which

- inputs a whole number (which is > 0)
- calculates the number of digits in the number
- outputs the number of digits and the original number (E.g. 147 would give an output of 3, 147) [4]
(a) Write an algorithm, using pseudocode or otherwise, which:
• Inputs the name of the country
• Inputs the time in Italy in hours (H) and minutes (M)
• Calculates the time in the country input using the data from the table
• Outputs the country and the time in hours and minutes [4]

(b) Describe, with examples, two sets of test data you would use to test your algorithm. [2]
17 A school has 1800 students. The start date and leaving date for each student is stored on file. Dates are in the format YYMMDD (e.g. a student starting on 10th September 2007 and leaving on 4th August 2012 has the data 070910 and 120804 on file).

(a) Write an algorithm, using pseudocode or otherwise, which
• inputs Student ID for all 1800 students
• inputs the start date and leaving date for each student
• carries out a check to ensure the second date is later
• if error, increments error counter
• outputs the number of errors [5]

(b) Describe, with examples, TWO sets of test data you would use to test your algorithm. [2]

(a) total = 0
   for x = 1 to 1800
      input student_id, start_date, leaving_date
      if leaving_date <= start_date then total = total + 1
   next x
   print total

(b) normal data that will be accepted:
   – e.g. 110606 and 220710 or 060911 and 100722

abnormal data that should be rejected:
   – e.g. 150911 and 201009 or 110915 and 091020

negative numbers that should be rejected:
   – e.g. –110209 or –090211

month/day/year out of range that should be rejected:
   – e.g. 352210 or 102235

use of text that should be rejected:
   – e.g. September 15, 2010 or 15th September 2010
May/June 2012. P12
15 An estate agent advertises houses for sale. The customer enquiries for a 7-day working week are entered weekly into a computer. Write an algorithm, using pseudocode or a program flowchart only, which:

• inputs the number of customer enquiries each day,
• inputs the house price each customer enquiries about,
• outputs how many customers enquired each day about houses costing less than $100 000,
• outputs the percentage of all enquiries made during the week about houses costing more than $500 000.

sample program:
total2 = 0: totalenquiries = 0
for day = 1 to 7
   input enquiries
   total1 = 0
   totalenquiries = totalenquiries + enquiries
   for i = 1 to enquiries
      input cust_enquiry
      if cust_enquiry < 100000 then total1 = total1 + 1
      if cust_enquiry > 500000 then total2 = total2 + 1
   next i
   print total1
next day
percent = (total2/totalenquiries) * 100
print percent

Oct/Nov 2012. P12
17 (a) Write an algorithm, using pseudocode or a program flowchart only, that:
• inputs a series of positive numbers (-1 is used to terminate the input),
• outputs how many numbers were less than 1000 and
• outputs how many numbers were greater than 1000. [4]

(b)Write an algorithm, using pseudocode or a program flowchart only, that
• inputs fifty numbers each as 4 separate digits, for example: 1 5 4 1
• outputs the percentage of numbers that were palindromes.
(note: a palindrome reads the same way backwards or forwards. For example, 1331 is a palindrome but 1541 is not).
Use separate variables to store the separate digits of a number (for example D1, D2, D3, D4). [4]
Computer Science 2210
Compiled By: Naqash Sachwani

(a) \( x = 0 \), \( y = 0 \)
\[
\text{input number}
\]
\[
\text{while number <> -1 do}
\]
\[
\quad \text{if number > 1000 then } x = x + 1
\]
\[
\quad \text{else if number < 1000 then } y = y + 1
\]
\[
\text{input number}
\]
\[
\text{endwhile}
\]
\[
\text{print } x, y
\]

(b) \( T = 0 \)
\[
\text{for } N = 1 \text{ to } 50
\]
\[
\quad \text{read } D1, D2, D3, D4
\]
\[
\quad \text{if } D1 = D4 \text{ and } D2 = D3 \text{ then } T = T + 1
\]
\[
\quad \text{next } N
\]
\[
\quad \text{percent} = T \cdot 2
\]
\[
\text{print percent}
\]

16 A small café sells five types of item:
- bun 0.50 dollars
- coffee 1.20 dollars
- cake 1.50 dollars
- sandwich 2.10 dollars
- dessert 4.00 dollars

Write an algorithm, using pseudocode or a program flowchart only, which
• inputs every item sold during the day,
• uses an item called “end” to finish the day’s input,
• adds up the daily amount taken for each type of item,
• outputs the total takings (for all items added together) at the end of the day,
• outputs the type of item that had the highest takings at the end of the day. [4]

\[
x = 0; \ t\text{bun} = 0; \ t\text{coffee} = 0; \ t\text{cake} = 0; \ t\text{sandwich} = 0; \ t\text{dessert} = 0
\]
\[
\text{repeat}
\]
\[
\quad \text{input } \text{item}
\]
\[
\quad \quad \text{if } \text{item} = \text{”bun” } \text{then } \text{t\text{bun} = t\text{bun} + 0.5}
\]
\[
\quad \quad \text{else if } \text{item} = \text{”coffee” } \text{then } \text{t\text{coffee} = t\text{coffee} + 1.20}
\]
\[
\quad \quad \text{else if } \text{item} = \text{”cake” } \text{then } \text{t\text{cake} = t\text{cake} + 1.50}
\]
\[
\quad \quad \quad \text{else if } \text{item} = \text{”sandwich” } \text{then } \text{t\text{sandwich} = t\text{sandwich} + 2.10}
\]
\[
\quad \quad \quad \quad \text{else if } \text{item} = \text{”dessert” } \text{then } \text{t\text{dessert} = t\text{dessert} + 4.00}
\]
\[
\quad \quad \quad \quad \text{else print “error”}
\]
\[
\quad \quad \text{until } \text{item = ”end”}
\]
\[
\quad \text{if } \text{t\text{bun} > x} \text{ then } x = \text{t\text{bun}}
\]
\[
\quad \text{if } \text{t\text{coffee} > x} \text{ then } x = \text{t\text{coffee}}
\]
\[
\quad \text{if } \text{t\text{cake} > x} \text{ then } x = \text{t\text{cake}}
\]
\[
\quad \text{if } \text{t\text{sandwich} > x} \text{ then } x = \text{t\text{sandwich}}
\]
\[
\quad \text{if } \text{t\text{dessert} > x} \text{ then } x = \text{t\text{dessert}}
\]
\[
\quad \text{total} = \text{t\text{bun} + t\text{coffee} + t\text{cake} + t\text{sandwich} + t\text{dessert}}
\]
\[
\text{print } \text{total}, \ x
\]

May/June 2013. P11
16 Name two different types of loop structure in a typical programming language. Give an example of how ten numbers could be input using the named loop. [6]
16 A small shop uses barcodes which represent 5 digits. The last digit is used as a check digit.

For example:

\[
\begin{array}{cccccc}
  a & b & c & d & e \\
  0 & 1 & 2 & 3 & 4
\end{array}
\]

The check digit (e) is found by:
• multiplying the first and third digits (i.e. a and c) by 3
• multiplying the second and fourth digits (i.e. b and d) by 2
• adding these four results together to give a total
• dividing this total by 10
• remainder is check digit (e)
Computer Science 2210

Write an algorithm, using pseudocode or flowchart only, which
- inputs 100 five-digit barcodes in the form a, b, c, d, e
- re-calculates the check digit for each number and checks whether the input check digit(e) is correct
- outputs the number of barcodes which were entered correctly

```
1 mark
for number = 1 to 100
    input a, b, c, d, e
    total = (a * 3) + (c * 3) + (b * 2) + (d * 2)
    repeat
        total = total - 10
    until total < 10
    if total = e then match = match + 1
next number
print match
```

May/June 2013. P12

17 A country has four mobile phone network operators. Each mobile phone number has eight digits. The first three digits identify the network operator:

- 444 Yodafone
- 555 N2 network
- 666 Kofee mobile
- 777 Satsuma mobile

Write an algorithm, using pseudocode or flowchart only, which reads 50 000 eight-digit mobile phone calls made during the day and outputs the number of calls made on each of the four networks.

```
Y = 0; N = 0; K = 0; S = 0
for count = 1 to 50 000
    input number
    X = number/100 000 000
    if X > 0.7 then S = S + 1
    else if X > 0.6 then K = K + 1
    else if X > 0.5 then N = N + 1
    else if X > 0.4 then Y = Y + 1
    else print "error in number"
next count
print Y, N, K, S
```

Oct/Nov 2013. P13

10 (a) The following pseudocode was written to input 1000 dates.

```
1 count = 1
2 repeat
3     input day, month, year
4     count = count + 1
5 until count = 1000
```

(i) Describe why the loop only inputs 999 dates instead of 1000. [1]
(ii) What needs to be changed or added to the above code to make sure 1000 dates are input? [1]
(b) Errors in code can be found using test data.
Name three different types of test data. Using month from the pseudocode above, give an example of each type of test data. [6]

(a) (i) – value of count starts at 1 so only 999 iterations
         – value of count reaches 1000, but before 1000th input

(ii) – line 1 should read \texttt{count = 0}
       – line 5 should read \texttt{count = 1001} (or \texttt{count >1000})
       – change to appropriate loop structure

(b) – 1 mark for naming data type + 1 mark for example related to month

- normal/valid (test data)
- any value in given range (1 to 12) e.g. 4
- abnormal/invalid (test data)
- any value which is outside the range/any value not acceptable
  - i.e. letters, negative numbers, values > 12 e.g. adfrk, -20, 36
- extreme/boundary (test data)
- date which is on the boundaries/edges of the acceptable range
  - i.e. 1 or 12 for extreme; 0, 1, 12 or 13 for boundary
- Month names, instead of values, are acceptable e.g. April

15 5000 numbers are being input which should have either 1 digit (e.g. 5), 2 digits (e.g. 36), 3 digits (e.g. 149) or 4 digits (e.g. 8567). Write an algorithm, using pseudocode or flowchart only, which

- inputs 5000 numbers
- outputs how many numbers had 1 digit, 2 digits, 3 digits and 4 digits
- outputs the % of numbers input which were outside the range [6]

```plaintext
single = 0; two = 0; three = 0; four = 0; error = 0
for x = 1 to 5000
    input number
    if number > 999 and number < 10000 then four = four + 1
    else if number > 99 then three = three + 1
    else if number > 9 then two = two + 1
    else if number > 0 then single = single + 1
    else error = error + 1
next x
percent = error/50
print single, two, three, four, percent
```

Oct/Nov 2013. P12

16 (a) A greenhouse is being monitored by a computer using 2 sensors. SENSOR1 measures the temperature and SENSOR2 measures oxygen levels. If the temperature exceeds 45°C or oxygen levels fall below 0.19, then an error message is output by the computer.
Write an algorithm, using pseudocode or flowchart only, which

- inputs both sensor readings
- checks the sensor input values and outputs a warning message if either are out of range
- continues monitoring until the <ESCAPE> key is pressed
(a) repeat
    read sensor1
    read sensor2
    if sensor1 > 45 then print "warning"
    if sensor2 < 0.19 then print "warning"
    read key
until key = ESCAPE

(b) DAC
-- need to convert computer output to analogue values
-- to allow it to operate motors, actuators, ....
-- .... to open/close windows, switch heaters on/off etc.
-- devices may not understand/respond to digital signals

May/June 2014 P12

18 A school has 1500 students. It is conducting a survey on their music preferences. Each student uses a computer and inputs their name and then chooses one of 5 options:
• rock (input value 1)
• soul (input value 2)
• pop (input value 3)
• jazz (input value 4)
• classical (input value 5)

Write an algorithm, using pseudocode or a flowchart, which:
• inputs the choice of all 1500 students (values 1 to 5)
• outputs all the names of the students who chose classical music
• outputs the percentage who chose each option

```
rock = 0; soul = 0; pop = 0; jazz = 0; classical = 0

for student = 1 to 1500
    input choice, pupil_name
    if choice = 1 then rock = rock + 1
    if choice = 2 then soul = soul + 1
    if choice = 3 then pop = pop + 1
    if choice = 4 then jazz = jazz + 1
    if choice = 5 then classical = classical + 1
next student
```

```
percent1 = rock/15
percent2 = soul/15
percent3 = pop/15
percent4 = jazz/15
percent5 = classical/15
output percent1, percent2, percent3, percent4, percent5
```

5 The following algorithm should:
• input ten numbers
• output the largest number input
• output the average value of the input data
There are four errors in this algorithm.
Locate these errors and suggest a correction.

error: line 40: input x, using same input value as loop variable will cause problems or line 30: for x = 1 to 10

correction: change loop variable e.g. for count = 1 to 10 or change input variable e.g. input number

error: line 50: formula is reversed

correction: .... then largest = x (or largest = number)

error: line 60: output shouldn't be inside the loop

correction: 100 output average, largest

error: line 90: incorrect formula

correction: average = sum / 10

May/June 2014. P11

15 A survey is being carried out which involves reading and recording sound levels near a busy road junction. Once all the data are collected, they are input manually into a computer. A sound level of 0 decibels (0 dB) is input to indicate the end of the data. Write an algorithm, using pseudocode or a flowchart, which:

• inputs all the sound levels
• after a sound level of 0 is input, outputs the following:
  o average sound level
  o highest recorded sound level.

```
total = 0; highest = 0; count = 0
input sound

while sound > 0 do
  total = total + sound
  if sound > highest then highest = sound
  count = count + 1
  input sound

endwhile

average = total / count

print average, highest
```

Oct/Nov 2014. P12

Question 6:
The following section of a pseudocode algorithm should:

• input 500 numbers
• generate a ratio called k
• output each value of k
• output how many numbers were larger than 10

10  total = 1
20  FOR x = 1 TO 500
30      IF number < 10 THEN total = total + 1
40      k = x / number
50      x = x + 1
60  OUTPUT k
70  NEXT x
80  OUTPUT x

(a) There are five errors in the above code.
Locate these errors and suggest a correction. [5]

(b) The corrected algorithm was converted to a computer program and run. However, after several numbers were input, the program stopped and an error message was generated, showing that there was a further error at line (k = x / number).

State what could cause this error to occur.
Suggest a change to line 40 to overcome this problem. [2]

(a) error: line 10: total = 1
correction: totals should be set to zero; total = 0

error: line 30: ... number < 10 ...
correction: check should be made if number > 10; ... number > 10 ...

error: no input inside loop
correction: input number

error: line 50: x = x + 1
correction: for ... to loops don’t need a counter; remove line 50 altogether

error: line 80: output x
correction: output should be total value; output total

(b) division by zero error (or similar description of error produced when dividing by 0)
add an error trap after input of number
e.g. 40 if number = 0 then k = 0 else k = x/number

Question 16:
A school has 3000 students sitting final examinations.
Each student sits eight examinations.
Write an algorithm, using pseudocode or a flowchart, which:
• inputs the marks for all 8 examinations for each student
• outputs for each student the average mark for their 8 examinations
• outputs the highest mark overall

highest = -1
for student = 1 to 3000
    total = 0
    for exam = 1 to 8
        input mark
        total = total + mark
        if mark > highest then highest = mark
    next
    average = total/8
    output average
next
output highest
JUNE 2015 (VARIANT 1)

2 Read this section of program code that should input 10 positive numbers and then output the smallest number input.
1 Small = 0
2 Counter = 0
3 REPEAT
4 INPUT Num
5 IF Num < Small THEN Small = Num
6 Counter = Counter + 1
7 PRINT Small
8 UNTIL Counter < 10
There are four errors in this code.
Locate these errors and suggest a corrected piece of code for each error.

1. Line 1: Small = 999
2. Line 5: IF Num < Small THEN Small = Num
3. Line 7: Line 7 should come after the end of the Repeat Loop
4. Line 8: UNTIL Counter = 10

6 Identify three different loop structures that you can use when writing pseudocode. [3]
1. FOR ... TO ... NEXT
2. WHILE ... DO ... ENDWHILE
3. REPEAT ... UNTIL

JUNE 2015 (VARIANT 2)

2 Read this section of program code that should input 30 positive numbers and then output the largest number input.

1 Large = 9999
2 Counter = 0
3 WHILE Counter > 30
4 DO
5 INPUT Num
6 IF Num < Large THEN Large = Num
7 Counter = Counter - 1
8 ENDWHILE
9 PRINT Large
There are four errors in this code.
Locate these errors and suggest a corrected piece of code for each error.

1. Line 1: Large = 0
2. Line 3: WHILE Counter < 30
3. Line 6: IF Num > Large THEN Large = Num
4. Line 7: Counter = Counter + 1

4 Four programming concepts and four examples of programming code are shown below. Draw a line to link each programming concept to the correct example of programming code. [4]
5 (a) Write an algorithm, using pseudocode and a FOR ... TO ... NEXT loop structure, to input 1000 numbers into an array. [2]
(b) Rewrite your algorithm using another loop structure. [4]

(a) 1 mark for FOR ... TO ... NEXT 1 mark for INPUT
FOR Count ← 1 TO 1000
   INPUT A[Count]
NEXT (Count)

(b) Example1
   Count ← 1
   REPEAT
      INPUT A[Count]
      Count ← Count + 1
   UNTIL Count > 1000

Example2
   Count ← 0
   WHILE Count < 1000
      DO
         Count ← Count + 1
         INPUT A[Count]
      END
   ENDWHILE

NOVEMBER 2015 (VARIANT 1)
2 Read this section of program code that should input 50 numbers and then output the average of the positive numbers only.
1 Total = 0
2 PosCount = 0
3 FOR Counter = 1 TO 50
4   INPUT Num
5   IF Num < 0 THEN Total = Total + Num
6   IF Num > 0 THEN Counter = Counter + 1
7   Average = Total/PosCount
8 NEXT Counter
9 PRINT Num
There are four errors in this code.
Locate these errors and suggest code corrections to remove each error.

1. Error: Line 5  
   Correction: IF NUM > 0 THEN Total = Total + Num

2. Error: Line 6  
   Correction: IF NUM > 0 THEN PosCount = PosCount + 1

3. Error: Line 7  
   Correction: This line should come outside and after the FOR Loop. This can be achieved by interchanging line 7 and line 8.

4. Error: Line 9  
   Correction: Print Average

3 (a) This pseudocode inputs an integer. The predefined function DIV gives the value of the division, e.g. \( y \leftarrow 10 \text{ DIV } 3 \) gives the value \( y = 3 \). The predefined function MOD gives the value of the remainder, e.g. \( y \leftarrow 10 \text{ MOD } 3 \) gives the value \( y = 1 \).

```
INPUT X
WHILE X > 15
  DO
    T1 \leftarrow X \text{ DIV } 16
    T2 \leftarrow X \text{ MOD } 16
    CASE T1 OF
      10: OUTPUT A
      11: OUTPUT B
      12: OUTPUT C
      13: OUTPUT D
      14: OUTPUT E
      15: OUTPUT F
      OTHERWISE OUTPUT T2
    ENDCASE
    X \leftarrow T1
  ENDMETHOD
ENDWHILE
ENDCASE
```

Complete a trace table for each of the two input values 37 and 191.

**Trace table for input value 37**

<table>
<thead>
<tr>
<th>X</th>
<th>T1</th>
<th>T2</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Trace table for input value 191**

<table>
<thead>
<tr>
<th>X</th>
<th>T1</th>
<th>T2</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Computer Science 2210
(b) State the purpose of the pseudocode in part (a).

(a) Number 1 Trace Table

<table>
<thead>
<tr>
<th>X</th>
<th>T1</th>
<th>T2</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1 mark) (1 mark)

Number 2 Trace Table

<table>
<thead>
<tr>
<th>X</th>
<th>T1</th>
<th>T2</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>191</td>
<td>11</td>
<td>15</td>
<td>F</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1 mark) (1 mark)

(b) – convert a denary number to hexadecimal
- and output it in reverse order

-----------------------------------------------------------------------------------------------------------------------------

NOVEMBER 2015 (VARIANT 2)

2 Read this section of program code that should input 50 numbers and then output the average.
   1 Total = 0
   2 For Counter = 1 TO 50
   3     INPUT Num
   4     Total = Total + 1
   5     Counter = Counter + 1
   6     Average = Total/Counter
   7 NEXT Counter
   8 PRINT Average

There are four errors in this code.
Locate these errors and suggest code corrections to remove each error. [4]

1. Error: Line 4
   Correction: Total = Total + Num
2. Error: Line 5
   Correction: Delete this line as the FOR Loop will automatically increment the value of the ‘counter’ variable.
3. Error: Line 6
   Correction: Average = Total/Counter
4. Error: Line 6
   Correction: This line should be outside and after the FOR Loop. This can be achieved by swapping Line 6 and Line 7.

5 Identify two different conditional statements that you can use when writing pseudocode. [2]
   - IF (... THEN ... ELSE ... ENDIF)
   - CASE (... OF ... OTHERWISE ... ENDCASE)

-----------------------------------------------------------------------------------------------------------------------------

JUNE 2016

2. Read this section of program code that inputs 10 positive numbers and then outputs the total.
This code works, but it is inefficient.

(i) Suggest three improvements that could be made. [3]
(ii) Rewrite the program code with your improvements. [3]

(i) 1. Use a FOR…NEXT Loop instead of a REPEAT…UNTIL Loop
    2. Move Line 6 (PRINT Total) after the end of the loop.
    3. Add statements to check that only Positive Numbers are input.

(ii) 1 Total = 0
    2 FOR Counter = 1 To 10
    3 REPEAT
    4 INPUT Num
    5 UNTIL Num >0
    6 Total = Total + Num
    7 NEXT Counter
    8 PRINT Total

4 Four statement types and four examples are shown below.
Draw a line to connect each statement type to the correct example.

<table>
<thead>
<tr>
<th>Statement type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>FOR X ← 1 TO 10</td>
</tr>
<tr>
<td>Iteration</td>
<td>READ X</td>
</tr>
<tr>
<td>Input</td>
<td>PRINT X</td>
</tr>
<tr>
<td>Output</td>
<td>X ← Y + Z</td>
</tr>
</tbody>
</table>

Solution:

<table>
<thead>
<tr>
<th>Statement type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>FOR X ← 1 TO 10</td>
</tr>
<tr>
<td>Iteration</td>
<td>READ X</td>
</tr>
<tr>
<td>Input</td>
<td>PRINT X</td>
</tr>
<tr>
<td>Output</td>
<td>X ← Y + Z</td>
</tr>
</tbody>
</table>

6 Identify two different selection statements that you can use when writing pseudocode. [2]
NOVEMBER 2016

2 Read this section of program code that inputs positive numbers, discards any negative numbers and then outputs the average. An input of zero ends the process.

1 Total = 0
2 Counter = 100
3 REPEAT
4    REPEAT
5        INPUT Num
6    UNTIL Num < 0
7    Total = Total + 1
8    Counter = Counter + Num
9    UNTIL Num = 0
10 Average = Total / (Counter - 1)
11 Print Average

There are four errors in this code.
Locate these errors and suggest a correction to remove each error.
- line 2 or Counter = 100
  - Counter = 0
- line 6 or UNTIL Num < 0
  - UNTIL Num >= 0
- line 7 or Total = Total + 1
  - Total = Total + Num
- line 8 or Counter = Counter + Num
  - Counter = Counter + 1

4 IF ... THEN ... ELSE ... ENDIF and CASE ... OF ... OTHERWISE ... ENDCASE are two different conditional statements that you can use when writing pseudocode.
Explain, using examples, why you would choose to use each conditional statement.
Example 1
Reason for choice
IF X > 0 AND X <= 10
    THEN PRINT 'In Range'
    ELSE PRINT 'Out of Range'
ENDIF
- e.g. checking a condition that may be complex/uses relational operators// checking for a range of values// only 2 options

Example 2
CASE X OF
    1 : PRINT 'Option 1'
    2 : PRINT 'Option 2'
    3 : PRINT 'Option 3'
    OTHERWISE PRINT 'Incorrect choice'
ENDCASE
- e.g. checking for discrete/large number/more than 2 of values

----------------------------------------------------------------------------------
2 This section of program code asks for 50 numbers to be entered. The total and average of the numbers are calculated.

```plaintext
1  Total = 0
2  Counter = 50
3  PRINT 'When prompted, enter 50 numbers, one at a time'
4  REPEAT
5   PRINT 'Enter a number'
6   INPUT Number
7   Total + Number = Total
8   Number = Number + 1
9  UNTIL Counter = 50
10  Average = Number * Counter
11  PRINT 'The average of the numbers you entered is ', Average
```

There are four errors in this code.

State the line number for each error and write the correct code for that line.

- **Line 2 Correct code**: `Counter = 0`
- **Line 7 Correct code**: `Total = Total + Number // Number + Total`
- **Line 8 Correct code**: `Counter = Counter + 1 // 1 + Counter`
- **Line 10 Correct code**: `Average = Total / Counter // Average = Total / 50`

5 (a) Describe the purpose of each statement in this algorithm. [2]

```plaintext
FOR I ← 1 TO 300
    INPUT Name[I]
NEXT I
```

(b) Identify, using pseudocode, another loop structure that the algorithm in part (a) could have used. [1]

(c) Write an algorithm, using pseudocode, to input a number between 0 and 100 inclusive. The algorithm should prompt for the input and output an error message if the number is outside this range. [3]

<table>
<thead>
<tr>
<th></th>
<th>Any two from:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Loop with 300 repetitions (starting at 1) / Loops from 1 to 300</td>
</tr>
<tr>
<td></td>
<td>- Values input/stored (in consecutive/different locations) in an array (at position I)</td>
</tr>
<tr>
<td></td>
<td>- Increases the loop counter/I value by 1 (and returns to the start of the loop)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>REPEAT (... UNTIL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WHILE (... DO ... ENDWHILE)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>OUTPUT &quot;Enter a number between 0 and 100. &quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INPUT Number</td>
</tr>
<tr>
<td></td>
<td>IF Number &lt; 0 OR Number &gt; 100</td>
</tr>
<tr>
<td></td>
<td>THEN</td>
</tr>
<tr>
<td></td>
<td>OUTPUT &quot;The number you have entered is outside the specified range&quot;</td>
</tr>
</tbody>
</table>

---

JUNE 2017 (VARIANT 2)

Question 2

(a) Write an algorithm to input three different numbers, and then output the largest number. Use either pseudocode or a flowchart. [4]

(b) Give two sets of test data to use with your algorithm in part (a) and explain why you chose each set.

Test data set 1

<table>
<thead>
<tr>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test data set 2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test data set 2</td>
</tr>
</tbody>
</table>

[4]
4 An algorithm has been written in pseudocode to input 100 numbers and print out the sum. A REPEAT ... UNTIL loop has been used.

   Count ← 0
   Sum ← 0
   REPEAT
      INPUT Number
      Sum ← Sum + Number
      Count ← Count + 1
   UNTIL Count > 100
   PRINT Sum

(a) Find the error in the pseudocode and suggest a correction. [2]

(b) Rewrite the correct algorithm using a more suitable loop structure. [3]

(a) Error: UNTIL Count > 100
   Correction: UNTIL Count = 100

(b) SUM = 0
   FOR Count = 1 TO 100
      INPUT Number
      Sum = Sum + Number
   NEXT Count
   PRINT Count

NOVEMBER 2017 (VARIANT 2)

2 Write an algorithm using either pseudocode or a flowchart, to:
   • input a positive integer
   • use this value to set up how many other numbers are to be input
   • input these numbers
   • calculate and output the total and the average of these numbers. [6]
4 IF ... THEN ... ELSE ... ENDIF is one type of conditional statement used when writing pseudocode.

Identify and describe another type of conditional statement that you could use when writing pseudocode. Give a reason why you would use this type of conditional statement.

**Conditional statement**

**Description**

**Reason**

**Identification:**

```plaintext
CASE ...
... OF ... OTHERWISE ...
... OF ... OTHERWISE ...
ENDCASE
```

**Description:**

- A statement that allows for multiple selections // not any of the above

**Reason:**

- To simplify pseudocode/make pseudocode more understandable etc.

---

**NOVEMBER 2017 (VARIANT 1)**

2 This section of program code asks for 80 numbers between 100 and 1000 to be entered. It checks that the numbers are in the correct range, and stores them in an array. It counts how many of the numbers are larger than 500 and then outputs the result when the program is finished.

```plaintext
1 Count = 0
2 FOR Index = 1 TO 80
3 INPUT 'Enter a number between 100 and 1000', Number
4 WHILE Number = 99 AND Number = 1001
5 INPUT 'This is incorrect, please try again', Number
6 ENDWHILE
7 Num[Index] = Number
8 IF Number > 500 THEN Count = Count + 1
9 UNTIL Index = 80
10 PRINT Index
11 PRINT 'numbers were larger than 500'
```

There are four lines of code that contain errors.

State the line number for each error and write the correct code for that line.

**Line 4 correct line** WHILE Number <= 99 OR Number > 1000
**Line 7 correct line** Num[Index] = Number
**Line 9 correct line** NEXT (Index)
**Line 10 correct line** PRINT Count

4 (a) Four pseudocode descriptions and five pseudocode statements are shown. Draw one line to link each pseudocode description to the correct pseudocode statement. Not all pseudocode statements will be used.
(b) Write an algorithm in pseudocode, using a single loop, to print 50 names that have been stored in an array. [3]
The global trade item number (GTIN-8) barcode has seven digits and a check digit. This pseudocode algorithm inputs seven digits and calculates the eighth digit, then outputs the GTIN-8.

DIV(X,Y), finds the number of divides in division for example DIV(23,10) is 2.
MOD(X,Y), finds the remainder in division for example MOD(23,10) is 3.

(a) Complete the trace table for the input data: 5, 7, 0, 1, 2, 3, 4

<table>
<thead>
<tr>
<th>Digit(1)</th>
<th>Digit(2)</th>
<th>Digit(3)</th>
<th>Digit(4)</th>
<th>Digit(5)</th>
<th>Digit(6)</th>
<th>Digit(7)</th>
<th>Digit(8)</th>
<th>Sum</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Explain how you would change the algorithm to input eight digits (seven digits and the check digit) and output if the check digit entered is correct or not. [3]

(a) Complete the trace table for the input data: 4, 3, 1, 0, 2, 3, 1

<table>
<thead>
<tr>
<th>Digit(1)</th>
<th>Digit(2)</th>
<th>Digit(3)</th>
<th>Digit(4)</th>
<th>Digit(5)</th>
<th>Digit(6)</th>
<th>Digit(7)</th>
<th>Digit(8)</th>
<th>Sum</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Reduce the number of iterations to a manageable amount // Simulate the input (e.g. random generation)
JUNE 2018 (VARIANT 2):

3 This pseudocode algorithm inputs two non-zero numbers and a sign, and then performs the calculation shown by the sign. An input of zero for the first number terminates the process.

```
INPUT Number1, Number2, Sign
WHILE Number1 <> 0
    IF Sign = '+' THEN Answer ← Number1 + Number2 ENDIF
    IF Sign = '-' THEN Answer ← Number1 - Number2 ENDIF
    IF Sign = '*' THEN Answer ← Number1 * Number2 ENDIF
    IF Sign = '/' THEN Answer ← Number1 / Number2 ENDIF
    IF Sign <> '/' AND Sign <> '+' AND Sign <> '-' AND Sign <> '+'
        THEN Answer ← 0
    ENDIF
    IF Answer <> 0 THEN OUTPUT Answer ENDIF
INPUT Number1, Number2, Sign
ENDWHILE
```

(a) Complete the trace table for the input data:
5, 7, +, 6, 2, -, 4, 3, *, 7, 8, ?, 0, 0, /

<table>
<thead>
<tr>
<th>Number1</th>
<th>Number2</th>
<th>Sign</th>
<th>Answer</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Show how you could improve the algorithm written in pseudocode by writing an alternative type of conditional statement in pseudocode. [3]
3(a) | Number1 | Number2 | Sign | Answer | OUTPUT |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>7</td>
<td>+</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>*</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>?</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>/</td>
<td>(U)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3(b) CASE Sign OF ...
    \text{List \#, \#, \# with correct assignments (1)}
    OTHERWISE Answer \leftarrow 0 (1)
EXAMPLE
    CASE Sign OF
        '4': Answer \leftarrow Number1 + Number2
        '1': Answer \leftarrow Number1 - Number2
        '2': Answer \leftarrow Number1 * Number2
        '/': Answer \leftarrow Number1 / Number2
    OTHERWISE Answer \leftarrow 0
ENDCASE

\text{NOVEMBER 2018 (VARIANT 1)}

3 Give an example of a pseudocode statement or statements to perform each of the following functions.

\text{A condition-controlled loop}

\text{A conditional statement}

\text{Totalling}

Condition controlled loop - 1 mark for each correct answer e.g.

\text{WHILE Number > 0 DO ... ENDWHILE} // REPEAT ... UNTIL Number > 0

Conditional statement - 1 mark for each correct answer e.g.

\text{IF Number = 0 THEN} \text{... ELSE} \text{Number} \leftarrow 1 \text{ENDDF} // \text{CASE Number OF}
\text{0: Number} \leftarrow 1
\text{\ldots ELSE) ... (ENDDCASE)}

Totalling - 1 mark for each correct answer e.g.

\text{Total} \leftarrow \text{Total} + \text{Number}

4 \text{This is a section of program code.}

1 \text{Total} = 100.00
2 \text{PRINT } '\text{Enter the height of each member of your class, one at a time, when prompted}'
3 \text{FOR Count = 1 TO 30}
4 \text{PRINT 'Enter a height in metres'}
5 \text{INPUT Height}
6 \text{Total} = \text{Total} + \text{Height}
7 \text{PRINT Total} / 30
8 \text{COUNT} = \text{COUNT} + 1
9 \text{NEXT Count}

(a) \text{There are three errors in this code. State the line numbers that contain the errors and describe how to correct each error.}\ [3]

(b) \text{State the purpose of this program.}\ [1]
The algorithm allows a number to be entered. It then calculates and outputs the next number in the mathematical series.

Fib ← 1
Prev2 ← 0
Prev1 ← 1

INPUT Number

IF Number = 0
    THEN Fib ← 0
ENDIF

WHILE Number > 2
    Fib ← Prev2 + Prev1
    Prev2 ← Prev1
    Prev1 ← Fib
    Number ← Number - 1
ENDWHILE

OUTPUT Fib

(a) Complete the trace table for the input data: 7

<table>
<thead>
<tr>
<th>Fib</th>
<th>Prev2</th>
<th>Prev1</th>
<th>Number</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[4]
(b) Complete the trace table for the input data:

<table>
<thead>
<tr>
<th>Fib</th>
<th>Prev2</th>
<th>Prev1</th>
<th>Number</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>8</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

(a)

<table>
<thead>
<tr>
<th>Fib</th>
<th>Prev2</th>
<th>Prev1</th>
<th>Number</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

NOVEMBER 2018 (VARIANT 2)

2 (a) Write an algorithm, using pseudocode, to input three different numbers, multiply the two larger numbers together and output the result. Use the variables: Number1, Number2 and Number3 for your numbers and Answer for your result.

(b) Give two sets of test data to use with your algorithm in part (a) and explain why you chose each set.
3 Four programming concepts and four descriptions are shown. Draw a line to connect each programming concept to the most appropriate description.

<table>
<thead>
<tr>
<th>Programming concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library routine</td>
<td>A subroutine that does not have to return a value.</td>
</tr>
<tr>
<td>Structure diagram</td>
<td>A standard subroutine that is available for immediate use.</td>
</tr>
<tr>
<td>Procedure</td>
<td>A subroutine that always returns a value.</td>
</tr>
<tr>
<td>Function</td>
<td>An overview of a program or subroutine.</td>
</tr>
</tbody>
</table>

4 A programmer wants to test that the readings from 2000 electricity meters are greater than 400 units and less than 900 units. The programmer uses selection and repetition statements as part of the program. Explain, using programming statements, how selection and repetition could be used in this program.

Selection
Repetition
JUNE 2019 (VARIANT 1)

3 (a) Give an example of a conditional statement using pseudocode. [2]

(b) Describe the purpose of a conditional statement [2]

(a) Give an example of a conditional statement using pseudocode. [2]

```
IF
  Condition and outcome
THEN
  PRINT "Negative"
ELSE
  PRINT "Not negative"
ENDIF
```

OR

```
CASE X OF
  1: PRINT ("ONE")
  2: PRINT ("TWO")
  OTHERWISE PRINT ("Less than ONE or more than TWO")
ENDCASE
```

(b) Describe the purpose of a conditional statement [2]

To allow different routes through a program

4 This section of program code may be used as a validation check.

1 PRINT "Input a value between 0 and 100 inclusive"
2 INPUT Value
3 WHILE Value < 0 OR Value > 100
4 PRINT "Invalid value, try again"
5 INPUT Value
6 ENDWHILE
7 PRINT "Accepted: ", Value

(a) Give a name for this type of validation check. [1]

(b) Describe what is happening in this validation check. [2]

(c) Complete the trace table for this program code using the test data: 200, 300, -1, 50, 60 [3]

<table>
<thead>
<tr>
<th>Value</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>
JUNE 2019 (VARIANT 2)

2 (a) An algorithm has been written in pseudocode to input 100 numbers, select and print the largest number and smallest number.

```
Count ← 1
INPUT Number
High ← Number
Low ← Count
REPEAT
   INPUT Number
   IF Number > High
      THEN
         High ← Number
   ENDIF
   IF Number > Low
      THEN
         Low ← Number
   ENDIF
   Count ← Count + 1
UNTIL Count > 99
PRINT "Largest Number is ", Number
PRINT "Smallest Number is ", Low
```

Find the four errors in the pseudocode and suggest a correction for each error. [4]

(b) Show how you would change the corrected algorithm to total the numbers and print the total. Use a variable Total. [4]

(a) [ ] Low ← Count should be Low ← Number
   [ ] Number > Low should be Number < Low
   [ ] UNTIL Count = 99 should be UNTIL Count > 99 or UNTIL Count = 100 or UNTIL Count >= 100 // Count ← 1 should be Count ← 0
   [ ] PRINT "Largest Number is ", Number should be PRINT "Largest Number is ", High

(b) Change the algorithm to total the numbers and print the total.

```
Total ← 0
REPEAT
   INPUT Number
   IF Number > High
      THEN
         High ← Number
   ENDIF
   IF Number > Low
      THEN
         Low ← Number
   ENDIF
   Total ← Total + Number
   Count ← Count + 1
UNTIL Count > 99
PRINT "Total is ", Total
```

(c) | Value | OUTPUT |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Invalid value, try again</td>
</tr>
<tr>
<td>300</td>
<td>Invalid value, try again</td>
</tr>
<tr>
<td>-1</td>
<td>Invalid value, try again</td>
</tr>
<tr>
<td>50</td>
<td>Accepted: 50</td>
</tr>
</tbody>
</table>
Computer Science 2210

(b) Count ← 1  
    INPUT Number  
    High ← Number  
    Low ← Number  
    Total ← Number  
    REPEAT  
        INPUT Number  
        Total ← Total + Number  
        IF Number > High  
            THEN  
                High ← Number  
            ENDIF  
        IF Number < Low  
            THEN  
                Low ← Number  
            ENDIF  
        Count ← Count + 1  
    UNTIL Count > 99  
    PRINT "Largest Number is ", High  
    PRINT "Smallest Number is ", Low  
    PRINT "Total is ", Total  

4 For each of the four groups of statements in the table, place a tick in the correct column to show whether it is an example of Selection or Repetition.  

<table>
<thead>
<tr>
<th>Statements</th>
<th>Selection</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR A ← 1 TO 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B ← B + 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEXT A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASE A OF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100: B ← A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200: C ← A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENDCASE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IF A &gt; 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B ← A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENDIF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REPEAT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A ← B + 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNTIL A &gt; 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statements</th>
<th>Selection</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOR A ← 1 TO 100</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>B ← B + 1</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>NEXT A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASE A OF</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>100: B ← A</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>200: C ← A</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>ENDCASE</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>IF A &gt; 100</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>THEN</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>B ← A</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>ENDIF</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>REPEAT</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>A ← B + 10</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>UNTIL A &gt; 100</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
2 An algorithm has been written in pseudocode to select a random number using the function `RandInt(n)`, which returns a whole number between 1 and the argument n. The algorithm then allows the user to guess the number.

```pseudocode
Number ← RandInt(100)
TotalTry ← 1
REPEAT
    PRINT "Enter your guess now, it must be a whole number"
    INPUT Guess
    IF TotalTry > Number
        THEN
            PRINT "Too large, try again"
        ENDIF
    IF Guess > Number
        THEN
            PRINT "Too small, try again"
        ENDIF
    TotalTry ← Guess + 1
UNTIL Guess <> Number
TotalTry ← TotalTry - 1
PRINT "Number of guesses ", TotalTry
```

Find the four errors in the pseudocode and suggest a correction to remove each error. [4]

**Solution:**

2 □ IF TotalTry > Number should be IF Guess > Number
□ IF Guess > Number should be IF Guess < Number
□ TotalTry ← Guess + 1 should be TotalTry ← TotalTry + 1
□ UNTIL Guess <> Number should be UNTIL Guess = Number

5 A programmer writes a program to weigh baskets of fruit in grams, keeping a total of the weight and counting the number of baskets. The total weight is stored in a variable `Total` and the number of baskets is stored in a variable `BasketCount`.

Explain, including examples of programming statements, how totalling and counting could be used in this program.

**Solution:**

```
5

<table>
<thead>
<tr>
<th>Totalling:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Adding the weight of each basket to the total weight as each weight is entered</td>
</tr>
<tr>
<td>□ Total = Total + Weight</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Counting:</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Adding one to/incrementing the number of baskets as each weight is entered</td>
</tr>
<tr>
<td>□ BasketCount = BasketCount + 1</td>
</tr>
</tbody>
</table>
```

Oct/Nov 2019 (VARIANT 1)

3 Name the three types of loop structure used in pseudocode. [3]

**Solution:**

- **FOR (...) TO (...) NEXT loop**
- **WHILE (...) DO (...) ENDM WHILE loop**
- **REPEAT (...) UNTIL loop**
The following pseudocode algorithm uses nested IF statements.

\[
\text{IF } \text{Response} = 1 \\
\text{THEN} \\
\quad X \leftarrow X + Y \\
\text{ELSE} \\
\quad \text{IF } \text{Response} = 2 \\
\quad \text{THEN} \\
\quad 
\quad X \leftarrow X - Y \\
\quad \text{ELSE} \\
\quad \quad \text{IF } \text{Response} = 3 \\
\quad \quad \text{THEN} \\
\quad \quad \quad X \leftarrow X \wedge Y \\
\quad \quad \text{ELSE} \\
\quad \quad \quad \text{IF } \text{Response} = 4 \\
\quad \quad \quad \text{THEN} \\
\quad \quad \quad \quad X \leftarrow X / Y \\
\quad \quad \quad \text{ELSE} \\
\quad \quad \quad \quad \text{OUTPUT } "\text{No response}" \\
\quad \quad \text{ENDIF} \\
\quad \text{ENDIF} \\
\text{ENDIF}
\]

(a) Name the type of statement demonstrated by the use of IF ... THEN ... ELSE ... ENDIF [1]

(b) Re-write the pseudocode algorithm using a CASE statement. [4]

Solution:

<table>
<thead>
<tr>
<th>4(a)</th>
<th>* Conditional / selection statement</th>
</tr>
</thead>
</table>

4(b) Four from:
- **MP1**: CASE statement with identifier Response
- **MP2**: Correct structure used for choices...
- **MP3**: ... correct statements used for choices
- **MP4**: OTHERWISE and correct statement
- **MP5**: Single ENDCASE included

e.g.

```
CASE OF Response // CASE Response OF 
1 : X ← X + Y
2 : X ← X - Y
3 : X ← X ^ Y
4 : X ← X / Y
OTHERWISE OUTPUT "No response"
ENDCASE
```

5 The algorithm performs an operation on the array named MyData.

DIV means integer division, so only the whole number part of the result is returned.

e.g. 7 DIV 2 returns a value of 3

```
First ← 0
Last ← 16
Found ← FALSE
INPUT UserIn
WHILE (First <= Last) AND (Found = FALSE) DO
  Middle ← (First + Last) DIV 2
  IF MyData[Middle] = UserIn 
  THEN 
  \quad Found ← TRUE 
  ELSE 
  \quad IF UserIn < MyData[Middle] 
  THEN 
  \quad \quad Last ← Middle - 1 
  ELSE 
  \quad \quad First ← Middle + 1 
  ENDIF 
  ENDIF 
ENDWHILE
OUTPUT Found
```
### Solution:

#### (a) Complete the trace table for the input data: 10

<table>
<thead>
<tr>
<th>First</th>
<th>Last</th>
<th>UserIn</th>
<th>Middle</th>
<th>Found</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18</td>
<td>10</td>
<td>8</td>
<td>FALSE</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>18</td>
<td>10</td>
<td>3</td>
<td>FALSE</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>10</td>
<td>5</td>
<td>TRUE</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

#### (b) Describe the function being performed by the algorithm.

**Two** from:
- Search for the value input...
- ... using an array...
- ... of sorted data
TURTLE GRAPHICS
1993-2019
May/June 1993 P1:

Question 12:
A programming language gives instructions for moving a pen on a piece of paper.

Examples are.

- F20  Move forward 20 cm
- B30  Move backwards 30 cm
- R90  Turn right 90 degrees
- L120 Turn left 120 degrees

The following program called FLAG 1 draws the shape shown returning the pen to the starting point.

```
F 100
R 90
F 50
R 90
F 50
R 90
F 50
R 90
B 50
```

(a) Write a program, called FLAG 2, to draw the shape shown, returning the pen to the starting point.  

(b) The program below, called PATTERN 1, draws the pattern shown.

```
REPEAT 4 TIMES
  FLAG 1
  R 90
ENDREPEAT
```

Write a program, called PATTERN 2, to draw the pattern shown below.
Solution:

a) F100
   R120
   F50
   R60
   F50
   R60
   B50

b) REPEAT 8 TIMES
   FLAG 2
   R 45
   END REPEAT

Oct/Nov 2000 P1

Question 10:
This set of instructions can be used to draw shapes

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward n</td>
<td>Move forward n steps</td>
</tr>
<tr>
<td>Backward n</td>
<td>Move backward n steps</td>
</tr>
<tr>
<td>Right d</td>
<td>Turn clockwise d degrees</td>
</tr>
<tr>
<td>Left d</td>
<td>Turn anti-clockwise d degrees</td>
</tr>
</tbody>
</table>

The following set of instructions will produce the square below
Forward 40
Right 90
Forward 40
Right 90
Forward 40
Right 90
Forward 40
Right 90

(a) Sketch the shape produced by this set of instructions.
Forward 30
Left 120
Forward 30
(b) The set of instructions in (a) can be shortened to

Repeat 3 [Forward 30, Left 120]

Write a shortened set of instructions to draw the square..............................

(c) Explain how the instructions for drawing the square can be turned into a procedure to draw a square of any specified side.

Solution:

a)  

\[\begin{array}{c}
\text{120}
\end{array}\]

b) Repeat 4 [forward 40, Right 90]

c) Value of x can be inserted which will provide the square with the required dimension Repeat 4 [forward x, Right 90]

May/June 2002 P1:

Question 8:
The following set of instructions can be used to control a robot, which moves heavy boxes.

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward n</td>
<td>Move forward n steps</td>
</tr>
<tr>
<td>Backward n</td>
<td>Move backward n steps</td>
</tr>
<tr>
<td>Right d</td>
<td>Turn clockwise d degrees</td>
</tr>
<tr>
<td>Left d</td>
<td>Turn anti-clockwise d degrees</td>
</tr>
<tr>
<td>Up n</td>
<td>Move the robots arms up n cm</td>
</tr>
<tr>
<td>Down n</td>
<td>Move the robots arms down n cm</td>
</tr>
</tbody>
</table>

a) Write three more instructions so that the robot will return to its original state. [3]

b) A procedure (subroutine) called BELT exists to take one box and put it on a conveyor belt. Write an algorithm, using the procedure, to put 50 boxes on the conveyor belt. [3]

Solution:

(a) Down 40
    Right 90
    Backward 20

(b) Set box = 0
    Set counter = 0
    If box is <= 50
        Input box
        box = box + 1
    Else
        End

May/June 2004 P1

7 A programming language has instructions for moving a pen on a piece of paper.
Examples are:
Solution:
F4
L90/R270
F4
L90/R270
F2
L90/R270
F2  one mark
R90/L270
F2  one mark
L90/R270
F2  (any L/R, B1, B2) one mark

Oct/Nov 2006 P1
10 A robot arm is to be used to move some objects which are positioned on the grid shown. Object “X” is located at A7 and is to be moved to F7. Object “Y” is located at C6 and is to be moved to G5.
The START position for the robot arm is shown. The robot arm can travel left and right along the top of the grid, and the robot arm can extend (lengthen) and retract (shorten) so that the gripper at the end of the arm can reach any grid square.
The following commands must be used:

<table>
<thead>
<tr>
<th>Instructions for Robot Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ( n ) Moves ( n ) squares to the right</td>
</tr>
<tr>
<td>Left ( n ) Moves ( n ) squares to the left</td>
</tr>
</tbody>
</table>

For example, to move block “X” from square A7 to F7 (beginning at START) would require the following instructions:

Left 8
Down 6
Close
Up 6
Right 5
Down 6
Open

Write a set of instructions to transfer block “Y” from C6 to G5 (beginning at START). [3]

Solution:
LEF 6
DOW 5
CLOS

UP 5
RIG 4

DOW 4
OPEN

May/June 2008 P1
7 A floor turtle can use the following instructions: [4]
Complete the set of instructions to draw the above shape

Solution:

PENDOWN
LEFT 90
FORWARD 40
RIGHT 90
FORWARD 70
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
LEFT 90
FORWARD 20
RIGHT 90
FORWARD 20
RIGHT 90
FORWARD 20
RIGHT 90
PENDUP

---

May/June 2010 P12

15 A floor turtle can use the following instructions:
(In the following grid, each square is 10 cm by 10 cm.)

Complete the set of instructions to draw the shape (shown in bold lines) by filling in the blank lines. [5]

Solution:
LEFT 90
PENDOWN
FORWARD 10
RIGHT 90
FORWARD 10
PENDOWN
FORWARD 20
RIGHT 90
FORWARD 20
RIGHT 90
FORWARD 20
RIGHT 90
FORWARD 20
RIGHT 90
PENDOWN
May/June 2011 P12

16 A floor turtle can use the following instructions:

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD $d$</td>
<td>Move $d$ cm forward</td>
</tr>
<tr>
<td>BACKWARD $d$</td>
<td>Move $d$ cm backward</td>
</tr>
<tr>
<td>LEFT $t$</td>
<td>Turn left $t$ degrees</td>
</tr>
<tr>
<td>RIGHT $t$</td>
<td>Turn right $t$ degrees</td>
</tr>
<tr>
<td>REPEAT $n$</td>
<td>Repeat the next set of instructions $n$ times</td>
</tr>
<tr>
<td>ENDREPEAT</td>
<td>End of REPEAT loop</td>
</tr>
<tr>
<td>PENUP</td>
<td>Raise the pen</td>
</tr>
<tr>
<td>PENDOWN</td>
<td>Lower the pen</td>
</tr>
</tbody>
</table>

(Each square in the drawing below is 10 cm by 10 cm.)

Complete the set of instructions to draw the above shape (shown in bold lines).

Solution:

PENDOWN
LEFT 90
REPEAT 3
FORWARD 30
RIGHT 90
ENDREPEAT
FORWARD 10
LEFT 90
PENDUP
FORWARD 10
PENDOWN
REPEAT 2
FORWARD 20
RIGHT 90
ENDREPEAT
FORWARD 20
LEFT 90
May/June 2012 P11
5 A floor turtle can use the following instructions.

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD x</td>
<td>Move x cm forwards</td>
</tr>
<tr>
<td>LEFT t</td>
<td>Turn left t degrees</td>
</tr>
<tr>
<td>RIGHT t</td>
<td>Turn right t degrees</td>
</tr>
<tr>
<td>REPEAT n</td>
<td>Repeat next set of instructions n times</td>
</tr>
<tr>
<td>ENDRERPEAT</td>
<td>Finish repeated instructions</td>
</tr>
<tr>
<td>PENUP</td>
<td>Lift the pen</td>
</tr>
<tr>
<td>PENDOWN</td>
<td>Lower the pen</td>
</tr>
</tbody>
</table>

Each square = 10 cm by 10 cm
Each diagonal line = 14 cm

Complete the set of instructions to draw the above shape in the direction shown by the arrows. [5]

Solution:
pendown
forward 20
left 90

forward 10
right 90
forward 20

right 90
forward 40
right 90
forward 20
right 90

forward 10
right 45
forward 14
May/June 2014 P11

5 A floor turtle can use the following instructions.

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD x</td>
<td>Move x cm forwards</td>
</tr>
<tr>
<td>BACKWARD x</td>
<td>Move x cm backwards</td>
</tr>
<tr>
<td>LEFT t</td>
<td>Turn left $t$ degrees</td>
</tr>
<tr>
<td>RIGHT t</td>
<td>Turn right $t$ degrees</td>
</tr>
<tr>
<td>REPEAT $n$</td>
<td>Repeat next set of instructions $n$ times</td>
</tr>
<tr>
<td>ENDREPEAT</td>
<td>Finish repeated instructions</td>
</tr>
<tr>
<td>PENUP</td>
<td>Lift the pen</td>
</tr>
<tr>
<td>PENDOWN</td>
<td>Lower the pen</td>
</tr>
</tbody>
</table>

Each square is 10 cm by 10 cm

Each diagonal line is 28 cm long

Complete the following set of instructions to draw the shape in the direction shown by the arrows. [5]

Solution:

```
pendown
left 45
forward 28
right 45
```
May/June 2014 P12

7 A floor turtle uses the following commands:

<table>
<thead>
<tr>
<th>command</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD $n$</td>
<td>Move $n$ cm in a forward direction</td>
</tr>
<tr>
<td>BACKWARD $n$</td>
<td>Move $n$ cm in a backward (reverse) direction</td>
</tr>
<tr>
<td>RIGHT $t$</td>
<td>Turn right through $t$ degrees</td>
</tr>
<tr>
<td>LEFT $t$</td>
<td>Turn left through $t$ degrees</td>
</tr>
<tr>
<td>PENUP</td>
<td>Lift the drawing pen up</td>
</tr>
<tr>
<td>PENDOWN</td>
<td>Lower the drawing pen</td>
</tr>
<tr>
<td>REPEAT $x$</td>
<td>Repeat the next set of instructions $x$ times</td>
</tr>
<tr>
<td>ENDREPEAT</td>
<td>Finish the REPEAT loop</td>
</tr>
</tbody>
</table>

In the following grid, each of the squares measures 10 cm by 10 cm:

```
+---+---+---+---+---+---+---+---+
|   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+
|   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+
|   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+
|   |   |   |   |   |   |   |   |
+---+---+---+---+---+---+---+---+
```

Complete the set of instructions to draw the shape shown above (in bold lines). [5]

Solution:
1. PENDOWN
2. REPEAT 2
Computer Science 2210

3. FORWARD 50
4. RIGHT 90
5. ENDREPEAT
6. FORWARD 10
7. RIGHT 90
8. FORWARD 20
9. PEN UP
10. LEFT 90
11. FORWARD 10
12. PEN DOWN
13. LEFT 90
14. FORWARD 20
15. RIGHT 90
16. FORWARD 10
17. RIGHT 90
18. FORWARD 40
19. LEFT 90
20. FORWARD 20
21. PENUP

Oct/Nov 2014 P12

9 A floor turtle uses the following commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD $n$</td>
<td>Move $n$ cm in a forward direction</td>
</tr>
<tr>
<td>BACKWARD $n$</td>
<td>Move $n$ cm in a backward (reverse) direction</td>
</tr>
<tr>
<td>RIGHT $t$</td>
<td>Turn right through $t$ degrees</td>
</tr>
<tr>
<td>LEFT $t$</td>
<td>Turn left through $t$ degrees</td>
</tr>
<tr>
<td>PENUP</td>
<td>Lift the drawing pen up</td>
</tr>
<tr>
<td>PENDOWN</td>
<td>Lower the drawing pen</td>
</tr>
<tr>
<td>REPEAT $x$</td>
<td>Repeat the next set of instructions $x$ times</td>
</tr>
<tr>
<td>ENDREPEAT</td>
<td>Finish the REPEAT loop</td>
</tr>
</tbody>
</table>

In the following grid, each of the squares represents 10 cm by 10 cm:

Complete the set of instructions to draw the shape shown on the left:

Solution:
1. PENDOWN
2. LEFT 90
3. REPEAT 2
4. FORWARD 20
5. RIGHT 90
6. END REPEAT
7. FORWARD 20
8. LEFT 90
9. FORWARD 20
10. LEFT 90
11. FORWARD 20
12. RIGHT 90
13. FORWARD 20
14. RIGHT 90
15. FORWARD 20
16. PEN UP
17. FORWARD 20
18. PEN DOWN
19. FORWARD 20
20. RIGHT 90
21. FORWARD 60
22. RIGHT 90
23. FORWARD 20

Oct/Nov 2017 P12

1 A robot arm in a factory is programmed to move products.

The binary instructions to operate the robot arm are:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Binary Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP</td>
<td>1 1 1 1</td>
</tr>
<tr>
<td>DOWN</td>
<td>0 0 0 1</td>
</tr>
<tr>
<td>LEFT</td>
<td>1 0 0 1</td>
</tr>
<tr>
<td>RIGHT</td>
<td>0 1 1 0</td>
</tr>
<tr>
<td>OPEN</td>
<td>1 1 0 0</td>
</tr>
<tr>
<td>CLOSE</td>
<td>0 0 1 1</td>
</tr>
</tbody>
</table>

The instructions are entered as hexadecimal values.

An operator enters the values: 9 1 C 3 F

Convert the values and write down the operation (e.g. RIGHT) carried out by the robot arm. [5]

Solution:
9 – LEFT
1 – DOWN
C – OPEN
3 – CLOSE
F – UP
DATA REPRESENTATION
2003-2019
Oct/Nov 2003:
12 Two 7 segment displays are used on a car dashboard to give information to the driver. Each segment is numbered as shown.

For example, the information 1P shown above is represented by:

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>and by:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Bit 0 is always zero

(a) What is being displayed to the driver if bytes (1) and (2) are showing?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>1</th>
<th>1</th>
<th>0</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>.................................................</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>.................................................</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) What bit patterns must be used to show the information 0L?

<p>| | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solution:
(a) 4
(b) (1) 01111110
     (2) 01110000
(c) (i) any one from:
     - drivers used to analogue instruments
     - readings are steadier
     - more accurate (because of infinite number of positions)
     - easier to see "trends" in read outs/easier to understand
(ii) any one from:
     - not as easy to read as digital
     - needs to be interpreted by user
     - mechanical device more likely to break down/fail

May/June 2005:
A microprocessor controls the washing cycle of an automatic washing machine and gives output to the following devices:

- water valve
- heater
- wash motor
- pump

Control bits are sent to turn parts of the system on or off, i.e., 1 is on and 0 is off.

(a) State what is happening when the above bit pattern is set.

(b) Write down the bit pattern that would be set if the water has reached the correct level, the temperature is the required temperature, the clothes have been washed and the pump is now pumping the water out of the machine.

(c) State one other process that the microprocessor could control.

Solution:
(a) heater on and motor on/hot wash

(b)  

(c) Any one from:
- release door – via door switch
- releasing powder at set intervals/fabric conditioner
- drying/spinning
- give error messages/beeps
- stored programs for different washes e.g. cottons/woollens

Oct/Nov 2005:
A company keeps details of all its employees on a file. The record format for each employee is:

<table>
<thead>
<tr>
<th>Field</th>
<th>Name</th>
<th>Sex</th>
<th>Department</th>
<th>Location</th>
<th>Years in company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size:</td>
<td>15 characters</td>
<td>1 character</td>
<td>1 character</td>
<td>10 characters</td>
<td>2 digits</td>
</tr>
</tbody>
</table>
Computer Science 2210

The following codes are used:

Sex: \( F = \text{female} \quad M = \text{male} \)

Department: \( A = \text{administration} \quad F = \text{finance} \quad M = \text{management} \quad S = \text{sales} \)

One typical record is:

\[
\begin{array}{cccccccc}
P & D & E & M & T & R & A & K & I & S & M & F & C & Y & P & R & U & S & 0 & 5 \\
\end{array}
\]

(a) In which Department does P Demetrakis work?

........................................................................................................................................[1]

(b) Complete the record for Miss K Schroder, who is in the sales department in Austria. She has worked in the company for 8 years.

........................................................................................................................................[3]

(c) Give two advantages of using codes when storing data.

1 ........................................................................................................................................

........................................................................................................................................[2]

2 ........................................................................................................................................

........................................................................................................................................[2]

(d) (i) Why is it not a good idea to use the field Years in company to store information about how long an employee has worked for the company?

........................................................................................................................................

........................................................................................................................................

(ii) What would be a more suitable field?

........................................................................................................................................

........................................................................................................................................[2]

Solution:

(a) Finance/Management

(b) (NOTE: Accept FS AUSTRIA one box to the left)

\[
\begin{array}{cccccccc}
K & S & C & H & R & O & D & E & R & F & S & A & U & S & T & R & I & A & 0 & 8 \\
\end{array}
\]

<......................................................................................................................................1 mark

<......................................................................................................................................1 mark

<......................................................................................................................................1 mk>
Computer Science 2210
Compiled By: Naqash Sachwani

(c) Any **two** advantages from
shorter, therefore less memory/storage used
shorter, therefore less typing required/faster input
less chance of errors being made
easier/faster to carry out searches/process data
easier/faster to do validation checks

(d) (i) Any one from
changes every year
files would need to be updated every year

(ii) date/year employee joined the company

-----------------------------------------------------------------------------------------------------------------------------

May/June 2007:

A 7-segment display is used to indicate which floor a lift is on. Each segment is numbered as shown:

```
\[
\begin{array}{c}
1 \\
2 \\
3 \\
4 \\
5 \\
6 \\
7 \\
\end{array}
\]
```

A byte is used to hold the data needed to light the correct segments. Bit 0 is always zero. For example, 3 is represented by

```
\[
\begin{array}{c}
1 & 0 & 0 & 1 & 1 & 1 & 0 \\
7 & 6 & 5 & 4 & 3 & 2 & 1 & 0 \\
\end{array}
\]
```

Bit Number

(a) If the lift is to stop at more than one floor, the data is held in successive bytes. For example:

FIRST BYTE: \[
\begin{array}{c}
0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \\
\end{array}
\]

SECOND BYTE: \[
\begin{array}{c}
1 & 1 & 0 & 1 & 1 & 0 & 1 & 0 \\
\end{array}
\]

Which floor numbers are stored in each byte?

First byte floor number ..........................................................................................................................

Second byte floor number .................................................................................................................. [2]

(b) What bit pattern is used to indicate Floor 2?

```
\[
\begin{array}{c}
1 & 0 & 0 & 0 & 0 \\
\end{array}
\]
```

[1]
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Compiled By: Naqash Sachwani

(c) The lift is travelling down to stop at Floors 5, 3 and 1. When it stops at Floor 5, a passenger gets in and presses the button for Floor 2.

How does the system ensure that the lift stops at Floors 3, 2 and 1 in that order?

Solution:

(a) 7

5

(b) 10110110

(c) Any three points from:

Notes lift is going down
Notes required floor is less than present floor
Sorts remaining numbers into descending order of floors

Oct/Nov 2009:

15 Electric guitars consist of strings and frets.

Musical notes on the guitar can be represented using the TAB notation:

Each line represents a string, the dots indicate which strings must be held down with the fingers. These are shown with a binary value of 1; otherwise the binary value is 0.

Thus, the above note would be shown as:

It is also important to indicate where the strings should be held down. This is shown on the FRET. If the fingers are to be held down at the 20th FRET, this is shown in binary as:
(a) A note is being played according to the TAB notation:

1
2
3
4
5
6

The strings are being held down on the 18th FRET.

Write down the binary notation for the TAB and for the FRET position:

<table>
<thead>
<tr>
<th>TAB notation:</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FRET position:</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) (i) Show on the diagram below which note corresponds to TAB notation: 000010.

1
2
3
4
5
6

(ii) What FRET position corresponds to 010011?  

(c) Describe two advantages of storing musical notes in this format.

1
2

Solution:
(a) TAB: 0 1 1 1 0 1
FRET: 0 1 0 0 1 0
(b) (i) 

(ii) 19
Oct/Nov 2013 P13:

16. A customer logs on to a secure website using a code and a password. The first stage is to key in a code which is his date of birth (DDMMYY) followed by 1234. The second stage is to type in the first, third, fourth and seventh character of his password.

   The customer last logged on to the website on 15th March 2010.

   (a) (i) The customer’s date of birth is 15th November 1985. What is the customer’s code?

   (ii) Why is this code not unique?

   (iii) Suggest how this coding system could be improved. [3]

   (b) (i) The customer’s password is PAULO168.

   What does the customer need to type at the second stage?

   

   1st 3rd 4th 7th

   (ii) Why are passwords used? [2]

   (c) If the customer gets through the two stages above he is then directed to a new security page which states:

   “You were last logged on to this website on 14th April 2010. Is this correct?”

   What could have happened to make the customer concerned about this statement? [1]

Solution:

(a) (i)

1 5 1 1 8 5 1 2 3 4

(ii) more than one person can have same date of birth

(iii) Any one from:

- give different 4-digit codes to people
- increase the number of digits in code (e.g. 10 instead of 4)

(b) (i)

P U L 6

(ii) to prevent illegal access to the website

(c) Any two from:

- he last logged on on 16th March 2010 and system shows 14th April 2010
- there is evidence of illegal access
May/June 2014 P11:

12 A digital light meter has a 3-digit LCD. The value of each digit on the instrument display is stored as a 4-bit binary number in a register.

For example:

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

is represented by:

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

(a) What value is shown on the display if the 4-bit binary registers contain:

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(b) What would be stored in the 4-bit binary registers if the display shows:

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Y</td>
<td>Z</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(c) If any of the 4-bit binary registers X, Y or Z contain the value 1 1 1 1 this indicates an error.

(i) How could this error be shown on the instrument display?

(ii) What could cause an error to occur?

Solution:

(a) 2 9 1

(b) 0 0 1 1
May/June 2014 P12:
16 An encryption system gives each letter of the alphabet a value:

Each letter is stored in a 12-bit binary register. The letter “S” (18th letter) is stored as:

\[
\begin{array}{c}
2048 & 1024 & 512 & 256 & 128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 \\
\end{array}
\]

A 4-bit register is used to store the encryption key. This register shows how many places the bits are shifted to the left in the 12-bit register when it is encrypted. So,

\[
\begin{array}{c}
8 & 4 & 2 & 1 \\
0 & 1 & 0 & 1 \\
\end{array}
\]

means each bit in the 12-bit register is shifted 5 places to the left and the register now becomes:

\[
\begin{array}{c}
2048 & 1024 & 512 & 256 & 128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\
0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

Therefore, the letter “S” would be transmitted with the 4-bit register and the 12-bit register as follows:

\[
\begin{array}{c}
0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

(a) “W” is the 23rd letter of the alphabet.

(i) Show how this letter would be stored in the 12-bit register before encryption:

(ii) The 4-bit register contains the following value:

\[
\begin{array}{c}
8 & 4 & 2 & 1 \\
0 & 1 & 1 & 0 \\
\end{array}
\]

Show how the letter “W” is now stored in the 12-bit register in encrypted form:

(b) Find which letter of the alphabet has been encrypted here. (Show all your working.)

\[
\begin{array}{c}
0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
\end{array}
\]

[2]

(c) (i) What is the largest encryption key that can be stored in the 4-bit register?
Computer Science 2210
Compiled By: Naqash Sachwani

(ii) Convert this into denary (base 10).

Solution:
(a) (i)

\[
\begin{array}{cccc}
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 \\
0 & 1 & 1 & 1 \\
\end{array}
\]

(ii)

\[
\begin{array}{cccc}
0 & 1 & 0 & 1 \\
1 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 \\
\end{array}
\]

(b) one mark
- letter "Y" or 25th letter

One mark
- the binary number 0 0 0 0 1 1 0 0 1 0 0 0 has been shifted (to the left) 3 places
- so the binary number becomes 0 0 0 0 0 0 0 1 1 0 0 1
- 1\times 8 + 16

(c) (i) 1 1 1 1
(ii) 15 (allow follow through from (i))
(iii) try to move 15 places to the left which is not possible
- only 12 bits in register to store letter; 15 is too large
- you would end up with 12 0s in the register

Oct/Nov 2014 P12:

12 An advertising sign uses large LED characters controlled by a microprocessor.

Each letter is formed from a grid made up of eight rectangles numbered 1 to 8:

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
5 & 6 & 7 & 8 \\
\end{array}
\]

For example, the letter 'Z' is formed as follows:

\[
\begin{array}{cccc}
1 & 2 & 4 \\
5 & 7 & 8 \\
\end{array}
\]

Each rectangle has six LEDs that can light up; these LEDs are labelled "a" to "f":

The LEDs in a rectangle can be represented in a 6-bit register. For example, rectangle 3 of the letter 'Z':

\[
\begin{array}{c}
a \\
e \\
f \\
d \\
c \\
b \\
\end{array}
\]
Computer Science 2210

Compiled By: Naqash Sachwani

can be represented as:

\[
\begin{array}{c}
\text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} \\
0 & 1 & 0 & 0 & 0 & 1
\end{array}
\]

Thus the letter “Z” can be represented by the 8 registers:

\[
\begin{array}{cccccccc}
\text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} & \text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
3 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
6 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
7 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

(a) Show how the letter “E” can be represented by the eight 6-bit registers (four registers have been done for you).

\[
\begin{array}{cccccccc}
\text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} & \text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
4 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
5 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
6 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
7 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
8 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

(b) State which letter of the alphabet is represented by the following eight 6-bit registers.

\[
\begin{array}{cccccccc}
\text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} & \text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]

Solution:

(a) 1 mark for each of four rows shown in bold below; there are two possible ways of doing this — one set of answers is shown on the left and the alternative is shown on the right in brackets. Don’t allow mix and match; answers must either be as shown on the left OR as shown on the right.

\[
\begin{array}{cccccccc}
\text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} & \text{f} & \text{e} & \text{d} & \text{c} & \text{b} & \text{a} \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{array}
\]
Oct/Nov 2014 P13:

14 Digits on an electronic display board can be represented on a 7 x 5 grid. For example, the digit 3 is represented as:

```
Row 1: 1 2 3 4 5
Row 2: 1 0 0 0 1
Row 3: 0 1 0 0 0
Row 4: 0 0 0 0 0
Row 5: 0 0 0 0 0
Row 6: 0 0 0 0 0
Row 7: 0 0 0 0 0
```

Each column in the grid is represented in a computer as a 7-bit register. Five registers are required to represent the state of the whole digit. The value 1 represents a shaded square and the value 0 represents an unshaded square. For example, the digit 3 is represented as:

| Register 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Register 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Register 3 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| Register 4 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| Register 5 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |

(a) Show the contents of the five 7-bit registers when representing the digit 9:

```
Row number: 1 2 3 4 5 6 7
Reg 1
Reg 2
Reg 3
Reg 4
Reg 5
```

(b) In order to prevent errors, an 8-bit register is used. The 8th bit will contain:

- 0 – if the first 7 bits add up to an even number
- 1 – if the first 7 bits add up to an odd number

Complete the 8th bit for each register. The first register has been completed for you.

| Reg 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Reg 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |   |
| Reg 3 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |   |
| Reg 4 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |   |
| Reg 5 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |   |
May/June 2015 P11:

8 An alarm clock is controlled by a microprocessor. It uses the 24 hour clock. The hour is represented by an 8-bit register, A, and the number of minutes is represented by another 8-bit register, B.

(a) Identify what time is represented by the following two 8-bit registers.

\[
\begin{array}{cccccccc}
128 & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\
A: & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\
B: & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 1
\end{array}
\]

Hours ........................................ Minutes ........................................ [2]

(b) An alarm has been set for 07:30. Two 8-bit registers, C and D, are used to represent the hours and minutes of the alarm time.

Show how 07:30 would be represented by these two registers:

\[
\begin{array}{cccccccc}
& & & & & & & \\
C: & & & & & & & \\
& & & & & & & \\
D: & & & & & & & \\
\end{array}
\]

Hours ........................................ Minutes ........................................ [2]

(c) Describe how the microprocessor can determine when to sound the clock alarm. [3]

(d) The LCD (liquid crystal display) on the clock face is back-lit using blue LEDs (light emitting diodes). The brightness of the clock face is determined by the level of light in the room. The amount of light given out by the LEDs is controlled by a control circuit.
Describe how the sensor, microprocessor and LEDs are used to maintain the correct brightness of the clock face.

(e) Modern LCD monitors and televisions use LED backlit technology.

Give two advantages of using this new technology compared to the older cold cathode fluorescent lamp (CCFL) method.

1. 
2. 

Solution:

(a) hours: 18  
minutes: 53

(b) hours (“C”) minutes (“D”)  

(c) Any three from:
   - reads values in registers “C” and “D”
   - and checks the values against those stored in registers “A” and “B”
   - if values in corresponding registers are the same
   - the microprocessor sends a signal to sound alarm/ring

(d) Any three from:
   - uses a light sensor
   - sends signal/data back to microprocessor
   - signal/data converted to digital (using ADC)
   - value compared by microprocessor with pre-set/stored value
   - if value < stored value, signal sent by microprocessor ...
   - ... to the voltage supply (unit)
   - “value” of signal determines voltage supplied/brightness of LED

(e) Any two from:
   - no need to warm up
   - whiter tint/more vivid colours/brighter image
   - higher resolution
   - much thinner monitors possible/lighter weight
   - more reliable technology/longer lasting
   - uses much less power/more efficient

May/June 2015 P12:

5 Parity checks are often used to check for errors that may occur during data transmission.

(a) A system uses even parity.

Tick (✓) to show whether the following three bytes have been transmitted correctly or incorrectly.

<table>
<thead>
<tr>
<th>Received byte</th>
<th>Byte transmitted correctly</th>
<th>Byte transmitted incorrectly</th>
</tr>
</thead>
<tbody>
<tr>
<td>11001000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01111100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01101001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) A parity byte is used to identify which bit has been transmitted incorrectly in a block of data.

The word “F L O W C H A R T” was transmitted using nine bytes of data (one byte per character). A tenth byte, the parity byte, was also transmitted.

The following block of data shows all ten bytes received after transmission. The system uses even parity and column 1 is the parity bit.
### Computer Science 2210
Compiled By: Naqash Sachwani

<table>
<thead>
<tr>
<th>Letter</th>
<th>Column 1</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
<th>Column 5</th>
<th>Column 6</th>
<th>Column 7</th>
<th>Column 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
<td>F</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Byte 2</td>
<td>L</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Byte 3</td>
<td>O</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Byte 4</td>
<td>W</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Byte 5</td>
<td>C</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Byte 6</td>
<td>H</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Byte 7</td>
<td>A</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Byte 8</td>
<td>R</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Byte 9</td>
<td>T</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Parity byte</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

(i) **One** of the bits has been transmitted incorrectly.
Write the byte number and column number of this bit:
- Byte number .......................................................... [2]
- Column number .......................................................... [2]

(ii) Explain how you arrived at your answer for part (b)(i). [1]

(c) Give the denary (base 10) value of the byte: **10111110**

(d) A parity check may not identify that a bit has been transmitted incorrectly.

Describe one situation in which this could occur. [1]

**Solution:**

1 mark per correctly placed tick

<table>
<thead>
<tr>
<th>Received byte</th>
<th>Byte transmitted correctly</th>
<th>Byte transmitted incorrectly</th>
</tr>
</thead>
<tbody>
<tr>
<td>11001000</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>01111100</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>01101001</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

(b) (i) Byte number: **7**
- Column number: **6**

(ii) **Any two from:**
- Letter "A" (byte 7) transmitted as odd parity (three 1s)
- Column 6 has odd parity (seven 1s)
- Intersection of byte 7 and column 6 indicates incorrect bit value

(c) **190**

(d) **Any one from:**
- 2 bits interchanged (e.g. 1 → 0 and 0 → 1) that won’t change parity value
- Even number of bits/digits are transposed
- If there are multiple errors in the same byte/column, that still produce the same parity bit, the error will not be detected

10 Letters from the alphabet are represented in a computer by the following denary (base 10) values:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>97</td>
</tr>
<tr>
<td>G</td>
<td>103</td>
</tr>
<tr>
<td>l</td>
<td>105</td>
</tr>
<tr>
<td>L</td>
<td>108</td>
</tr>
<tr>
<td>N</td>
<td>110</td>
</tr>
</tbody>
</table>

The word “**A L I G N**” is stored as: **97 108 105 103 110**
(a) Convert each of the five values to binary. The first one has been done for you.

<table>
<thead>
<tr>
<th>Letter</th>
<th>Denary value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (97):</td>
<td>0 1 1 0 0 0 0 1</td>
</tr>
<tr>
<td>L (108):</td>
<td></td>
</tr>
<tr>
<td>I (105):</td>
<td></td>
</tr>
<tr>
<td>G (103):</td>
<td></td>
</tr>
<tr>
<td>N (110):</td>
<td></td>
</tr>
</tbody>
</table>

(b) An encryption system works by shifting the binary value for a letter one place to the left. “A” then becomes:

```
1 1 0 0 0 0 1 0
```

This binary value is then converted to hexadecimal; the hexadecimal value for “A” will be:

C 2

For the two letters “L” and “G”, shift the binary values one place to the left and convert these values into hexadecimal:

<table>
<thead>
<tr>
<th>Letter</th>
<th>Hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>L:</td>
<td>...................................</td>
</tr>
<tr>
<td>G:</td>
<td>...................................</td>
</tr>
</tbody>
</table>

Solution:

(a)

<table>
<thead>
<tr>
<th>Letter</th>
<th>Hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>L (108):</td>
<td>0 1 1 0 1 1 0 0</td>
</tr>
<tr>
<td>I (105):</td>
<td>0 1 1 0 1 0 0 1</td>
</tr>
<tr>
<td>G (103):</td>
<td>0 1 1 0 0 1 1 1</td>
</tr>
<tr>
<td>N (110):</td>
<td>0 1 1 0 1 1 1 0</td>
</tr>
</tbody>
</table>

(b) hexadecimal

<table>
<thead>
<tr>
<th>Letter</th>
<th>Hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>L:</td>
<td>1 1 0 1 1 0 0 0</td>
</tr>
<tr>
<td>G:</td>
<td>1 1 0 0 1 1 1 0</td>
</tr>
</tbody>
</table>

Oct/Nov 2015 P12:

4 (a) (i) Convert the following two hexadecimal numbers into binary:

F A 7
D 3 E
Computer Science 2210

Compiled By: Naqash Sachwani

(i) Now perform the AND (logic) operation on each corresponding pair of binary bits in the two numbers from part (i).

(ii) Convert your answer in part (ii) into hexadecimal.

(b) (i) The following code shows HTML 'tag' pairs on either side of the text stating the colour that each creates.

<font color="FF0000">RED</font>
<font color="00FF00">GREEN</font>
<font color="0000FF">BLUE</font>
<font color="#FF00FF">YELLOW</font>
<font color="#FFFF00">MAGENTA</font>
<font color="#00FFFF">CYAN</font>

Yellow is a combination of red and green, magenta a combination of red and blue and cyan a combination of green and blue.

State what 6-digit hexadecimal values should replace X, Y and Z in the above code.

X ..........................................................................................................................

Y ..........................................................................................................................

Z ..........................................................................................................................

(ii) Describe how other colours, such as a darker shade of blue, are created.

(c) 1A – 16 – C5 – 22 – FF – FF is an example of a MAC address.

(i) Identify what the first six and last six hexadecimal digits represent.

First six digits ..................................................................................................................

Last six digits ..................................................................................................................

(ii) State why MAC addresses are used.

Solution:

(a) (i) F A 7: 1 1 1 1 1 0 1 0 0 1 1 1

D 3 E: 1 1 0 1 0 0 1 1 1 1 0

(ii) 1 1 0 1 0 0 1 1 0 1 1 0

(iii) D 2 6
7 (a) Check digits are used to ensure the accuracy of input data.

A 7-digit code number has an extra digit on the right, called the check digit.

<table>
<thead>
<tr>
<th>Digit position</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The check digit is calculated as follows:

- each digit in the number is multiplied by its digit position
- the seven results are then added together
- this total is divided by 11
- the remainder gives the check digit (if the remainder = 10, the check digit is X)

(i) Calculate the check digit for the following code number. Show all your working.

3 2 4 0 0 4 5 X

Check digit: 8

(ii) An operator has just keyed in the following code number:

4 2 4 1 5 0 8 ...

Has the operator correctly keyed in the code number?

(b) When data are transmitted from one device to another, a parity check is often carried out on each byte of data. The parity bit is often the leftmost bit in the byte.

(i) If a system uses even parity, give the parity bit for each of the following bytes:

parity bit

\[
\begin{array}{ccccccc}
1 & 1 & 0 & 0 & 1 & 1 & 0 \\
\end{array}
\]

parity bit

\[
\begin{array}{ccccccc}
0 & 0 & 0 & 0 & 0 & 0 & 1 \\
\end{array}
\]

(ii) A parity check can often detect corruption of a byte.

Describe a situation in which it cannot detect corruption of a byte.

Solution:
Oct/Nov 2015 P13:

2 Sensors and a microprocessor monitor a car exhaust for high temperature and high carbon monoxide (CO) levels.

(a) Describe how the sensors and microprocessor are used to monitor the temperature and CO levels and warn the driver if either is out of range. [5]

(b) The information from seven sensors is sent to an engine management system in the car. The status of each sensor is stored in an 8-bit register; a value of 1 indicates a fault condition:

parity bit | CO level too high | voltage too low | oil pressure | airbag fault | brake pads too thin

For example, a register showing 0 1 0 1 0 0 0 indicates:
- temperature too high
- fuel pressure too low
- voltage too low

(i) Identify the fault condition(s) that the following register indicates:

0 0 1 0 0 1 0 1 [2]

(ii) The system uses odd parity.
Write the correct parity bit in each register.

1 1 1 0 0 1 0 0
A car has a faulty airbag and the CO level is too high. Write what should be contained in the 8-bit register.

(iv) Give the hexadecimal value of the binary number shown in part (iii).

Solution:

(a) Any five from:
- sensors send signals/data to microprocessor
- signal/data converted to digital (by an ADC)
- microprocessor compares temperature/carbon monoxide level/value with stored level/value
- if CO level > stored value, microprocessor sends signal...
- if temperature > stored value, microprocessor sends signal...
- ...to light warning bulb on dashboard/sounds alarm

(b) (i) CO (carbon monoxide) level too high
- oil pressure too low
- brake pads too thin

(ii) 

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

(iii) 

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

(iv) A 2 (allow follow through from part (iii))

3 A section of computer memory is shown below:

<table>
<thead>
<tr>
<th>Address</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 0000</td>
<td>0110 1110</td>
</tr>
<tr>
<td>1000 0001</td>
<td>0101 0001</td>
</tr>
<tr>
<td>1000 0010</td>
<td>1000 1101</td>
</tr>
<tr>
<td>1000 0011</td>
<td>1000 1100</td>
</tr>
<tr>
<td>1000 1100</td>
<td></td>
</tr>
<tr>
<td>1000 1101</td>
<td></td>
</tr>
<tr>
<td>1000 1110</td>
<td></td>
</tr>
<tr>
<td>1000 1111</td>
<td></td>
</tr>
</tbody>
</table>

(a) (i) The contents of memory location 1000 0001 are to be read.

Show the contents of the Memory Address Register (MAR) and the Memory Data Register (MDR) during this read operation:

MAR

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

MDR

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
Computer Science 2210

(ii) The value 0111 1001 is to be written into memory location 1000 1110. Show the contents of the MAR and MDR during this write operation:

<table>
<thead>
<tr>
<th>MAR</th>
<th>MDR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(iii) Show any changes to the computer memory following the read and write operations in part (a)(i) and part (a)(ii).

<table>
<thead>
<tr>
<th>Address</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 0000</td>
<td>0110 1110</td>
</tr>
<tr>
<td>1000 0001</td>
<td>0101 0001</td>
</tr>
<tr>
<td>1000 0010</td>
<td>1000 1101</td>
</tr>
<tr>
<td>1000 0011</td>
<td>1000 1100</td>
</tr>
<tr>
<td>1000 1100</td>
<td></td>
</tr>
<tr>
<td>1000 1101</td>
<td></td>
</tr>
<tr>
<td>1000 1110</td>
<td></td>
</tr>
<tr>
<td>1000 1111</td>
<td></td>
</tr>
</tbody>
</table>

Solution:

(b) Name three other registers used in computers.

(c) The control unit is part of a computer system. What is the function of the control unit?

Solution:

(a) (i)

<table>
<thead>
<tr>
<th>MAR</th>
<th>MDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0 0 0 0 0 0 0 1</td>
<td>0 1 0 1 0 0 0 1</td>
</tr>
</tbody>
</table>

(ii)

<table>
<thead>
<tr>
<th>MAR</th>
<th>MDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0 0 0 1 1 1 0</td>
<td>0 1 1 1 1 0 0 1</td>
</tr>
</tbody>
</table>

(iii)

<table>
<thead>
<tr>
<th>Address</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 0000</td>
<td>0110 1110</td>
</tr>
<tr>
<td>1000 0001</td>
<td>0101 0001</td>
</tr>
<tr>
<td>1000 0010</td>
<td>1000 1101</td>
</tr>
<tr>
<td>1000 0011</td>
<td>1000 1100</td>
</tr>
<tr>
<td>1000 1100</td>
<td></td>
</tr>
<tr>
<td>1000 1101</td>
<td></td>
</tr>
<tr>
<td>1000 1110</td>
<td></td>
</tr>
<tr>
<td>1000 1111</td>
<td></td>
</tr>
</tbody>
</table>

(b) - CIR (Current Instruction Register)
- PC (Program Counter)
- Acc (Accumulator)
Computer Science 2210
Compiled By: Naqash Sachwani

(c) – Controls operation of memory, processor and input/output
   - Instructions are interpreted
   - Sends signals to other components telling them “what to do”

May/June 2016 P11:
7 Each seat on a flight is uniquely identified on an LCD above the seat. For example, seat 035C is shown as:

```
035C
```

The first three characters are digits that represent the row.
The fourth character is the seat position in that row. This is a single letter, A to F, that is stored as a hexadecimal value.

Each of the four display characters can be stored in a 4-bit register. For example, 0 and C would be represented as:

```
| 8 | 4 | 2 | 1 |
-------------------------------------
| 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 |
```

(a) Show how the 4-bit registers would store the remaining two characters, 3 and 5.

```
3
```
```
5
```

(b) Identify which seat is stored in the following 4-bit registers.

```
| 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |
```

Solution:
(a) 3

```
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
```

(b) 0

```
| 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |
```

9 Check digits are used to ensure the accuracy of entered data.
A 7-digit number has an extra digit on the right, called the check digit.

<table>
<thead>
<tr>
<th>digit position:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>digit:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>check digit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The check digit is calculated as follows:
- each digit in the number is multiplied by its digit position
- the seven results are then added together
- this total is divided by 11
- the remainder gives the check digit (if the remainder = 10, the check digit is X)
(a) Calculate the check digit for the following number. Show all your working.

\[
\begin{array}{cccccccc}
4 & 2 & 4 & 1 & 5 & 0 & 8 & \ldots
\end{array}
\]

Check digit \[\ldots\] \[2\]

(b) An operator has just keyed in the following number:

\[
\begin{array}{cccc}
3 & 2 & 4 & 0 & 0 & 4 & 5 & X
\end{array}
\]

Circle below correct if the check digit is correct OR incorrect if the check digit is incorrect.

\[
\begin{array}{cccc}
\text{correct} & \text{incorrect}
\end{array}
\]

Explain your answer. \[3\]

Solution:

(a) \((4 \times 1) + (2 \times 2) + (4 \times 3) + (1 \times 4) + (5 \times 5) + (0 \times 6) + (8 \times 7)\)

\[= 4 + 4 + 12 + 4 + 25 + 0 + 56 = 105\]

\[105/11 = 9 \text{ remainder } 6\]

check digit is: 6

(b) incorrect check digit
- check digit should be 1
- \((3\times1) + (2\times2) + (4\times3) + (0\times4) + (0\times5) + (4\times6) + (5\times7)\) \(\text{// } 3 + 4 + 12 + 0 + 0 + 24 + 35 \text{//}\)

Total = 78
- 78/11 gives 7 remainder 1

12 (a) Name the following type of barcode:

(b) The barcode in part (a) contains the decimal value \(2640\)

Convert this value to hexadecimal.

Write the value as a 12-bit binary number:

\[
\begin{array}{c}
0
\end{array}
\]

(c) An airport uses the type of barcode shown in part (a) to advertise local places of interest. Describe how a visitor landing at the airport could use these barcodes to help plan their visit.

Solution:

(a) QR (quick response) Code

(b) \(A50\) (1 mark)

\[
\begin{array}{c}
1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0
\end{array}
\]

(c) Any three from:
- visitor scans the QR code with (the camera on) the mobile device
- App is used to read/interpret the QR code
- links to a website/opens a document...
- ... to access local tourist information
- can store the QR code to refer to again for the information

May/June 2016 P12:

3 (a) Convert the following hexadecimal number into 12-bit binary:

\(4A\)
The 2016 Olympic Games will be held in Rio de Janeiro. A timer that counts down to the opening of the Games is shown on a microprocessor-controlled display. The number of hours, minutes and seconds until the Games open are held in three 8-bit registers.

The present register values are:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>105 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>32 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>20 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The timer will count down in seconds.

(i) Show the values in each 8-bit register 30 seconds after the time shown above:

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>seconds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) Write the hexadecimal value of the minutes register from part (b)(i).

Solution:
(a) 0100 1010 1111
(b) (i) 0 1 1 0 1 0 0 1
       0 0 1 1 1 1 1
       0 0 1 1 0 0 1 0
       105 hours
       31 minutes
       50 seconds

(ii) 1F

9. In the following barcode, each binary number is made up of seven bars. Each bar is black or grey. A black bar is interpreted as a “1” and a grey bar is interpreted as a “0”.

(a) Write the binary numbers that would be produced from this barcode:

Binary number A: 

Binary number B: 

(b) This barcode system uses odd parity. Write the parity bit for each of the binary numbers in part (a):

Parity bit

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary number A:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary number B:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solution:
(a) Binary number A: 1 1 1 0 0 1 0
Oct/Nov 2016 P12:

4. Nine bytes of data are transmitted from one computer to another. Even parity is used. An additional parity byte is also sent. The ten bytes arrive at the destination computer as follows:

<table>
<thead>
<tr>
<th>parity bit</th>
<th>bit 1</th>
<th>bit 2</th>
<th>bit 3</th>
<th>bit 4</th>
<th>bit 5</th>
<th>bit 6</th>
<th>bit 7</th>
<th>bit 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>byte 1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>byte 2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>byte 3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>byte 4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>byte 5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>byte 6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>byte 7</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>byte 8</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>byte 9</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>parity byte</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

One of the bits was corrupted during the data transmission.
(a) **Circle** the corrupt bit in the corrupt byte in the table above. [1]
(b) Explain how the corrupted bit was found. [2]

Solution:
(a) Intersection of Row 7 and column 4 circled
(b) - Row (byte number) 7 has an odd number of 1s (five 1s)
    - Column (bit number) 4 has an odd number of 1s (five 1s)

5. A computer uses an 8-bit register. The 8-bit register contains binary integers.
(a) Write the denary (base 10) value represented by:

```
  128  64  32  16  8  4  2  1
0  1  1  1  0  0  0  0
```

(b) **All the bits in the register are shifted one place to the right** as shown below.

```
  0  1  1  1  0  0  0  0
  
  0  0  1  1  1  0  0  0
```

[1]
Solution:

(a) 112
(b) 56
(c) divided by 2 // value 112 was halved // multiplied by 0.5
(d) (i) 0 0 0 0 1 1 1 0
(ii) 14
(e) Any two from:
- run out of places to the right of register // at the end of register
- right-most 1 would be lost
- number would become 3 instead of 3.5
- loss of precision

11 A security system is installed in a house. A hexadecimal number is entered to activate or deactivate the alarm.

(a) The alarm code is set to hexadecimal number 2 A F
(b) Identify two sensors that the security system could use to detect intruders.

Solution:

(a) 0010 1010 1111
(b) Infrared/motion sensor:
- Receives infrared rays/heat
- Sends data to microprocessor
- Receives microwaves
- Placed in the corner of a room, across a doorway
- Used to detect the heat of an intruder // used to detect if an infrared beam has been broken by an intruder

Pressure sensor:
- Receives current if circuit created // stops receiving current if circuit is broken
- Sends data to microprocessor
- Placed on a window/door, at the entrance
- Used to detect a change in pressure

5 (c) A microprocessor regularly samples the output, X. Each sample value is stored in an 8-bit register as shown below. One bit of this register is reserved as a parity bit.

Five consecutive output values of 1 indicate a fault condition.
Identify which of the following registers shows a fault condition.

Register Y
1 1 1 1 1 0 0 1
Register Z
0 1 0 1 1 1 1 1

Register ........................................... [1]
(d) When eight bytes of data have been collected, they are transmitted to a computer 100 km away. Parity checks are carried out to identify if the data has been transmitted correctly. The system uses even parity and column 1 is the parity bit.

The eight bytes of data are sent together with a ninth parity byte:

<table>
<thead>
<tr>
<th></th>
<th>parity bit</th>
<th>column 2</th>
<th>column 3</th>
<th>column 4</th>
<th>column 5</th>
<th>column 6</th>
<th>column 7</th>
<th>column 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>byte 1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>byte 2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>byte 3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>byte 4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>byte 5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>byte 6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>byte 7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>byte 8</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>parity byte</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

(i) Identify which of the eight bytes contains an error.

byte ............................................................................................................ [1]

(ii) Identify which column contains an error.

column ........................................................................................................... [1]

(iii) The incorrect bit is indicated where the byte number and column cross.

Give the corrected byte.

[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [1]

(iv) Calculate the denary value of the corrected byte. [1]

(v) Considering the fault condition given in part (c), explain why it is very important that the incorrect bit is located and corrected. [2]

Solution:

(c) Register Z

(d) (i) (byte) 5

(ii) (column) 4

(iii) corrected byte is: 1 0 0 1 1 1 1

(iv) that gives the value: 1 5 9

(follow through applies)

(v) Any two from:

- The byte would be transmitted without having 5 consecutive 1’s
- The fault condition would not be recognised

10 (a) A manufacturer of aeroplane engines assigns a denary identification number (ID) to each engine.

One engine has the ID: 0431

(i) Convert this denary number to a 12-bit binary format.

[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [2]

(ii) Show how this number would be represented in hexadecimal. [3]

(b) The current status of the engine is sent to a computer in the aeroplane.

Each piece of data collected is 8 bytes in size. Data collection occurs every 30 seconds. Calculate the number of kilobytes that would be needed to store the data collected during a 10-hour flight. Show your working.

............................................................... kilobytes [3]
Specimen paper 2016:

1. A company selling CDs uses a unique 6-digit identification number for each CD title. The rightmost digit (position 1) is a check digit.
   - For example,
     
     $\begin{array}{c}
     6 \ 5 \ 4 \ 3 \ 2 \ 1 \\
     3 \ 0 \ 6 \ 1 \ 4 \ 9 \\
     \end{array}$
     
     $\text{digit position} \rightarrow \text{identification number}$

   The validity of the number and check digit is calculated as follows:
   - multiply each digit by its digit position
   - add up the results of the multiplications
   - divide the answer by 11
   - if the remainder is 0, the identification number and check digit are valid.

(a) Show whether the following identification numbers are valid or not. You must show how you arrived at your answer.
   - Identification number 1: 4 2 1 9 2 3
     
     working:
     \[ (4 \times 6) + (2 \times 5) + (1 \times 4) + (9 \times 3) + (2 \times 2) + (3 \times 1) \]
     \[ = 24 + 10 + 4 + 27 + 4 + 3 \]
     \[ = 77 \div 11 \]
     \[ = \text{6 remainder 6} \]
     \[ \text{valid/not valid: NOT valid} \]

   Identification number 2: 8 2 0 1 5 6
     
     working:
     \[ (8 \times 6) + (2 \times 5) + (0 \times 4) + (1 \times 3) + (5 \times 2) + (6 \times 1) \]
     \[ = 48 + 10 + 0 + 3 + 10 + 6 \]
     \[ = 77 \div 11 \]
     \[ = \text{7 remainder 0} \]
     \[ \text{valid/not valid: VALID} \]

(b) Find the check digit for this identification number.
   - 5 0 2 4 1 __
     
     working:
     \[ (5 \times 6) + (0 \times 5) + (2 \times 4) + (1 \times 3) \]
     \[ = 30 + 0 + 8 + 3 \]
     \[ = 41 \div 11 \]
     \[ = \text{6 remainder 5} \]
     \[ \text{check digit:} 5 \]

(c) Describe, with examples, two different types of data entry errors that a check digit would detect.
   - 1
     
     2

Solution:

(a) Identification number 1: working
   \[ (4 \times 6) + (2 \times 5) + (1 \times 4) + (9 \times 3) + (2 \times 2) + (3 \times 1) \]
   \[ = 24 + 10 + 4 + 27 + 4 + 3 \]
   \[ = 72 \div 11 \]
   \[ = \text{6 remainder 6} \]
   \[ \text{valid/not valid: NOT valid} \]
Computer Science 2210
Compiled By: Naqash Sachwani

(b) working
\[
= (5 \times 6) + (0 \times 5) + (2 \times 4) + (4 \times 3) + (1 \times 2)
= 30 + 0 + 8 + 12 + 2
= 52
\]

need to add 3 to make the total 55 (i.e. exactly divisible by 11)
check digit: 3

(c) 2 digits transposed
(e.g. 280419 becomes 280149/two digits have been switched)
incorrect digit
(e.g. 280419 becomes 250419/one of the digits has been mistyped)

4 A digital alarm clock is controlled by a microprocessor. It uses the 24-hour clock system (i.e. 6 pm is 18:00).
Each digit in a typical display is represented by a 4-digit binary code.

For example:

![Clock display]

| 1 0 0 0 0 | 1st digit (0) |
| 1 0 0 0 0 | 2nd digit (8) |
| 0 0 1 1 | 3rd digit (3) |
| 0 1 0 1 | 4th digit (5) |

(a) What time is shown on the clock display if the 4-digit binary codes are:

![Clock display]

(b) What would be stored in the 4-digit binary codes if the clock display time was:

![Clock display]

(c) The clock alarm has been set at 08:00.
Describe the actions of the microprocessor which enable the alarm to sound at 08:00.

Solution:

(a) 1 6 : 4 9
(b) 0 0 0 1 1 1
     0 1 1 1
     0 0 1 0
     1 0 0 1
(c) Any two from:
- microprocessor compares present time with stored time
- if the values are the same
- sends signal to sound alarm
Computer Science 2210

5 Bytes of data transferred using a serial cable are checked for errors at the receiving end using an even parity check.

Can these bytes of data pass the even parity check?

(a) 01010101
(b) 11001000
(c) How can any errors be corrected? [1][2]

Solution:

(a) Yes
(b) No
(c) – re-reading the byte that was sent
request that the byte be resent

13 When a key is pressed on the keyboard, the computer stores the ASCII representation of the character typed into main memory.
The ASCII representation for A is 65 (denary), for B is 66 (denary), etc.
There are two letters stored in the following memory locations:

<table>
<thead>
<tr>
<th>Location 1</th>
<th>Location 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
</tr>
</tbody>
</table>

(a) (i) Show the contents of Location 1 and Location 2 as binary using 8 bits.

<table>
<thead>
<tr>
<th>Location 1</th>
<th>Location 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) Show the contents of Location 1 and Location 2 as hexadecimal.

Location 1: 01000001
Location 2: 01000111

(b) The following machine code instruction is stored in a location of main memory:

1111101010010100101111

Convert this binary pattern into hexadecimal. [4]

(c) Explain why a programmer would prefer to see the contents of the locations displayed as hexadecimal rather than binary, when debugging his program that reads the key presses. [2]

Solution:

(a) (i) Location 1: 001000001
Location 2: 001000001

(ii) 41
43

(b) FA97

(c) – easier to identify values
– easier to spot errors

May/June 2017 P11:

The memory of a computer contains data and instructions in binary.
The following instruction is stored in a location of the memory.

00101000111111111111100

(a) Convert the instruction into hexadecimal. [2]

(b) Explain why a programmer might prefer to read the instruction in hexadecimal rather than in binary. [2]

(c) Give two other uses of hexadecimal.
Use 1
Use 2
**Computer Science 2210**

**Compiled By: Naqash Sachwani**

### Solution:

(a) 29FC

(b) Two from:
- Easier/quicker to understand/read
- Easier to debug/identify errors
- Fewer digits are used / shorter // takes up less space on screen // more can be shown on screen / page

(c) Two from:
- Notations for colour in HTML // HTML colour (codes)
- Error messages
- MAC address // IP address
- Locations in memory
- Memory dump

5 (a) Parity checks are often used to detect errors that may occur during data transmission. The received bytes in the table below were transmitted using **odd parity**.

Tick (✓) to show whether each byte has been **corrupted during transmission** or not.

<table>
<thead>
<tr>
<th>Received byte</th>
<th>corrupted during transmission (✓)</th>
<th>not corrupted during transmission (✓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10110100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01101101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10000001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Another method of error detection is **Automatic Repeat reQuest (ARQ)**. Explain how ARQ is used in error detection.

### Solution:

(a) | Received byte | corrupted during transmission (✓) | not corrupted during transmission (✓) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10110100</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01101101</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>10000001</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

(b) Four from:
- Uses acknowledgement and time out
- Check performed on received data // error is detected by e.g. parity check, check sum
- If error detected, request sent to resend data // negative acknowledgment is used
- If no acknowledgement is sent that data is received // positive acknowledgment is used
- Data is resent // Resend request repeated, till data is resent correctly ...
- ... or request times out // limit is reached

**May/June 2017 P12:**

5 (a) The denary number 57 is to be stored in two different computer registers.

**Convert 57 from denary to binary and show your working.**

(b) Show the binary number from **part (a)** as it would be stored in the following registers.
(c) A binary number stored in a register can have many different uses, for example an address in main memory.
Give two other uses for a binary number stored in a register.
Use 1
Use 2

(d) A register in a computer contains binary digits.

0 0 1 1 1 0 1 0

The contents of the register represent a binary integer. Convert the binary integer to hexadecimal.

Solution:

(a) \(32 + 16 + 8 + 1\) (00)111001

(b) 

0 0 1 1 0 0 1

0 0 0 0 0 0 0 1 1 1 0 0 1

(c) Two from:
- data
- ASCII value / Unicode value / character
- number
- part of image / small image
- a sound / sound sample / small sound track
- instruction

(d) 3A

Oct/Nov 2017 P12:

3 (a) Explain the differences between the binary number system and the denary number system. [4]
(b) Explain the process of converting the binary number 1010 into a denary number. [5]

Solution:

(a) Any four from (Max 2 per number system):
- A binary number system is a base-2 system
- A denary number system is a base-10 system
- A binary number system uses 0 and 1 values
- A denary number system uses 0 to 9 values
- A binary number system has units/ placeholders/column headings that increase by the power of 2
- A denary number system has units/ placeholders/column headings that increase by the power of 10
- Binary has more digit for the same value// Denary has less digits for the same value

(b) Five from:
- Correct column headings / place holders by example
- Correctly place a 1 or a 0 for each column
- Identify the columns to be added
- Add together the (denary) values identified ...
- ... this will give a total which is the denary number/answer
- Answer is 10
Solution:

(a) 2048/1024 (or 1024 ÷ 2)
   2 GB

(b) Instructions/programs/data
    ... currently in use

(c) Any three from:
   - RAM is volatile, ROM is non-volatile
   - RAM is temporary, ROM is (semi) permanent
   - RAM normally has a larger capacity than ROM
   - RAM can be edited ROM cannot be edited // Data can be read from and written to RAM, ROM can only be read from

Oct/Nov 2017 P13:

1. A washing machine has a small display screen built into it.
   One use of the display screen is to show an error code when a problem has occurred with a washing cycle.

(a) State whether the display screen is an input, output or storage device.
   [1]

(b) The display screen shows a hexadecimal error code: E04

This error code means that the water will not empty out of the washing machine.
Convert this error code to binary.

(c) State why hexadecimal is used to display the error code.
   [1]

Solution:

<table>
<thead>
<tr>
<th>E</th>
<th>0</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

(c) Any one from:
   - Hexadecimal codes can fit in a smaller display rather than a full text based message
   - Smaller amount of memory needed to store the hex error messages than text based

May/June 2018 P11:

Jane answers an examination question about computers and data correctly.
Six different words or numbers have been removed from her answer:
Complete the sentences in Jane’s answer, using the list given. Not all items in the list need to be used.

- 2
- 10
- 16
- analogue
- binary
- denary
- digital
- hexadecimal

As humans, we process ........................................... data, but a computer cannot
process this type of data. For a computer to be able to process data it needs to be converted to ____________________ data.

As humans, we mostly use a ____________________ number system;

this is a base ____________________ number system.

Computers use a ____________________ number system;

this is a base ____________________ number system.  [6]

Solution:
- analogue
- digital
- denary
- 10
- binary
- 2

2  Dheeraj identifies three hexadecimal numbers.
Write the denary number for each of the three hexadecimal numbers:

2A ................................................................. [3]

101 .................................................................

21E .................................................................

Solution:
- 42
- 257
- 542

3  The three binary numbers in the registers A, B and C have been transmitted from one computer to another.

<table>
<thead>
<tr>
<th>Parity bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register A</td>
</tr>
<tr>
<td>Register B</td>
</tr>
<tr>
<td>Register C</td>
</tr>
</tbody>
</table>

One binary number has been transmitted incorrectly. This is identified through the use of a parity bit. Identify which register contains the binary number that has been transmitted incorrectly. Explain the reason for your choice.
The binary number that has been transmitted incorrectly is in Register ____________________.
Explanation ................................................................. [4]

Solution:
- Register C

Any three from:
- Count the number of 1/0 bits (in each byte/register)
- Two bytesregisters have an odd number of 1/0 bits // Two use odd parity
- Odd parity must be the parity used
- One byte/register has an even number of 1/0 bits // One uses even parity
- One with an even number of one bits/even parity is incorrect // Register C should have odd parity

May/June 2018 P12:
1  Different units of data can be used to represent the size of a file, as it changes in size.
Fill in the missing units of data, using the list given:
- byte
- gigabyte (GB)
- megabyte (MB)
- nibble
The units of data increase in size from smallest to largest.

Smallest

- bit
- kilobyte (kB)
- terabyte (TB)

Largest

Solution:
- nibble
- byte
- megabyte (MB)
- gigabyte (GB)

3 A stopwatch uses six digits to display hours, minutes and seconds. The stopwatch is stopped at:

\[
\begin{array}{ccc}
0 & 2 & 3 \\
1 & 5 & 8 \\
\end{array}
\]

An 8-bit register is used to store each pair of digits.

(a) Write the 8-bit binary numbers that are currently stored for the Hours, Minutes and Seconds.

<table>
<thead>
<tr>
<th>Hours</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seconds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) The stopwatch is started again and then stopped. When the watch is stopped, the 8-bit binary registers show:

<table>
<thead>
<tr>
<th>Hours</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>1</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Seconds</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Write the denary values that will now be shown on the stopwatch.

\[
\begin{array}{ccc}
\cdot & \\
\cdot & \\
\cdot & \\
\end{array}
\]

Solution:

(a) Hours: 0 0 0 0 0 0 1 0

Minutes: 0 0 0 1 1 1 1 1

Seconds: 0 0 1 1 1 0 1 0

(b) Hours: 0 5 2 6 5 5

Minutes: 0 5 2 6 5 5

Seconds: 0 5 2 6 5 5
Jafar is using the Internet when he gets the message:
“D03, page is not available”
Jafar remembers that hexadecimal is often used to represent binary values in error codes.
Convert the hexadecimal number in the error message into 12-bit binary.

Solution:

<p>| | | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Oct/Nov 2018 P12:

1. Computers use a character set to convert text into binary.
   One character set that can be used is ASCII.
   Each letter in ASCII can also be represented as a denary value.
   (a) The word BUS has the denary values:

<table>
<thead>
<tr>
<th>B</th>
<th>U</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>85</td>
<td>83</td>
</tr>
</tbody>
</table>

   Convert the denary values into 8-bit binary.

<table>
<thead>
<tr>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>85</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>83</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

(b) Each letter in ASCII can also be represented as a hexadecimal value.
The word KEY has the 8-bit binary values:
(i) Convert the three 8-bit binary values into hexadecimal.
01001011 .......................................................... [3]
01000101 .......................................................... [3]
01011001 .......................................................... [3]
(ii) Give three other uses of hexadecimal notation in computer science.
(iii) State two benefits of using hexadecimal notation to represent binary values.
    Benefit 1 .................................................................................................................. [2]
    Benefit 2 .................................................................................................................. [2]

Solution:

(a)  

<table>
<thead>
<tr>
<th>66</th>
<th>0</th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>0</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>93</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

(b)(i) 4B 45 59

(b)(ii) Three from:
- (HTML) colour codes
- Error messages
- MAC addresses
- IP addresses
- Assembly language
- Memory dump
- Locations in memory

(b)(iii) Two from:
- Easier to read/write/understand (for humans)
- Easier to remember (for humans)
- Short way to represent binary // Uses less screen/display space
- Fewer errors made (in data transcription)
- Easier to debug (for humans)

Oct/Nov 2018 P13:
2 Parity checks and Automatic Repeat reQuests (ARQ) can be used to check for errors during data transmission and storage.
    (a) A system uses even parity. Write the appropriate parity bit for each byte.

<table>
<thead>
<tr>
<th>Parity Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

(b) Explain how Automatic Repeat reQuests (ARQ) are used in data transmission and storage. [2]
(c) State one other method that could be used to check for transmission errors. [1]

Solution:
2(a) Parity Bit

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

2(b) Two from:
- Set of rules for controlling error checking/detection // it's an error detection method // used to detect errors
- Uses acknowledgement and timeout
- Request is sent (with data) requiring acknowledgement
- If no response/acknowledgement within certain time frame data package is resent
- When data received contains an error a request is sent (automatically) to resend the data
- The resend request is repeatedly sent until packet is received error free/limit is reached/acknowledgement received

2(c) Checksum

4 The MAC address of a device is represented using hexadecimal.

A section of a MAC address is shown. Each pair of hexadecimal digits is stored using 8-bit binary.

(a) Complete the table to show the 8-bit binary equivalents for the section of MAC address. The first number has already been converted.

<table>
<thead>
<tr>
<th>Frame Checksum</th>
<th>FF</th>
<th>08</th>
<th>93</th>
</tr>
</thead>
<tbody>
<tr>
<td>01101010</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Explain why data is stored as binary in computers.

Solution:

4(a) 01101010 1111111 00001000 10010011

4(b)
- Computers use switches / logic gates
- Only uses 2 states / On or Off / 1 or 0

May/June 2019 P11:

1 Hexadecimal is used for MAC addresses.

Part of a MAC address is given: \( 97 - 5C - E1 \)

Each pair of digits is stored as binary in an 8-bit register.

(a) Show what the binary register stores for each pair of the given digits.

\( 97 \)

\( 5C \)

\( E1 \)

(b) Explain what is meant by a MAC address.

(c) Give two other examples where hexadecimal can be used.

Example 1 .................................................................

Example 2 .................................................................

Solution:

1(a) 97 0 0 1 0 1 1 1

5C 0 1 0 1 1 1 0 0

E1 1 1 1 0 0 0 0 1
May/June 2019 P12:

9. The contents of three binary registers have been transmitted from one computer to another. Even parity has been used as an error detection method.

The outcome after transmission is:
- **Register A** and **Register C** have been transmitted correctly.
- **Register B** has been transmitted incorrectly.

Complete the Parity bit for each register to show the given outcome.

<table>
<thead>
<tr>
<th>Parity bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register A</td>
</tr>
<tr>
<td>Register B</td>
</tr>
<tr>
<td>Register C</td>
</tr>
</tbody>
</table>

Solution:

<table>
<thead>
<tr>
<th>Parity bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register A</td>
</tr>
<tr>
<td>Register B</td>
</tr>
<tr>
<td>Register C</td>
</tr>
</tbody>
</table>

Oct/Nov 2019 P12:

4. An 8-bit binary register contains the value:

\[
\begin{array}{cccccccc}
0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 \\
\end{array}
\]

(a) Convert the binary value to denary.

(b) The contents of the register shifted one place to the right would give the result:

\[
\begin{array}{cccccccc}
0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 \\
\end{array}
\]

The contents of the register shown at the start of question 4 are shifted two places to the left. Show the contents of the register after this shift has taken place.
(c) State the effect this shift has on the denary value in part (a).

Solution:

<table>
<thead>
<tr>
<th>4(a)</th>
<th>52</th>
</tr>
</thead>
<tbody>
<tr>
<td>4(b)</td>
<td>1 1 0 1 0 0 0 0</td>
</tr>
<tr>
<td>4(c)</td>
<td>It is multiplied by 4</td>
</tr>
</tbody>
</table>

Oct/Nov 2019 P13:

5 The contents of three binary registers have been transmitted from one computer to another. Odd parity has been used as an error detection method.

The outcome after transmission is:

- Register A and Register B have been transmitted correctly.
- Register C has been transmitted incorrectly.

Write the appropriate Parity bit for each register to show the given outcome.

<table>
<thead>
<tr>
<th>Parity bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register A</td>
</tr>
<tr>
<td>Register B</td>
</tr>
<tr>
<td>Register C</td>
</tr>
</tbody>
</table>

Solution:

<table>
<thead>
<tr>
<th>Parity bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register A</td>
</tr>
<tr>
<td>Register B</td>
</tr>
<tr>
<td>Register C</td>
</tr>
</tbody>
</table>
DATABASE
2003-2019
12. An estate agent keeps a file of properties for rent in the city. Several records are shown in the following diagram:

<table>
<thead>
<tr>
<th>REF</th>
<th>AREA</th>
<th>TYPE</th>
<th>FEATURE</th>
<th>RENT($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H002</td>
<td>South</td>
<td>Detached</td>
<td>Waterfall</td>
<td>21000</td>
</tr>
<tr>
<td>H006</td>
<td>South</td>
<td>Bungalow</td>
<td>Pool</td>
<td>19000</td>
</tr>
<tr>
<td>H008</td>
<td>West</td>
<td>Bungalow</td>
<td>Pond</td>
<td>15000</td>
</tr>
<tr>
<td>H005</td>
<td>South</td>
<td>Detached</td>
<td>Patio</td>
<td>14000</td>
</tr>
<tr>
<td>H003</td>
<td>North</td>
<td>Semi-Detached</td>
<td>Pool</td>
<td>12000</td>
</tr>
<tr>
<td>H009</td>
<td>North</td>
<td>Detached</td>
<td>Courtyard</td>
<td>11000</td>
</tr>
<tr>
<td>H004</td>
<td>West</td>
<td>Bungalow</td>
<td>Pool View</td>
<td>9000</td>
</tr>
<tr>
<td>H001</td>
<td>South</td>
<td>Semi-Detached</td>
<td>Fish Pond</td>
<td>8000</td>
</tr>
<tr>
<td>H007</td>
<td>North</td>
<td>Terraced</td>
<td>BBQ Pit</td>
<td>2000</td>
</tr>
</tbody>
</table>

(a) Which field in the file should be used as a key field? [1]
(b) State a validation check that should be made on the AREA data as it is entered into the file. [1]
(c) Which RENT($) data will be listed if the following search condition is input?
   
   \[ \text{FEATURE} = \text{“Pool”} \text{ OR (TYPE = “Bungalow”)} \] [2]

(d) Write down a search condition to find all the properties in the south which have a rent less than $15000. [3]
(e) Write down the reference numbers if the file is sorted in ascending order on TYPE then AREA. [3]

Solution:
(a) REF
(b) One mark per named check:
    - presence
    - type
    - description
(c) 19000, 15000, 12000, 9000
    - minus one mark each error;
    - ignore order and dollar if given

Oct/Nov 2003:
9. A mail order company selling hi-fi equipment keeps details of its stock on a database. Part of the database is shown below:

<table>
<thead>
<tr>
<th>Code_Num</th>
<th>Colour</th>
<th>Speakers</th>
<th>Power(W)</th>
<th>Num_of_CDs</th>
<th>Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13416</td>
<td>Black</td>
<td>4</td>
<td>50</td>
<td>4</td>
<td>650</td>
</tr>
<tr>
<td>13425</td>
<td>Silver</td>
<td>2</td>
<td>60</td>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>13504</td>
<td>Silver</td>
<td>4</td>
<td>80</td>
<td>5</td>
<td>750</td>
</tr>
<tr>
<td>14001</td>
<td>Black</td>
<td>4</td>
<td>100</td>
<td>3</td>
<td>1100</td>
</tr>
<tr>
<td>14005</td>
<td>Black</td>
<td>4</td>
<td>100</td>
<td>10</td>
<td>1200</td>
</tr>
<tr>
<td>14010</td>
<td>Silver</td>
<td>2</td>
<td>40</td>
<td>1</td>
<td>350</td>
</tr>
</tbody>
</table>

(a) Which field should be used as the key field? [1]
(b) Which Code_Num data will be listed if the following search condition is input? [2]
   
   (Speakers=4) AND (Num_of_CDs>4)
May/June 2004:
16 A music club keeps a file of members on a computer system. Part of the file is shown in the following diagram:

<table>
<thead>
<tr>
<th>CODE</th>
<th>SURNAME</th>
<th>INITIAL</th>
<th>SEX</th>
<th>PHONE NO</th>
<th>DATE OF BIRTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1001</td>
<td>Philips</td>
<td>R</td>
<td>F</td>
<td>3294625</td>
<td>11/12/86</td>
</tr>
<tr>
<td>M1011</td>
<td>Patel</td>
<td>P</td>
<td>M</td>
<td>2453674</td>
<td>04/01/86</td>
</tr>
<tr>
<td>M1025</td>
<td>Brown</td>
<td>A</td>
<td>F</td>
<td>2756484</td>
<td>15/05/86</td>
</tr>
<tr>
<td>M1037</td>
<td>Khan</td>
<td>S. L</td>
<td>M</td>
<td>2759815</td>
<td>18/02/87</td>
</tr>
<tr>
<td>M1057</td>
<td>Lee</td>
<td>B. R</td>
<td>M</td>
<td>2456785</td>
<td>21/07/86</td>
</tr>
<tr>
<td>M1073</td>
<td>Smith</td>
<td>L</td>
<td>F</td>
<td>3297894</td>
<td>09/02/88</td>
</tr>
<tr>
<td>M1096</td>
<td>Chong</td>
<td>M. A</td>
<td>M</td>
<td>2765492</td>
<td>03/09/87</td>
</tr>
<tr>
<td>M1102</td>
<td>Schon</td>
<td>G</td>
<td>M</td>
<td>2451843</td>
<td>22/04/88</td>
</tr>
<tr>
<td>M1124</td>
<td>Shah</td>
<td>J. A</td>
<td>M</td>
<td>3290746</td>
<td>14/04/86</td>
</tr>
<tr>
<td>M1139</td>
<td>Davies</td>
<td>S. L</td>
<td>F</td>
<td>2768798</td>
<td>09/01/88</td>
</tr>
</tbody>
</table>

(a) State how many fields there are in each record. [1]
(b) State the data type that should be used for the CODE data. [1]
(c) State two reasons why the data in the SEX field has been coded. [2]
(d) Which CODE data will be listed if the following search condition is input? [2]
   (DATE OF BIRTH< 01/01/87) AND (SEX = “M”)
(e) Describe how the file can be sorted in ascending order of SURNAME. [2]

Solution:
(a) 6
(b) text/alphanumeric/string
(c) less errors on input
    requires less storage space
    validation
    quicker to input
    quicker to find
(d) M1057, M1124
(e) highlight/select SURNAME field
    click on sort A to Z icon/in menu
    or query, click on (sort) ascending

Oct/Nov 2004:
A database stores details about cars in a showroom. The format of the first three fields is shown below.

<table>
<thead>
<tr>
<th>Field name</th>
<th>Field description</th>
<th>Data type</th>
<th>Field length</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAKE</td>
<td>name of manufacturer</td>
<td>text</td>
<td>30</td>
</tr>
<tr>
<td>NUMPLATE</td>
<td>car registration no.</td>
<td>alphanumeric</td>
<td>8</td>
</tr>
<tr>
<td>REG</td>
<td>date car registered</td>
<td>date</td>
<td>6</td>
</tr>
</tbody>
</table>

(a) State two more fields, one numeric and one text, and for each give the field description and the field length.

Field name (numeric) ..........................................................................................................................................................
Field description ..................................................................................................................................................................
Field length ...........................................................................................................................................................................

Field name (text) .............................................................................................................................................................
Field description ..................................................................................................................................................................
Field length ...........................................................................................................................................................................

(b) Give a situation, in each case, where data about these cars would need to be amended, deleted and inserted.

amended: ...........................................................................................................................................................................
deleted: ..........................................................................................................................................................................
inserted: ...........................................................................................................................................................................

Solution:

(a) (i) name of field | description | field length
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGSIZE</td>
<td>engine capacity (litres)</td>
<td>4</td>
</tr>
<tr>
<td>NUMDOOR</td>
<td>number of doors</td>
<td>1</td>
</tr>
<tr>
<td>FUELCON</td>
<td>economy of vehicle</td>
<td>3</td>
</tr>
<tr>
<td>PRICE</td>
<td>cost of vehicle</td>
<td>6</td>
</tr>
<tr>
<td>ODOMETER</td>
<td>recorded distance (km or miles)</td>
<td>7</td>
</tr>
</tbody>
</table>

(ii) name of field | description | field length
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COLOUR</td>
<td>colour of vehicle</td>
<td>20</td>
</tr>
<tr>
<td>MODEL</td>
<td>make and model of vehicle</td>
<td>20</td>
</tr>
<tr>
<td>PREVIOUS</td>
<td>details of previous owner</td>
<td>50</td>
</tr>
<tr>
<td>OPTION</td>
<td>list of extras on vehicle</td>
<td>30</td>
</tr>
</tbody>
</table>

(b) amend
information is incorrect
price of vehicle needs to be changed (e.g. sales)
change of colour

delete (record deleted)
vehicle sold
vehicle scrapped

insert (info into a field)
new vehicle arrived
more information about current vehicle becomes known

May/June 2005:

A shop keeps its stock file on a computer system. Part of the file is shown in the diagram below:
The following codes have been used.

<table>
<thead>
<tr>
<th>Field</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Black</td>
</tr>
<tr>
<td>G</td>
<td>Green</td>
</tr>
<tr>
<td>R</td>
<td>Red</td>
</tr>
<tr>
<td>S</td>
<td>Silver</td>
</tr>
</tbody>
</table>

(a) State how many records are shown in the diagram. [1]
(b) State two advantages of coding the data in the COLOUR field. [2]
(c) State the data type that should be used for the WEIGHT (KG) data. [1]
(d) State one advantage of using fixed-length records for storing the data. [1]
(e) Which STOCK NO data will be listed if the following search condition is input? [2]

(COLOUR NOT “B”) AND (WEIGHT (KG) < 2.0)

(f) Write down a search condition that will search for all the items with less than 16 in stock and the price is more than $100. [3]

(g) State which field should be used to link this stock file to a supplier file. Give a reason for your choice of field.

Field ..............................................................
Reason ..............................................................................[2]

Solution:
(a) 10
(b) fewer errors on input
    less storage space required/less memory
    easier/access quicker to input
    quicker to find/search/easier to locate
    easier/faster validation
(c) number/numeric/decimal/1 d.p.
(d) faster process/easier to program
    updated/new records will occupy the same space as the old records
    allows accurate estimation of storage required
(e) L807, L808 or 807, 808
(f) (IN STOCK < 16) AND (PRICE ($) > 100)
    or
    (IN STOCK < = 15) AND (PRICE ($) > 100)
    1 mark 1 mark 1 mark
    NOTE: ignore case
    16/15 and 100/101 award the mark with or without speech marks
(g) field – STOCK NO
    reason – unique/primary key/key
Computer Science 2210

18 A car dealer uses a database to keep details of cars in stock. Part of the stock file is shown below.

<table>
<thead>
<tr>
<th>RegNo</th>
<th>Make</th>
<th>Model</th>
<th>Colour</th>
<th>Doors</th>
<th>Engine(cc)</th>
<th>Price($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 15 APC</td>
<td>Renault</td>
<td>Laguna</td>
<td>Black</td>
<td>5</td>
<td>1600</td>
<td>5800</td>
</tr>
<tr>
<td>NX 21 TPQ</td>
<td>Opel</td>
<td>Corsa</td>
<td>Green</td>
<td>3</td>
<td>1400</td>
<td>2000</td>
</tr>
<tr>
<td>WS 48 ART</td>
<td>VW</td>
<td>Golf</td>
<td>Blue</td>
<td>3</td>
<td>1600</td>
<td>3400</td>
</tr>
<tr>
<td>RP 09 NTR</td>
<td>VW</td>
<td>Golf</td>
<td>Red</td>
<td>5</td>
<td>2000</td>
<td>6350</td>
</tr>
<tr>
<td>VV 81 KKT</td>
<td>Proton</td>
<td>Wira</td>
<td>White</td>
<td>4</td>
<td>1300</td>
<td>2200</td>
</tr>
<tr>
<td>NK 55 ARM</td>
<td>VW</td>
<td>Golf</td>
<td>White</td>
<td>3</td>
<td>1600</td>
<td>4100</td>
</tr>
</tbody>
</table>

(a)(i) State the fieldname that should be used as the key field.
(ii) Explain the purpose of a key field.

(b) The following search condition is input: (Price($) < 5000) AND (Model = Golf) Write down the records that match the above search condition using only RegNo.

(c) Write down a search condition to find cars with an Engine greater than 1400cc or which have less than 5 Doors. (d) When a car is sold, the sale needs to be linked to a customer file. Suggest a new field which could be used to link the stock file to the customer file.

Solution:
(a) (i) Reg No
(ii) unique identifier
   used to search the database
   used to link to other tables of data (foreign data)

(b) WS 48 ART
    NK 55 ARM

(c) Either (Engine (cc) > 1400) OR (Doors < 5)
    Or (Doors < 5) OR (Engine (cc) > 1400)

(d) customer code
    customer ref no
    (NOT customer name)

May/June 2007:
7 A hospital has decided to computerise its administration system.
(a) Give three ways this could affect the hospital workers. The hospital will be using a database which holds confidential personal data.
(b) State two precautions that the hospital should take to prevent unauthorised access to the data.
(c) Describe how the database could be recovered if it became corrupted.
(d) Give one example, in each case, of when it would be necessary to amend data, delete data and insert data into the patient database.

Solution:
(a) deskilling
    retraining needed
    loss of jobs
    frees staff from admin jobs
    less time wasted looking for lost paperwork

(b) passwords (changed regularly)
    use of ids/log on ids/user names
    firewalls
    physical measures (e.g. locked rooms)
    logging off after use
    encryption = 0
    removal of external memory = 0

(c) use of back up files
    generations of files (GFS)
Oct/Nov 2007:

15 A school Science department is going to use a database to record details about its equipment.

(a) Give two advantages of using a computer system rather than a manual filing system.

(b) Part of the database is shown below:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Code No</th>
<th>Quantity in Stock</th>
<th>Need to re-order?</th>
<th>Supplier Name</th>
<th>Price ($)</th>
<th>Stock Value ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaker</td>
<td>01043</td>
<td>25</td>
<td>Y</td>
<td>Labquip</td>
<td>1.04</td>
<td>26.00</td>
</tr>
<tr>
<td>Test tube</td>
<td>01051</td>
<td>200</td>
<td>N</td>
<td>Labquip</td>
<td>0.40</td>
<td>80.00</td>
</tr>
<tr>
<td>Clmp stand</td>
<td>01065</td>
<td>51</td>
<td>N</td>
<td>Anglera</td>
<td>3.25</td>
<td>165.75</td>
</tr>
<tr>
<td>Tongs</td>
<td>01151</td>
<td>23</td>
<td>Y</td>
<td>Anglera</td>
<td>0.55</td>
<td>12.65</td>
</tr>
<tr>
<td>Spotula</td>
<td>01222</td>
<td>62</td>
<td>N</td>
<td>Anglera</td>
<td>0.66</td>
<td>40.92</td>
</tr>
<tr>
<td>Flask</td>
<td>01341</td>
<td>15</td>
<td>Y</td>
<td>Labquip</td>
<td>1.70</td>
<td>27.50</td>
</tr>
</tbody>
</table>

(i) As data is entered it needs to be verified. Describe one way this could be done.

(ii) Data also needs to be validated. Using fields from the database as examples, describe two different validation checks which could be performed on the data.

Solution:

(a) easier to know when to re-order
   automatic re-ordering
   easier/faster to update
   easier/faster to access information
   more up to date stock levels
   fewer mistakes
   takes up less storage space

(b) (i) double entry
   visual check/comparison with original
   (ii) equipment
        code
        quantity
        need to re-order
        supplier name
        price
        stock value
        character check, length check
        length check, character check, check digit
        range check, character check
        character check, length check, Boolean check
        character check, length check
        format check, range check
        range check, character check

Oct/Nov 2008:

8 To gain access to a database, a user must first type in a user ID and then a password which needs to be verified.

(a) How is a password usually verified?

(b) In spite of these safeguards, unauthorised access to the database is still possible. What could be done:

(i) to prevent data being used by unauthorised people?

(ii) to prevent loss of data once the database has been illegally accessed?
(c) Personal data is protected to some extent by a Data Protection Act. Give two requirements of a Data Protection Act.

Solution:
(a) keyed/typed in twice/compared to stored password
(b) (i) encrypt the data
(ii) Any one from:
   read only access
   back up the files regularly
   generations of files
(c) Any two from:
   data must be up to date
   data can only be read/used for the purpose for which it was collected
   data must be accurate
   data must be destroyed/deleted when no longer required/don’t keep longer than necessary
   data user must register what data is used/stored
   data must be used/collected fairly and lawfully
   data must be held securely
   data must be protected from accidental damage
   only authorised people can have access to data
   fines imposed for data mis-use
   data should not be passed on to a 3rd party without owner’s permission
   person can view data and have it changes/removed if incorrect
   safe harbour

15) A database has been produced showing solar system statistics.

<table>
<thead>
<tr>
<th>Name of planet</th>
<th>Distance from sun (x10^6 km)</th>
<th>Number of moons</th>
<th>Number of rings</th>
<th>Maximum surface temperature (°C)</th>
<th>Diameter (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>53</td>
<td>0</td>
<td>0</td>
<td>427</td>
<td>4880</td>
</tr>
<tr>
<td>Venus</td>
<td>108</td>
<td>0</td>
<td>0</td>
<td>480</td>
<td>12100</td>
</tr>
<tr>
<td>Earth</td>
<td>150</td>
<td>1</td>
<td>1</td>
<td>58</td>
<td>12756</td>
</tr>
<tr>
<td>Mars</td>
<td>228</td>
<td>2</td>
<td>0</td>
<td>17</td>
<td>6787</td>
</tr>
<tr>
<td>Jupiter</td>
<td>773</td>
<td>16</td>
<td>3</td>
<td>-150</td>
<td>143200</td>
</tr>
<tr>
<td>Saturn</td>
<td>1427</td>
<td>18</td>
<td>1000</td>
<td>-180</td>
<td>120000</td>
</tr>
<tr>
<td>Uranus</td>
<td>2871</td>
<td>15</td>
<td>11</td>
<td>-210</td>
<td>51800</td>
</tr>
<tr>
<td>Neptune</td>
<td>4497</td>
<td>8</td>
<td>4</td>
<td>-214</td>
<td>49528</td>
</tr>
<tr>
<td>Pluto</td>
<td>5914</td>
<td>1</td>
<td>0</td>
<td>-220</td>
<td>2330</td>
</tr>
</tbody>
</table>

(a) How many records are there in this database?
(b) The following search condition was typed in: (Number of moons > 0) AND (Diameter (km) < 15000)
Using Name of planet, write down the results of this search:
(c) Write down a search condition to find out which planets have rings or have a diameter more than 50000 km.
(d) Name a different validation check for each of the following fields.
   (i) Maximum surface temperature (°C)
   (ii) Name of planet
(e) The data in the database was sorted in descending order using the Number of moons field. Using Name of planet only, write down the results of this sort

Solution:
(a) 9
(b) Earth, Mars, Pluto
   (-1 for each error/addition/omission)
17 A car sales company uses a database.

Here are three tables from the database:

**New Car Sales**

<table>
<thead>
<tr>
<th>Customer Reference</th>
<th>Car Ordered</th>
<th>Specification</th>
<th>Delivery Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>151319</td>
<td>Cancelled order</td>
<td>None</td>
<td>Not applicable</td>
</tr>
<tr>
<td>162154</td>
<td>VW Golf</td>
<td>21215168</td>
<td>December 2008</td>
</tr>
<tr>
<td>171216</td>
<td>BMW 320i</td>
<td>07981624</td>
<td>February 2009</td>
</tr>
</tbody>
</table>

**Customer Details**

<table>
<thead>
<tr>
<th>Customer Reference</th>
<th>Customer Name</th>
<th>Customer Address</th>
<th>Trade In?</th>
</tr>
</thead>
<tbody>
<tr>
<td>141516</td>
<td>J Smith</td>
<td>7 Toll Road</td>
<td>No</td>
</tr>
<tr>
<td>151319</td>
<td>M Kyle</td>
<td>14 Coast Road</td>
<td>No</td>
</tr>
<tr>
<td>162154</td>
<td>D Khan</td>
<td>19 Main Street</td>
<td>Yes</td>
</tr>
<tr>
<td>165196</td>
<td>S Gogic</td>
<td>555 Trabant Road</td>
<td>No</td>
</tr>
<tr>
<td>171216</td>
<td>D Marques</td>
<td>21 Lakki Harbour</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Car Manufacturer**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Car Description</th>
<th>List of Extras</th>
<th>Cost Price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07981624</td>
<td>BMW 320i</td>
<td>C N O R V Z</td>
<td>48 500</td>
</tr>
<tr>
<td>21151198</td>
<td>VW Golf</td>
<td>A B C E T U</td>
<td>16 200</td>
</tr>
<tr>
<td>21215168</td>
<td>VW Golf</td>
<td>B D E F J L</td>
<td>21 000</td>
</tr>
<tr>
<td>31311115</td>
<td>Ford Focus</td>
<td>A P R S W</td>
<td>17 000</td>
</tr>
</tbody>
</table>

(a) How many records are shown in the Customer Details table?
(b) (i) Which field connects the New Car Sales table with the Customer Details table?
   (ii) Which field connects the New Car Sales table with the Car Manufacturer table?
(c) Give two reasons why List of Extras in the Car Manufacturer table is stored in code form.
(d) A customer goes into the showroom and the salesperson keys in 162154. What fields and information would be shown on the output screen?
(e) Give one advantage to the car sales company of holding customer information on a database.
Solution:

(a) 5

(b) (i) Customer Reference

(ii) Specification

(c) any two from:
- reduces typing errors
- uses less memory
- faster to type in
- quicker to sort
- store in one field
- easier to validate

(d) Car Description/Car Ordered: VW Golf
   Delivery Date: Dec 2008
   Specification: 21215168
   Customer Name: D Khan
   Customer Address: 19 Main Street
   Trade In: Yes

(1 mark 1 field name and contents from New Car Sales table plus 1 field name and contents from Customer Details table)

List of Extras: B D E F J L
Cost Price ($): 21 000

(1 mark 1 field name and contents from Car Manufacturer table)

(e) any one advantage from:
- later use if customer wants to trade in again in 2 or 3 years’ time
- can send out new product information
- if safety/recall issues from car manufacturers
- service/safety check reminders

Oct/Nov 2009:

13 A radio station keeps a database of all its music CDs. Here is part of this database:

<table>
<thead>
<tr>
<th>Reference Number</th>
<th>CD title</th>
<th>number of tracks</th>
<th>special edition</th>
<th>CD length (mins)</th>
<th>number of hit tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111</td>
<td>Afternoon Glory</td>
<td>12</td>
<td>N</td>
<td>55</td>
<td>1</td>
</tr>
<tr>
<td>1112</td>
<td>Stone Tulips</td>
<td>10</td>
<td>N</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>1113</td>
<td>Aftermath</td>
<td>8</td>
<td>N</td>
<td>33</td>
<td>0</td>
</tr>
<tr>
<td>1114</td>
<td>Major Peppers</td>
<td>15</td>
<td>Y</td>
<td>72</td>
<td>5</td>
</tr>
<tr>
<td>1115</td>
<td>Seaside</td>
<td>9</td>
<td>N</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>1116</td>
<td>Lookout</td>
<td>12</td>
<td>N</td>
<td>62</td>
<td>2</td>
</tr>
<tr>
<td>1117</td>
<td>Future Dreams</td>
<td>11</td>
<td>N</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td>1118</td>
<td>Moonlight</td>
<td>14</td>
<td>Y</td>
<td>70</td>
<td>2</td>
</tr>
</tbody>
</table>

(a) How many records are there in the database section?
(b) If the following query was input: (CD length (mins) < 60) AND (number of hit tracks > 1) using Reference Number only, write down which data items would be output.
(c) Write down a query to select which CDs are special edition or have more than 10 tracks.
(d) The database is sorted in descending order on CD length (mins). Using Reference Number only, write down the order of the records following this sort.
(e) The radio station has a phone-in service where a listener texts the title of the CD on their mobile phone. The popularity of each CD is then known and which CDs the radio station should play.
(i) How would this information be stored?
(ii) How could this information be linked to the database?
May/June 2010 P11:
A database has been set up to bring together information about the world’s tallest buildings. A section of the database is shown below.

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Building Name</th>
<th>City</th>
<th>Country</th>
<th>Year</th>
<th>No. of Floors</th>
<th>Height (m)</th>
<th>Height (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA1</td>
<td>Taipei 101</td>
<td>Taipei</td>
<td>Taiwan</td>
<td>2004</td>
<td>101</td>
<td>508</td>
<td>1667</td>
</tr>
<tr>
<td>MA1</td>
<td>Petronas Towers</td>
<td>Kuala Lumpur</td>
<td>Malaysia</td>
<td>1998</td>
<td>88</td>
<td>452</td>
<td>1483</td>
</tr>
<tr>
<td>US1</td>
<td>Sears Tower</td>
<td>Chicago</td>
<td>USA</td>
<td>1974</td>
<td>110</td>
<td>442</td>
<td>1451</td>
</tr>
<tr>
<td>CH1</td>
<td>Jiu Mao Building</td>
<td>Shanghai</td>
<td>China</td>
<td>1999</td>
<td>88</td>
<td>421</td>
<td>1381</td>
</tr>
<tr>
<td>CH2</td>
<td>Finance Centre</td>
<td>Hong Kong</td>
<td>China</td>
<td>2003</td>
<td>88</td>
<td>415</td>
<td>1362</td>
</tr>
<tr>
<td>CH3</td>
<td>CITIC Plaza</td>
<td>Guangzhou</td>
<td>China</td>
<td>1996</td>
<td>80</td>
<td>391</td>
<td>1283</td>
</tr>
<tr>
<td>CH4</td>
<td>Shun Hing Square</td>
<td>Shenzhen</td>
<td>China</td>
<td>1996</td>
<td>69</td>
<td>384</td>
<td>1260</td>
</tr>
<tr>
<td>US2</td>
<td>Empire State Building</td>
<td>New York</td>
<td>USA</td>
<td>1931</td>
<td>102</td>
<td>381</td>
<td>1250</td>
</tr>
<tr>
<td>CH5</td>
<td>Central Plaza</td>
<td>Hong Kong</td>
<td>China</td>
<td>1992</td>
<td>78</td>
<td>374</td>
<td>1227</td>
</tr>
<tr>
<td>CH6</td>
<td>Bank of China</td>
<td>Hong Kong</td>
<td>China</td>
<td>1989</td>
<td>70</td>
<td>367</td>
<td>1205</td>
</tr>
<tr>
<td>DU1</td>
<td>Emirates Tower</td>
<td>Dubai</td>
<td>Dubai</td>
<td>1999</td>
<td>54</td>
<td>355</td>
<td>1165</td>
</tr>
<tr>
<td>TA2</td>
<td>Tuntex Sky Tower</td>
<td>Kechiung</td>
<td>Taiwan</td>
<td>1987</td>
<td>85</td>
<td>343</td>
<td>1140</td>
</tr>
</tbody>
</table>

(a) How many records are in the section of the database shown?
(b) Using Ref No. only, which records would be output if the following search condition was entered: (Year < 1990) AND (Height (m) > 375)?
(c) Write down a search condition to find out how many buildings are in China or how many buildings have more than 80 floors.
(d) For each of the following fields give a different validation check. Year Ref No.
(e) The database was sorted in descending order of Year. Using Ref No. only, write down the results of the sort:

Solution:
(a) 12
(b) US1,US2
(c) (Country = "China") OR (No. of Floors > 80)
(d) (i) range check, character check, length check
(ii) character check, type check, length check, format check
May/June 2010 P12:

11 A database has been set up showing information about cars:

<table>
<thead>
<tr>
<th>Car ref</th>
<th>No of doors</th>
<th>Engine (litres)</th>
<th>CO₂ (g/km)</th>
<th>Fuel used (km/litre)</th>
<th>No of cylinders</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3</td>
<td>1.4</td>
<td>145</td>
<td>15.3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td>2.0</td>
<td>193</td>
<td>12.8</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>2.5</td>
<td>231</td>
<td>10.9</td>
<td>6</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>2.0</td>
<td>190</td>
<td>11.2</td>
<td>6</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>1.3</td>
<td>120</td>
<td>17.5</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>5</td>
<td>1.8</td>
<td>180</td>
<td>14.6</td>
<td>4</td>
</tr>
<tr>
<td>G</td>
<td>4</td>
<td>3.0</td>
<td>240</td>
<td>9.5</td>
<td>6</td>
</tr>
<tr>
<td>H</td>
<td>4</td>
<td>1.2</td>
<td>115</td>
<td>19.7</td>
<td>3</td>
</tr>
</tbody>
</table>

(a) Using Car ref only, write down which cars would be output if the following search condition was used:

(No of doors = 4) AND (Fuel used (km/litre) > 15)

(b) Write down a search condition to find out which cars have engines larger than 1.8 litres OR have CO₂ emissions higher than 150 g/km.

(c) The database is sorted in ascending order on Fuel used (km/litre). Using Car ref only, write down the results of the sort.

Solution:

(a) E, H

(b) (Engine (litres) > 1.8) OR (CO₂ (g/km) > 150)

(c) G, C, D, B, F, A, E, H

Oct/Nov 2010 P11:

10 A database has been set up to store information about aircraft. A section is shown below.

<table>
<thead>
<tr>
<th>Ref No</th>
<th>Aircraft Name</th>
<th>Max Weight (kg)</th>
<th>Length (m)</th>
<th>Wing Span (m)</th>
<th>Max Speed (kph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>An-225 Cossack</td>
<td>600 000</td>
<td>84</td>
<td>88</td>
<td>850</td>
</tr>
<tr>
<td>2001</td>
<td>Airbus A380F</td>
<td>591 950</td>
<td>73</td>
<td>80</td>
<td>951</td>
</tr>
<tr>
<td>3001</td>
<td>C-5 Galaxy</td>
<td>381 000</td>
<td>76</td>
<td>68</td>
<td>845</td>
</tr>
<tr>
<td>3002</td>
<td>Boeing 777-600</td>
<td>351 500</td>
<td>74</td>
<td>65</td>
<td>930</td>
</tr>
<tr>
<td>2002</td>
<td>Airbus A340-600</td>
<td>366 000</td>
<td>75</td>
<td>63</td>
<td>877</td>
</tr>
<tr>
<td>3003</td>
<td>Boeing 747</td>
<td>397 000</td>
<td>71</td>
<td>64</td>
<td>967</td>
</tr>
<tr>
<td>3004</td>
<td>Boeing 777</td>
<td>660 000</td>
<td>74</td>
<td>61</td>
<td>893</td>
</tr>
<tr>
<td>2003</td>
<td>Airbus A330-300</td>
<td>234 000</td>
<td>63</td>
<td>60</td>
<td>800</td>
</tr>
<tr>
<td>3005</td>
<td>Boeing 767</td>
<td>204 100</td>
<td>61</td>
<td>52</td>
<td>914</td>
</tr>
<tr>
<td>3006</td>
<td>B52 Fortress</td>
<td>221 400</td>
<td>49</td>
<td>56</td>
<td>927</td>
</tr>
<tr>
<td>3007</td>
<td>Boeing 757</td>
<td>123 400</td>
<td>54</td>
<td>38</td>
<td>914</td>
</tr>
</tbody>
</table>

(a) How many fields are in each record?
May/June 2011 P11:
15 A database showing the population of world cities has been produced. A section of the database is shown below.

<table>
<thead>
<tr>
<th>Ref No</th>
<th>Name of City</th>
<th>Country</th>
<th>Area</th>
<th>City Population (m)</th>
<th>Urban Population (m)</th>
<th>Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tokyo</td>
<td>Japan</td>
<td>Asia</td>
<td>33.2</td>
<td>34.1</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>New York</td>
<td>USA</td>
<td>America</td>
<td>17.8</td>
<td>21.9</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Sao Paulo</td>
<td>Brazil</td>
<td>America</td>
<td>17.7</td>
<td>20.2</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Seoul</td>
<td>S Korea</td>
<td>Asia</td>
<td>17.5</td>
<td>22.3</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Mexico City</td>
<td>Mexico</td>
<td>America</td>
<td>17.4</td>
<td>22.7</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>Osaka</td>
<td>Japan</td>
<td>Asia</td>
<td>16.4</td>
<td>16.8</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Manila</td>
<td>Philippines</td>
<td>Asia</td>
<td>14.8</td>
<td>14.9</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Mumbai</td>
<td>India</td>
<td>Asia</td>
<td>14.4</td>
<td>19.7</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>Jakarta</td>
<td>Indonesia</td>
<td>Asia</td>
<td>14.3</td>
<td>17.2</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Calcutta</td>
<td>India</td>
<td>Asia</td>
<td>12.7</td>
<td>15.0</td>
<td>No</td>
</tr>
</tbody>
</table>

(a) How many records are shown above?
(b) Using Ref No only, which records would be found if the following search condition was typed in
(Country = "India" OR Area = "America") AND (Capital = "No")
(c) Write a search condition to find the cities in Asia with a city population greater than 17 million OR an urban population greater than 20 million.
(d) Give one advantage of using Y or N rather than Yes or No in the Capital column.

Solution:
(a) 10
(b) 2, 3, 8, 10

1 mark per two correct records  
Loose 1 mark for each additional record
(c) (Area = "Asia") AND (City Population(m) > 17 OR Urban Population(m) > 20)

OR

(d) Any one advantage from:
- less likely for entry/typing errors
- uses less memory to store records
- faster data entry
12A database has been set up to show details about countries. Part of the database is shown below.

<table>
<thead>
<tr>
<th>Country code</th>
<th>Country</th>
<th>Continent</th>
<th>Area (millions sq km)</th>
<th>Population (millions)</th>
<th>Coastline</th>
<th>Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>China</td>
<td>Asia</td>
<td>9.6</td>
<td>1320</td>
<td>Yes</td>
<td>yuan</td>
</tr>
<tr>
<td>IN</td>
<td>India</td>
<td>Asia</td>
<td>3.8</td>
<td>1150</td>
<td>Yes</td>
<td>rupee</td>
</tr>
<tr>
<td>PO</td>
<td>Poland</td>
<td>Europe</td>
<td>0.3</td>
<td>39</td>
<td>Yes</td>
<td>zloty</td>
</tr>
<tr>
<td>BO</td>
<td>Bolivia</td>
<td>America</td>
<td>1.1</td>
<td>9</td>
<td>No</td>
<td>boliviano</td>
</tr>
<tr>
<td>TI</td>
<td>Tibet</td>
<td>Asia</td>
<td>1.2</td>
<td>2</td>
<td>No</td>
<td>yuan</td>
</tr>
<tr>
<td>BR</td>
<td>Brazil</td>
<td>America</td>
<td>8.5</td>
<td>192</td>
<td>Yes</td>
<td>real</td>
</tr>
<tr>
<td>RO</td>
<td>Romania</td>
<td>Europe</td>
<td>0.2</td>
<td>22</td>
<td>No</td>
<td>leu</td>
</tr>
<tr>
<td>SA</td>
<td>Saudi Arabia</td>
<td>Asia</td>
<td>2.2</td>
<td>28</td>
<td>Yes</td>
<td>nyal</td>
</tr>
<tr>
<td>ZA</td>
<td>Zambia</td>
<td>Africa</td>
<td>0.7</td>
<td>12</td>
<td>No</td>
<td>kwacha</td>
</tr>
</tbody>
</table>

(a) How many fields are in each record? [1]
(b) Using Country code only, what would be output if the following search condition was used? [2]
   
   (Population (millions) > 1000) OR (Continent = “Asia”)

(c) Write down a search condition to find which countries have a land area less than 3 million square km and also have a coastline. [2]

(d) If the database was sorted in descending order of population size, using Country code only, what would be the order of countries in the database? [2]

Solution:
(a) 7
(b) CH, IN, TI, SA
(c) \(\text{(Area (millions sq km) < 3) AND (Coastline = “Yes”) }\)

\[ \text{<-------- 1 mark ---------><-------- 1 mark --------> } \]

OR

\(\text{(Coastline = “Yes”) AND (Area (millions sq km) < 3)} \)

\[ \text{<----- 1 mark ------><----- 1 mark ------> } \]

(d) CH, IN, BR, PO, SA, RO, ZA, BO, TI

May/June 2012:
14 A database was set up to show the properties of certain chemical elements. Part of the database is shown below.

<table>
<thead>
<tr>
<th>Name of element</th>
<th>Element Symbol</th>
<th>Atomic Number</th>
<th>Atomic Weight</th>
<th>Melting Point (C)</th>
<th>Boiling Point (C)</th>
<th>State at room temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>oxygen</td>
<td>O</td>
<td>8</td>
<td>16</td>
<td>-218</td>
<td>-183</td>
<td>gas</td>
</tr>
<tr>
<td>iron</td>
<td>Fe</td>
<td>26</td>
<td>56</td>
<td>1538</td>
<td>2861</td>
<td>solid</td>
</tr>
<tr>
<td>mercury</td>
<td>Hg</td>
<td>80</td>
<td>201</td>
<td>-38</td>
<td>356</td>
<td>liquid</td>
</tr>
<tr>
<td>bromine</td>
<td>Br</td>
<td>35</td>
<td>80</td>
<td>-7</td>
<td>59</td>
<td>liquid</td>
</tr>
<tr>
<td>osmium</td>
<td>Os</td>
<td>76</td>
<td>190</td>
<td>3033</td>
<td>5012</td>
<td>solid</td>
</tr>
<tr>
<td>caesium</td>
<td>Cs</td>
<td>55</td>
<td>133</td>
<td>28</td>
<td>671</td>
<td>solid</td>
</tr>
<tr>
<td>gallium</td>
<td>Ga</td>
<td>31</td>
<td>70</td>
<td>30</td>
<td>2204</td>
<td>solid</td>
</tr>
<tr>
<td>argon</td>
<td>Ar</td>
<td>18</td>
<td>40</td>
<td>-189</td>
<td>-186</td>
<td>gas</td>
</tr>
<tr>
<td>silver</td>
<td>Ag</td>
<td>47</td>
<td>108</td>
<td>961</td>
<td>2162</td>
<td>solid</td>
</tr>
</tbody>
</table>

(a) How many fields are in each record?
(b) The following search condition was entered: (Melting Point (C) < 40) AND (Atomic Weight > 100) Using Element Symbol only, which records would be output?
(c) We need to know which elements have an atomic number greater than 50 and are solid at room temperature. Write down the search condition to find out these elements.
(d) The data are to be sorted in descending order of Boiling Point (C). Write down the new order of records using the Element Symbol only.

Solution:
(a) Hg, Cs
(b) 7
(c) (Atomic Number > 50) AND (State at room temp = "solid")
   <- 1 mark -> <- 1 mark ->
   Or
   (State at room temp = "solid") AND (Atomic Number > 50)
   <- 1 mark -> <- 1 mark ->
   Must use exact spelling
(d) Os, Fe, Ga, Ag, Cs, Hg, Br, O, Ar

Oct/Nov 2012:
11 A database was set up showing the largest ocean-going liners. Part of the database is shown below.

<table>
<thead>
<tr>
<th>Liner ID</th>
<th>Year built</th>
<th>Gross Tonnage</th>
<th>Country of Registration</th>
<th>Country of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA</td>
<td>2009</td>
<td>225282</td>
<td>Norway</td>
<td>Finland</td>
</tr>
<tr>
<td>IN</td>
<td>2008</td>
<td>154407</td>
<td>Norway</td>
<td>Finland</td>
</tr>
<tr>
<td>QM</td>
<td>2004</td>
<td>148528</td>
<td>UK</td>
<td>France</td>
</tr>
<tr>
<td>EX</td>
<td>2000</td>
<td>137308</td>
<td>Norway</td>
<td>Finland</td>
</tr>
<tr>
<td>VO</td>
<td>1999</td>
<td>137276</td>
<td>Norway</td>
<td>Finland</td>
</tr>
<tr>
<td>GP</td>
<td>1997</td>
<td>108865</td>
<td>UK</td>
<td>Italy</td>
</tr>
<tr>
<td>DE</td>
<td>1996</td>
<td>101509</td>
<td>USA</td>
<td>Italy</td>
</tr>
<tr>
<td>SP</td>
<td>1995</td>
<td>77499</td>
<td>UK</td>
<td>Italy</td>
</tr>
<tr>
<td>SO</td>
<td>1988</td>
<td>73192</td>
<td>Norway</td>
<td>France</td>
</tr>
<tr>
<td>FR</td>
<td>1972</td>
<td>66343</td>
<td>France</td>
<td>France</td>
</tr>
<tr>
<td>QE</td>
<td>1940</td>
<td>86673</td>
<td>UK</td>
<td>UK</td>
</tr>
<tr>
<td>NO</td>
<td>1935</td>
<td>79280</td>
<td>France</td>
<td>France</td>
</tr>
<tr>
<td>MJ</td>
<td>1922</td>
<td>56561</td>
<td>UK</td>
<td>Germany</td>
</tr>
<tr>
<td>TI</td>
<td>1912</td>
<td>46329</td>
<td>UK</td>
<td>UK</td>
</tr>
<tr>
<td>MA</td>
<td>1907</td>
<td>31938</td>
<td>UK</td>
<td>UK</td>
</tr>
</tbody>
</table>

(a) How many records are shown in the above part?
(b) Using Liner ID only, what would be output if the following search condition was typed in:
   (Year built < 2000) AND (Country of Registration = Country of Construction)?
(c) Write the search condition to find out which liners have a gross tonnage larger than 80 000 or are registered in the UK.

Solution:
(a) 15 records
(b) FR, QE, NO, TI, MA
   (-1 mark for each error or omission)
(c) (Gross Tonnage > 80 000) OR (Country of Registration = "UK")
   <- 1 mark -> <- 1 mark ->
   or
   (Country of Registration = "UK") OR (Gross Tonnage > 80 000)
   <- 1 mark -> <- 1 mark ->
May/June 2013 P11:

12 A database was set up to compare oil companies. A section of the database is shown below:

<table>
<thead>
<tr>
<th>Code</th>
<th>Name of company</th>
<th>No of employees</th>
<th>No of countries</th>
<th>Head office</th>
<th>Profits (billion $)</th>
<th>Share price ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR</td>
<td>Arrows</td>
<td>60000</td>
<td>30</td>
<td>Americas</td>
<td>8.0</td>
<td>39.00</td>
</tr>
<tr>
<td>GZ</td>
<td>Gazjeti</td>
<td>35000</td>
<td>4</td>
<td>Asia</td>
<td>5.0</td>
<td>44.50</td>
</tr>
<tr>
<td>KO</td>
<td>Konoco</td>
<td>40000</td>
<td>22</td>
<td>Americas</td>
<td>10.0</td>
<td>18.55</td>
</tr>
<tr>
<td>OS</td>
<td>Oilbras</td>
<td>56000</td>
<td>11</td>
<td>Americas</td>
<td>4.0</td>
<td>59.60</td>
</tr>
<tr>
<td>SD</td>
<td>Sand Oil</td>
<td>102000</td>
<td>51</td>
<td>Europe</td>
<td>12.0</td>
<td>15.30</td>
</tr>
<tr>
<td>SN</td>
<td>Southern Oil</td>
<td>50000</td>
<td>15</td>
<td>Americas</td>
<td>11.0</td>
<td>10.90</td>
</tr>
<tr>
<td>ST</td>
<td>Static Oil</td>
<td>80000</td>
<td>31</td>
<td>Americas</td>
<td>10.0</td>
<td>52.05</td>
</tr>
<tr>
<td>SU</td>
<td>Summation</td>
<td>70000</td>
<td>40</td>
<td>Europe</td>
<td>9.0</td>
<td>30.40</td>
</tr>
<tr>
<td>WP</td>
<td>Wasp Petrol</td>
<td>90000</td>
<td>44</td>
<td>Europe</td>
<td>15.0</td>
<td>92.80</td>
</tr>
</tbody>
</table>

(a) How many fields are there in each record?
(b) The following search condition was entered:
   (No of countries < 30) AND (Head office = “Americas”)
   Using Code only, which records would be output?
(c) What search condition is needed to find out which oil companies have a share price less than $50 or whose profits were greater than 8 billion dollars?

Solution:
(a) 7
(b) KO, OS, SN
(c) (Share price ($) < 50.00) OR (Profits (billion $) > 8.0)

May/June 2013:

11 A survey of motorways was carried out and a database was produced. A section of the database is shown below.

<table>
<thead>
<tr>
<th>Motorway ID</th>
<th>Length (km)</th>
<th>Cars per day</th>
<th>Toll charge per km ($)</th>
<th>Number of lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>100</td>
<td>50000</td>
<td>0.60</td>
<td>2</td>
</tr>
<tr>
<td>M2</td>
<td>210</td>
<td>75000</td>
<td>0.40</td>
<td>3</td>
</tr>
<tr>
<td>M3</td>
<td>180</td>
<td>60000</td>
<td>0.50</td>
<td>4</td>
</tr>
<tr>
<td>M4</td>
<td>40</td>
<td>20000</td>
<td>0.30</td>
<td>3</td>
</tr>
<tr>
<td>M5</td>
<td>25</td>
<td>15000</td>
<td>0.10</td>
<td>2</td>
</tr>
<tr>
<td>M6</td>
<td>100</td>
<td>40000</td>
<td>0.70</td>
<td>4</td>
</tr>
<tr>
<td>M7</td>
<td>30</td>
<td>10000</td>
<td>0.40</td>
<td>2</td>
</tr>
<tr>
<td>M8</td>
<td>150</td>
<td>60000</td>
<td>0.60</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) How many fields and how many records are shown?
   (i) number of fields
   (ii) number of records
(b) Using Motorway ID only, what would be output if the following search condition was used?
(Length (km) > 100) AND (Number of lanes > 3)
(c) What search condition is needed to find the motorways where the number of cars per day exceeds 50,000 or the toll charge per kilometre is greater than $0.50?

Solution:
(a) (i) 5
(ii) 8
(b) M3 and M8 only
(c) (Cars per day > 50,000) OR (Toll charge per km ($) > 0.50)

Oct/Nov 2013 P12:
3 A motor car manufacturer offers various combinations of
• seat colours
• seat materials
• car paint colours
A database was set up to help customers choose which seat and paint combinations were possible

<table>
<thead>
<tr>
<th>code</th>
<th>cloth</th>
<th>leather</th>
<th>seat colour</th>
<th>white</th>
<th>red</th>
<th>black</th>
<th>blue</th>
<th>green</th>
<th>silver</th>
<th>grey</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB</td>
<td>N</td>
<td>N</td>
<td>black</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>LB</td>
<td>N</td>
<td>Y</td>
<td>black</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>CC</td>
<td>Y</td>
<td>N</td>
<td>cream</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>LC</td>
<td>N</td>
<td>Y</td>
<td>cream</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>CG</td>
<td>Y</td>
<td>N</td>
<td>grey</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>LG</td>
<td>N</td>
<td>Y</td>
<td>grey</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>CR</td>
<td>N</td>
<td>N</td>
<td>red</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>LR</td>
<td>N</td>
<td>Y</td>
<td>red</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>CL</td>
<td>Y</td>
<td>N</td>
<td>lime</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>LL</td>
<td>N</td>
<td>Y</td>
<td>lime</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

(Note: N = no, not a possible combination, Y = yes, combination is possible)
(a) How many records are shown in the database? [1]
(b) The following search condition was entered:
cloth = “Y” AND (blue = “Y”)
Using code only, which records will be found? [2]
(c) A customer wanted to know the possible combinations for a car with leather seats and either silver or grey paint colour.
What search condition would need to be input? [2]
(d) A customer decided to buy a green car. He wanted to know which seat colours and seat materials were not a possible combination with green paint.
What search condition would he need to enter? [1]
(e) Give one advantage of using the codes Y and N in the database rather than using Yes and No. [1]

Solution:
(a) 10/10en
9 A database was set up to keep track of goods in a shop. A section of the database is shown below.

<table>
<thead>
<tr>
<th>Item code</th>
<th>Number in stock</th>
<th>Re-order level</th>
<th>Price of item ($)</th>
<th>Value of stock ($)</th>
<th>Items ordered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1113</td>
<td>155</td>
<td>200</td>
<td>1.50</td>
<td>232.50</td>
<td>Yes</td>
</tr>
<tr>
<td>1124</td>
<td>84</td>
<td>50</td>
<td>2.50</td>
<td>210.00</td>
<td>No</td>
</tr>
<tr>
<td>1200</td>
<td>30</td>
<td>60</td>
<td>5.00</td>
<td>150.00</td>
<td>Yes</td>
</tr>
<tr>
<td>1422</td>
<td>600</td>
<td>500</td>
<td>1.00</td>
<td>600.00</td>
<td>No</td>
</tr>
<tr>
<td>1515</td>
<td>90</td>
<td>100</td>
<td>2.00</td>
<td>180.00</td>
<td>No</td>
</tr>
<tr>
<td>1668</td>
<td>58</td>
<td>50</td>
<td>4.00</td>
<td>232.00</td>
<td>No</td>
</tr>
<tr>
<td>1801</td>
<td>60</td>
<td>100</td>
<td>8.00</td>
<td>480.00</td>
<td>No</td>
</tr>
<tr>
<td>1844</td>
<td>195</td>
<td>200</td>
<td>1.50</td>
<td>292.50</td>
<td>Yes</td>
</tr>
</tbody>
</table>

(a) How many records are shown in this section of database?  [1]

(b) (i) Using item code only, what would be output if the following search was carried out:

(Number in stock < Re-order level) AND (Items ordered = “No”)  [2]

(ii) What useful information does this search produce?  [1]

(c) Write a search condition to locate items costing more than $2.00 or have a stock value exceeding $300.00.  [2]

Solution:

(a) 8
(b) (i) 1515
     1801
     (−1 mark for each error)
May/June 2014 P11:
3 A hospital holds records of its patients in a database. Four of the fields are:
• date of visit (dd/mm/yyyy)
• patient’s height (m)
• 8-digit patient ID
• contact telephone number

The presence check is one possible type of validation check on the data. For each field, give another validation check that can be performed. Give an example of data which would fail your named validation check.

A different validation check needs to be given for each field.

<table>
<thead>
<tr>
<th>field name</th>
<th>name of validation check</th>
<th>example of data which would fail the validation check</th>
</tr>
</thead>
<tbody>
<tr>
<td>date of visit</td>
<td>format check</td>
<td>e.g. 2012/12/04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. 3rd March 2012</td>
</tr>
<tr>
<td>patient’s height</td>
<td>type/character check range check, limit check</td>
<td>can’t be &lt; 0 or &gt; 2.5m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. –5, five</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. 8, -3,</td>
</tr>
<tr>
<td>patient ID</td>
<td>type check, length check, range check</td>
<td>(can’t be &lt; 0 or &gt; 999999999)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. 3142ABCD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. 2131451, 136498207</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. –3, 851341625</td>
</tr>
<tr>
<td>contact telephone number</td>
<td>length check, type/character check, formal check</td>
<td>e.g. 0773141621834</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. 7H215GD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. 01223/123456/8901234</td>
</tr>
</tbody>
</table>
A database was set up showing statistics for some states in the USA. Part of the database is shown below.

<table>
<thead>
<tr>
<th>Ref</th>
<th>Name of state</th>
<th>Population (millions)</th>
<th>Number of houses (millions)</th>
<th>Area (sq miles)</th>
<th>Density</th>
<th>Travel time to work (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR</td>
<td>Oregon</td>
<td>3.8</td>
<td>1.6</td>
<td>96000</td>
<td>39.6</td>
<td>22.3</td>
</tr>
<tr>
<td>CO</td>
<td>Colorado</td>
<td>4.9</td>
<td>2.1</td>
<td>104000</td>
<td>47.1</td>
<td>24.3</td>
</tr>
<tr>
<td>NJ</td>
<td>New Jersey</td>
<td>8.7</td>
<td>3.5</td>
<td>7400</td>
<td>1175.7</td>
<td>30.0</td>
</tr>
<tr>
<td>TX</td>
<td>Texas</td>
<td>24.3</td>
<td>9.4</td>
<td>262000</td>
<td>92.7</td>
<td>25.4</td>
</tr>
<tr>
<td>CA</td>
<td>California</td>
<td>36.8</td>
<td>13.3</td>
<td>156000</td>
<td>235.9</td>
<td>27.7</td>
</tr>
<tr>
<td>FL</td>
<td>Florida</td>
<td>18.3</td>
<td>8.7</td>
<td>53900</td>
<td>339.5</td>
<td>26.2</td>
</tr>
<tr>
<td>AK</td>
<td>Alaska</td>
<td>0.7</td>
<td>0.3</td>
<td>572000</td>
<td>1.2</td>
<td>19.6</td>
</tr>
<tr>
<td>NV</td>
<td>Nevada</td>
<td>2.6</td>
<td>1.1</td>
<td>110000</td>
<td>23.6</td>
<td>23.3</td>
</tr>
<tr>
<td>NY</td>
<td>New York</td>
<td>19.5</td>
<td>7.9</td>
<td>47000</td>
<td>414.9</td>
<td>31.7</td>
</tr>
</tbody>
</table>

(a) (i) How many records are in this section of the database? [1]
(ii) How many fields are in each record? [1]
(b) The following search condition was entered:
(Population (millions) < 4.0) OR (Number of houses (millions) < 4.0)
Using Ref only, write down which records will be found. [2]
(c) Write down the search condition to find out which states have an area over 100 000 square miles and where it takes less than 25 minutes to get to work. [2]
(d) (i) What should be the key field in this database? [1]
(ii) Give a reason for your choice.

Solution:
(a) (i) 9
(ii) 7
(b) OR, CO, NJ, AK, NV
(1 mark for each error: i.e. each omission, each incorrect additional item)
(c) (Area(sq miles) > 100 000) AND (Travel time to work (min) < 25)
(1 mark) <---------- (1 mark) <----------

Or
(Travel time to work (min) < 25) AND (Area(sq miles) > 100 000)
(1 mark) <---------- (1 mark) <----------

(i) Ref or Name of State
(ii) this is unique to for each state
____________________________________________________________________________________________________________________________

May/June 2015 P21
7 A database, PROPERTY, was set up to show the prices of properties for sale and the features of each property. Part of the database is shown below.
(a) Give the number of fields that are in each record. [1]

(b) State which field you would choose for the primary key.
   Give a reason for choosing this field. [2]

(c) State the data type you would choose for each of the following fields.
   Garage ........................................................................................................................................
   Number of Bedrooms ................................................................................................................
   Price in $ ....................................................................................................................................

(d) The query-by-example grid below selects all houses with more than 1 bathroom and more than 2 bedrooms.

<table>
<thead>
<tr>
<th>Field:</th>
<th>Property Type</th>
<th>Number of Bedrooms</th>
<th>Number of Bathrooms</th>
<th>Price in $</th>
<th>Brochure No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td>Ascending</td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Criteria:</td>
<td>‘House’</td>
<td>&gt;2</td>
<td>&gt;1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Show what would be output. [2]

(e) Complete the query-by-example grid below to select and show the brochure number, property type and price of all properties with a garage below $200,000.

Examiner Report Question 7
(a) Many candidates correctly identified the number of fields in each record.
(b) Most candidates correctly identified the field to choose for the primary key. Better candidates gave a correct reason for their choice.
(c) Nearly all candidates correctly stated at least one data type.
Computer Science 2210

(d) Most candidates correctly showed only the Price in $ and the Brochure No, as identified by the query-by-example grid. Better candidates showed attention to detail, by correctly putting the prices in ascending order and the Price in $ field before the Brochure No field as indicated by the query-by-example grid.

(e) Most candidates correctly identified the fields to include in the query-by-example grid and identified those that were to be shown. A common error was to incorrectly set the criterion for the garage, when the data type had been set as a Boolean field in part (c).

Solution:

<table>
<thead>
<tr>
<th>Field:</th>
<th>Property Type</th>
<th>Garage</th>
<th>Price in $</th>
<th>Brochure No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
<td>PROPERTY</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>☑</td>
<td>□</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Criteria:</td>
<td>True</td>
<td>&lt; 200000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

May/June 2015 P22

6 A database, MARKS, was set up to record the test results for a class of students. Part of the database is shown below.

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Class ID</th>
<th>Maths</th>
<th>English</th>
<th>Science</th>
<th>History</th>
<th>Geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paul Smith</td>
<td>0017</td>
<td>70</td>
<td>55</td>
<td>65</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>Ravi Gupta</td>
<td>0009</td>
<td>29</td>
<td>34</td>
<td>38</td>
<td>41</td>
<td>44</td>
</tr>
<tr>
<td>Chin Hwee</td>
<td>0010</td>
<td>43</td>
<td>47</td>
<td>50</td>
<td>45</td>
<td>52</td>
</tr>
<tr>
<td>John Jones</td>
<td>0013</td>
<td>37</td>
<td>67</td>
<td>21</td>
<td>28</td>
<td>35</td>
</tr>
<tr>
<td>Diana Abur</td>
<td>0001</td>
<td>92</td>
<td>88</td>
<td>95</td>
<td>89</td>
<td>78</td>
</tr>
<tr>
<td>Rosanna King</td>
<td>0016</td>
<td>21</td>
<td>13</td>
<td>11</td>
<td>27</td>
<td>15</td>
</tr>
</tbody>
</table>

(a) Give the number of fields that are in each record. [1]

(b) State which field you would choose for the primary key.

Give a reason for choosing this field. [2]

(c) The query-by-example grid below selects all students with more than 60 marks in History or more than 60 marks in Geography.

<table>
<thead>
<tr>
<th>Field:</th>
<th>Student Name</th>
<th>History</th>
<th>Geography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>MARKS</td>
<td>MARKS</td>
<td>MARKS</td>
</tr>
<tr>
<td>Sort:</td>
<td>Ascending</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>☑</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Criteria:</td>
<td>&gt;60</td>
<td>&gt;60</td>
<td></td>
</tr>
</tbody>
</table>

or:
Show what would be output. [2]
(d) Complete the query-by-example grid below to select and show the student names only of all students with less than 40 marks in both Maths and English.

<table>
<thead>
<tr>
<th>Field:</th>
<th>Student Name</th>
<th>Maths</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>MARKS</td>
<td>MARKS</td>
<td>MARKS</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>☑</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>Criteria:</td>
<td>&lt;40</td>
<td>&lt;40</td>
<td></td>
</tr>
<tr>
<td>or:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Examiner’s comments on Question 6
(a) Many candidates correctly identified the number of fields in each record.
(b) Most candidates correctly identified the field to choose for the primary key. Better candidates gave a correct reason for their choice.
(c) Better candidates correctly showed only the student names as identified by the query-by-example grid.
Some of these candidates correctly ordered the names in ascending order.
(d) Most candidates correctly identified the fields to include in the query-by-example grid and identified those that were to be shown. A common error was to set the Maths or English criteria to OR rather than AND, where both criteria are on the same row.

6 (a) – 7
(b) – Class ID
– Uniquely identifies each student
(c) Diana Abur, Paul Smith
– both names
– …… correct order
(d) Field: Student Name | Maths | English
Table: MARKS | MARKS | MARKS
Sort: |       |     |
Show: ☑ | ☑     | ☐   |
Criteria: | <40 | <40  |
or: |      |      |

Oct/Nov 2015 P22
6 A picture gallery owner has decided to set up a database to keep information about the pictures he has for sale. The database table, PICTURE, will contain the following fields:

Title; Artist; Description; Catalogue Number; Size (area in square centimetres); Price; Arrived (date picture arrived at gallery); Sold (whether picture is already sold)

(a) (i) State what data type you would choose for each field.

Title ........................................................................................................................................
Artist ........................................................................................................................................
Description .............................................................................................................................
Examiners’ Comments Question 6

(a) (i) Most candidates correctly identified the correct data type for some of the fields. Candidates who did less well throughout, incorrectly used data types from programming rather than database management.

(ii) Most candidates correctly identified the field to choose for the primary key.

(b) Many candidates correctly identified at least one suitable validation check. Candidates with stronger responses throughout identified four different checks; a few candidates incorrectly repeated a validation check.

(c) Many candidates correctly identified the fields to include in the query-by-example grid; stronger responses identified those fields that were to be shown. A common error was to not include the table name.

Solution:

6 (a) (i) One mark for every two correct types
Title – text
Artist – text
Description – text/memo
Catalogue Number – text/(auto)number
Size – number
Price – currency/number
Arrived – date
Sold – “yes/no”/text/Boolean
0. 1 no marks
2. 3 one mark
4. 5 two marks
6. 7 three marks
8 four marks
A motor boat hire company decides to set up a database to keep information about boats that are available for hire. The database table, BOAT, will contain the following fields:

Boat Name; Model; Engine Power (in hp); Number of Seats; Life Raft (whether there is a life raft kept on the boat); Day Price (price for a day’s hire).

(a) Give the data type you would choose for each field.

   Boat Name ..............................................................................................................
   Model .....................................................................................................................
   Engine Power ....................................................................................................... 
   Number of Seats ...................................................................................................
   Life Raft ...................................................................................................................
   Day Price ..................................................................................................................

(b) State a validation check that you can perform on each of these fields. Each validation check must be different.

   Boat Name ..............................................................................................................
   Model .....................................................................................................................
   Engine Power ....................................................................................................... 
   Number of Seats ...................................................................................................
   Day Price ..................................................................................................................

(c) Complete the query-by-example grid below to select and show the Boat Name, Model and Day Price of a day’s hire for all boats with 4 seats and an Engine Power of more than 100hp.
Solution:

5 One mark for every two correct types
- **Boat Name** – text
- **Model** – text
- **Engine Power** – number
- **Number of Seats** – number
- **Life Raft** – "yes/no"/text/Boolean
- **Day Price** – currency/number

0, 1 no marks
2, 3 one mark
4, 5 two marks
6 three marks

(b) One mark for each correct different check
- **Boat Name** Presence Check/Type Check/Character Check
- **Model** Format check/Type check/Presence Check/Length check/
  Use of Drop-down box to select
- **Number of Seats** Type check/Presence Check/Range Check/
  Use of Drop-down box to select
- **Day Price** Type check/Presence Check/Range Check

(c) Field: | Boat Name | Model | Day Price | Number of Seats | Engine Power
---|---|---|---|---|---
Table: | BOAT | BOAT | BOAT | BOAT | BOAT
Sort: |
Show: | ☑ | ☑ | ☑ | ☐ | ☐
Criteria: |
or: | (1 mark) | (1 mark) | (1 mark) | (1 mark) | (1 mark)

May/June 2016 P21

6 A database, STAFFPHONE, was set up to show the telephone extension numbers for members of staff working in a department store.

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Extension number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jane Smith</td>
<td>Toys</td>
<td>129</td>
</tr>
<tr>
<td>Sue Wong</td>
<td>Books</td>
<td>124</td>
</tr>
<tr>
<td>David Chow</td>
<td>Toys</td>
<td>129</td>
</tr>
<tr>
<td>Amy Tang</td>
<td>Household</td>
<td>123</td>
</tr>
<tr>
<td>Joe Higgs</td>
<td>Books</td>
<td>124</td>
</tr>
<tr>
<td>Jane Smith</td>
<td>Shoes</td>
<td>125</td>
</tr>
<tr>
<td>Adel Abur</td>
<td>Shoes</td>
<td>125</td>
</tr>
<tr>
<td>Peter Patel</td>
<td>Toys</td>
<td>129</td>
</tr>
</tbody>
</table>
May/June 2016 P22

7 A database, SOFASELECT, was set up to show the prices of suites, sofas and chairs for sale from an online furniture warehouse. Part of the database is shown below.

<table>
<thead>
<tr>
<th>Description</th>
<th>Brochure Number</th>
<th>Number of Seats</th>
<th>Number of Pieces</th>
<th>Material</th>
<th>Colour</th>
<th>Price in $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sofa</td>
<td>SF17</td>
<td>2</td>
<td>1</td>
<td>Leather</td>
<td>Red</td>
<td>950</td>
</tr>
<tr>
<td>Sofa</td>
<td>SF19</td>
<td>3</td>
<td>1</td>
<td>Vinyl</td>
<td>Black</td>
<td>1,000</td>
</tr>
<tr>
<td>Suite</td>
<td>SU10</td>
<td>4</td>
<td>3</td>
<td>Velvet</td>
<td>Green</td>
<td>1,500</td>
</tr>
<tr>
<td>Suite</td>
<td>SU23</td>
<td>5</td>
<td>3</td>
<td>Leather</td>
<td>Brown</td>
<td>950</td>
</tr>
<tr>
<td>Recliner chair</td>
<td>RC01</td>
<td>1</td>
<td>1</td>
<td>Leather</td>
<td>Cream</td>
<td>600</td>
</tr>
<tr>
<td>Chair</td>
<td>CH16</td>
<td>1</td>
<td>1</td>
<td>Vinyl</td>
<td>Red</td>
<td>250</td>
</tr>
<tr>
<td>Recliner sofa</td>
<td>RS23</td>
<td>4</td>
<td>1</td>
<td>Leather</td>
<td>Cream</td>
<td>1,200</td>
</tr>
<tr>
<td>Chair</td>
<td>CH10</td>
<td>1</td>
<td>1</td>
<td>Velvet</td>
<td>Red</td>
<td>175</td>
</tr>
</tbody>
</table>

(a) How many fields are in each record? [1]
(b) State which field you would choose for the primary key. [2]
Give a reason for choosing this field.

(c) State the data type you would choose for each of the following fields.

Number of Seats.................................................................................................................................[2]
Price in $............................................................................................................................................[2]

(d) The query-by-example grid below selects all the furniture in cream leather.

<table>
<thead>
<tr>
<th>Field:</th>
<th>Description</th>
<th>Material</th>
<th>Colour</th>
<th>Price in $</th>
<th>Brochure Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>SOFASELECT</td>
<td>SOFASELECT</td>
<td>SOFASELECT</td>
<td>SOFASELECT</td>
<td>SOFASELECT</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Criteria:</td>
<td>= 'Leather'</td>
<td>= 'Cream'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Show the output from the query-by-example. [3]

(e) Complete the query-by-example grid below to select and show the brochure number, material, colour and price of all the furniture with 3 or more seats. [5]

<table>
<thead>
<tr>
<th>Field:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>SOFASELECT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Criteria:</td>
<td>&gt;2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solution:

7 (a) - 7
(b) - Brochure Number........
    - ..... Uniquely identifies each record/each Brochure Number different/no duplicates [2]
(c) - Number of Seats – number/integer
    - Price in $ – currency/real [2]
(d) 1 mark for each correct result, 1 mark for the results in descending order of price

- Recliner sofa 1,200 RS23
- Recliner chair  600 RC01 [3]

Oct/Nov 2016 P22
5 A database, PLAYPRODUCTION, was set up to show the performance dates, prices and number of seats available at a theatre specialising in Shakespeare productions.
(a) Give the number of fields that are in each record. [1]
(b) State the data type you would choose for each of the following fields.

Play.....................................................................................................................................................[1]
Number Seats Stalls..................................................................................................................................[3]
Price Stalls Seats $ ..................................................................................................................................[3]
(c) The query-by-example grid below selects all the productions with more than 100 seats left in either the stalls or the circle.

Field:
Table:
Sort: Ascending
Show: 🔔
Criteria: > 100
or: > 100

Show what would be output from the query-by-example. [3]
(d) Complete the query-by-example grid below to select all the productions with at least six seats left in the circle and show the Play, Performance Date and Price Circle Seats $ in Performance Date order.

Field:
Table:
Sort:
Show: 🔔
Criteria: 
or:

Solution:
5 (a) – 6
(b) – 6
- Play
- No Seats Stalls
- Price Stalls Seats $
Oct/Nov 2016 P23

6 A database, THEATRETOURS, was set up to show the tour dates, towns, number of seats and prices in local currency for a Shakespeare play.

<table>
<thead>
<tr>
<th>Town</th>
<th>Tour Date</th>
<th>Number of Seats</th>
<th>Price Local Currency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wigan</td>
<td>18/08/2016</td>
<td>120</td>
<td>15.00</td>
</tr>
<tr>
<td>Dumfries</td>
<td>20/08/2016</td>
<td>160</td>
<td>12.50</td>
</tr>
<tr>
<td>Turin</td>
<td>25/08/2016</td>
<td>200</td>
<td>17.00</td>
</tr>
<tr>
<td>Macon</td>
<td>27/08/2016</td>
<td>75</td>
<td>18.00</td>
</tr>
<tr>
<td>Bordeaux</td>
<td>29/08/2016</td>
<td>170</td>
<td>20.00</td>
</tr>
<tr>
<td>Algiers</td>
<td>01/09/2016</td>
<td>125</td>
<td>1350.00</td>
</tr>
<tr>
<td>Windhoek</td>
<td>05/09/2016</td>
<td>65</td>
<td>90.00</td>
</tr>
<tr>
<td>Windhoek</td>
<td>06/09/2016</td>
<td>65</td>
<td>90.00</td>
</tr>
<tr>
<td>Port Elizabeth</td>
<td>10/09/2016</td>
<td>200</td>
<td>110.00</td>
</tr>
</tbody>
</table>

(a) Explain why none of the fields in the database can be used as a primary key. [2]
(b) State a field that could be added as a primary key.
Give a reason for choosing this field. [2]
(c) Use the query-by-example grid below to provide a list of tour dates and seat prices in alphabetical order of town. [4]
May/Jun 2017 P21

7 A television (TV) store has a database table, TVSTOCK, for its new range of televisions. The table stores the screen size of each TV, whether it will show 3D, whether the screen is curved or flat, if the internet is available on the TV, if it has a built-in hard disk drive and the price. Part of the database table is shown below.

<table>
<thead>
<tr>
<th>TVID</th>
<th>Screen Size</th>
<th>3D</th>
<th>Curved Flat</th>
<th>Internet</th>
<th>HDD</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV80CVINT</td>
<td>80</td>
<td>YES</td>
<td>CV</td>
<td>YES</td>
<td>YES</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>TV65CVINT</td>
<td>65</td>
<td>YES</td>
<td>CV</td>
<td>YES</td>
<td>YES</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>TV60CVINT</td>
<td>60</td>
<td>YES</td>
<td>CV</td>
<td>YES</td>
<td>YES</td>
<td>$4,500.00</td>
</tr>
<tr>
<td>TV60FTINT</td>
<td>60</td>
<td>YES</td>
<td>FT</td>
<td>YES</td>
<td>YES</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>TV55CVINT</td>
<td>55</td>
<td>YES</td>
<td>CV</td>
<td>YES</td>
<td>NO</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>TV55FTINT</td>
<td>55</td>
<td>YES</td>
<td>FT</td>
<td>YES</td>
<td>NO</td>
<td>$3,500.00</td>
</tr>
<tr>
<td>TV55FTNNI</td>
<td>55</td>
<td>YES</td>
<td>FT</td>
<td>NO</td>
<td>NO</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>TV50CVINT</td>
<td>50</td>
<td>YES</td>
<td>CV</td>
<td>YES</td>
<td>NO</td>
<td>$2,500.00</td>
</tr>
<tr>
<td>TV50FTINT</td>
<td>50</td>
<td>YES</td>
<td>FT</td>
<td>YES</td>
<td>NO</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>TV50FTNNI</td>
<td>50</td>
<td>YES</td>
<td>FT</td>
<td>NO</td>
<td>NO</td>
<td>$1,750.00</td>
</tr>
<tr>
<td>TV42FTINT</td>
<td>42</td>
<td>YES</td>
<td>FT</td>
<td>YES</td>
<td>NO</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>TV37FTINT</td>
<td>37</td>
<td>NO</td>
<td>FT</td>
<td>YES</td>
<td>NO</td>
<td>$1,200.00</td>
</tr>
<tr>
<td>TV20FTNNI</td>
<td>20</td>
<td>NO</td>
<td>FT</td>
<td>NO</td>
<td>NO</td>
<td>$800.00</td>
</tr>
<tr>
<td>TV15FTNNI</td>
<td>15</td>
<td>NO</td>
<td>FT</td>
<td>NO</td>
<td>NO</td>
<td>$400.00</td>
</tr>
</tbody>
</table>

(a) State the type of the field TVID and give a reason for your choice. [1]

(b) Complete the table with the most appropriate data type for each field. [3]
(c) Use the query-by-example grid below to provide a list of all of the curved screen TVs that have a built-in hard disk drive. Make sure the list only displays the TVID, the price and the screen size in ascending order of price.

<table>
<thead>
<tr>
<th>Field:</th>
<th>Table:</th>
<th>Sort:</th>
<th>Show:</th>
<th>Criteria:</th>
<th>or:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solution:

<table>
<thead>
<tr>
<th>Field name</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ScreenSize</td>
<td>Number</td>
</tr>
<tr>
<td>3D</td>
<td>Boolean</td>
</tr>
<tr>
<td>CurvedFlat</td>
<td>Text</td>
</tr>
<tr>
<td>Internet</td>
<td>Boolean</td>
</tr>
<tr>
<td>HDD</td>
<td>Boolean</td>
</tr>
<tr>
<td>Price</td>
<td>Currency</td>
</tr>
</tbody>
</table>

1 mark for every two correct data types

May/June 2017 P22

5 A database table, SHEEP, is used to keep a record of the sheep on a farm. Each sheep has a unique ear tag, EARnnnn; n is a single digit. The farmer keeps a record of the date of birth, the gender and the current weight of each sheep in kilograms.

(a) Identify the four fields required for the database. Give each field a suitable name and data type. Provide a sample of data that you could expect to see in the field.

Field 1 name ..............................................................................................................................................
Data type .......................................................................................................................................................
Data sample ...................................................................................................................................................
Field 2 name ..............................................................................................................................................
Data type .......................................................................................................................................................
Data sample ...................................................................................................................................................
Field 3 name ..............................................................................................................................................
Data type .......................................................................................................................................................
Data sample ...................................................................................................................................................
Field 4 name ................................................................................................................................. [8]
Data type ..................................................................................................................................................
Data sample ..............................................................................................................................................

(b) State the field that you would choose as the primary key. [1]

(c) Using the query-by-example grid below, write a query to identify the ear tags of all male sheep weighing over 10 kilograms. Only display the ear tags. [3]

<table>
<thead>
<tr>
<th>Field</th>
<th>Table</th>
<th>Sort</th>
<th>Show</th>
<th>Criteria</th>
<th>or</th>
</tr>
</thead>
</table>

Solution:

5(a) for each field name (1), data type and sample (1)

The following are examples there are many different correct answers.
- EarTag (1), text, EAR1011 (1)
- DOB (1), date, 4/3/2017 (1)
- Gender (1), text, M (1)
- Weight (1), number, 5.9 (1)

5(b) EarTag

5(c) Field: | EarTag | Gender | Weight
-------------|--------|--------|--------
Table: SHEEP | SHEEP | SHEEP |
Sort:        |       |       |
Show:  ☑ | ☐      | ☑      |
Criteria:    | 'M'   | > 10   |

Oct/Nov 2017 P22

6 A database table, TRAIN, is to be set up for a railway company to keep a record of the engines available for use. Each engine has a unique number made up of 5 digits, nnnnn. The engines are classified as freight (F) or passenger (P) together with a power classification that is a whole number between 0 and 9, for example F8. The railway company keeps a record of the date of the last service for each engine.

(a) Identify the three fields required for the database. Give each field a suitable name and data type. Provide a sample of data that you could expect to see in the field.

Field 1 Name ........................................................................................................................................
Data type ...............................................................................................................................................
Data sample ...........................................................................................................................................
Field 2 Name ........................................................................................................................................
Data type ...............................................................................................................................................
Data sample ...........................................................................................................................................
Field 3 Name ........................................................................................................................................
Data type ...............................................................................................................................................

(b) State the field that you should choose as the primary key. [1]

(c) Using the query-by-example grid below, write a query to identify all passenger engines that have not been serviced in the past 12 months. Only display the engine numbers. [3]

Solution:

Oct/Nov 2017 P23

6 A wildlife park has a database table, called LIVESTOCK, to classify and record its animal species. Part of the database table is shown.

(a) Suggest another appropriate field that could be added to this database by stating its name and data type. State its purpose and give an example of the data it could contain.
(b) Use the query-by-example grid below to provide a list of all four-legged mammals that are herbivores, sorted alphabetically by species, with only the species displayed. [4]

<table>
<thead>
<tr>
<th>Field</th>
<th>Table</th>
<th>Sort</th>
<th>Show</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solution:

6(a) 1 mark for any sensible appropriate field name
1 mark for data type, purpose + example data

Example 1:
Field Name: SPECIESID
Data Type: Alphanumeric
Purpose: Primary key
Example Data: SP06583

Example 2:
Field Name: NUMBER
Data Type: Integer
Purpose: To record how many of that species there are at the park
Example Data: 30

6(b)  

<table>
<thead>
<tr>
<th>Field</th>
<th>Table</th>
<th>Sort</th>
<th>Show</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>LIVESTOCK</td>
<td>Ascending/Descending</td>
<td></td>
<td>“Mammal” “Herbivore” 4</td>
</tr>
</tbody>
</table>

May/June 2018 P21

6 A database table, PERFORMANCE, is used to keep a record of the performances at a local theatre.

<table>
<thead>
<tr>
<th>Show Number</th>
<th>Type</th>
<th>Title</th>
<th>Date</th>
<th>Sold Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>SN091</td>
<td>Comedy</td>
<td>An Evening at Home</td>
<td>01 Sept</td>
<td>Yes</td>
</tr>
<tr>
<td>SN102</td>
<td>Drama</td>
<td>Old Places</td>
<td>02 Oct</td>
<td>No</td>
</tr>
<tr>
<td>SN113</td>
<td>Jazz</td>
<td>Acoustic Evening</td>
<td>03 Nov</td>
<td>No</td>
</tr>
<tr>
<td>SN124</td>
<td>Classical</td>
<td>Mozart Evening</td>
<td>04 Dec</td>
<td>Yes</td>
</tr>
<tr>
<td>SN021</td>
<td>Classical</td>
<td>Bach Favourites</td>
<td>01 Feb</td>
<td>Yes</td>
</tr>
<tr>
<td>SN032</td>
<td>Jazz</td>
<td>30 Years of Jazz</td>
<td>02 Mar</td>
<td>Yes</td>
</tr>
<tr>
<td>SN043</td>
<td>Comedy</td>
<td>Street Night</td>
<td>03 Apr</td>
<td>No</td>
</tr>
<tr>
<td>SN054</td>
<td>Comedy</td>
<td>Hoot</td>
<td>04 May</td>
<td>No</td>
</tr>
</tbody>
</table>

(a) State the number of fields and records in the table.
6 A database table, TREES, is used to keep a record of the trees in a park. Each tree is given a unique number and is examined to see if it is at risk of dying. There are over 900 trees; part of the database table is shown.

<table>
<thead>
<tr>
<th>Tree Number</th>
<th>Type</th>
<th>Map Position</th>
<th>Age in Years</th>
<th>At Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN091</td>
<td>Acacia</td>
<td>A7</td>
<td>250</td>
<td>Y</td>
</tr>
<tr>
<td>TN172</td>
<td>Olive</td>
<td>C5</td>
<td>110</td>
<td>N</td>
</tr>
<tr>
<td>TN913</td>
<td>Cedar</td>
<td>B9</td>
<td>8</td>
<td>N</td>
</tr>
<tr>
<td>TN924</td>
<td>Banyan</td>
<td>A3</td>
<td>50</td>
<td>Y</td>
</tr>
<tr>
<td>TN021</td>
<td>Pine</td>
<td>D5</td>
<td>560</td>
<td>Y</td>
</tr>
<tr>
<td>TN532</td>
<td>Teak</td>
<td>C8</td>
<td>76</td>
<td>Y</td>
</tr>
<tr>
<td>TN043</td>
<td>Yew</td>
<td>B1</td>
<td>340</td>
<td>N</td>
</tr>
<tr>
<td>TN354</td>
<td>Spruce</td>
<td>D4</td>
<td>65</td>
<td>N</td>
</tr>
<tr>
<td>TN731</td>
<td>Elm</td>
<td>B10</td>
<td>22</td>
<td>Y</td>
</tr>
<tr>
<td>TN869</td>
<td>Oak</td>
<td>C9</td>
<td>13</td>
<td>N</td>
</tr>
<tr>
<td>TN954</td>
<td>Pine</td>
<td>E11</td>
<td>3</td>
<td>N</td>
</tr>
</tbody>
</table>

(a) State the number of fields in the table. [1]  
(b) The tree numbering system uses TN followed by three digits. The numbering system will not work if there are over 1000 trees.
Describe, with the aid of an example, how you could change the tree numbering system to allow for over 1000 trees. Existing tree numbers must not be changed. [2]

(c) Using the query-by-example grid, write a query to identify at risk trees over 100 years old. Display only the type and the position on the map. [4]

Solution:

<table>
<thead>
<tr>
<th>Field:</th>
<th>Tree Type</th>
<th>Size 1</th>
<th>Size 1 In</th>
<th>Size 2</th>
<th>Size 2 In</th>
<th>Size 3</th>
<th>Size 3 In</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>TREES</td>
<td>TREES</td>
<td>TREES</td>
<td>TREES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Oct/Nov 2018 P23

6 An online fruit tree specialist sells fruit trees in various sizes. A database table, TREETAB, shows the tree type and, for each size, the price and whether they are in stock.

<table>
<thead>
<tr>
<th>Tree Type</th>
<th>Size 1</th>
<th>Size 1 In</th>
<th>Size 2</th>
<th>Size 2 In</th>
<th>Size 3</th>
<th>Size 3 In</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>10.95</td>
<td>Yes</td>
<td>14.95</td>
<td>Yes</td>
<td>29.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Apple</td>
<td>12.95</td>
<td>Yes</td>
<td>14.95</td>
<td>Yes</td>
<td>29.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Cherry</td>
<td>24.95</td>
<td>No</td>
<td>34.95</td>
<td>No</td>
<td>59.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Fig</td>
<td>19.95</td>
<td>Yes</td>
<td>29.95</td>
<td>No</td>
<td>49.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Guava</td>
<td>19.95</td>
<td>No</td>
<td>29.95</td>
<td>No</td>
<td>59.95</td>
<td>No</td>
</tr>
<tr>
<td>Nectarine</td>
<td>8.50</td>
<td>Yes</td>
<td>11.95</td>
<td>Yes</td>
<td>19.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Olive</td>
<td>19.95</td>
<td>No</td>
<td>39.95</td>
<td>Yes</td>
<td>59.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Peach</td>
<td>9.25</td>
<td>No</td>
<td>11.95</td>
<td>Yes</td>
<td>19.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Pear</td>
<td>10.95</td>
<td>Yes</td>
<td>14.95</td>
<td>Yes</td>
<td>29.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Plum</td>
<td>8.95</td>
<td>Yes</td>
<td>11.95</td>
<td>Yes</td>
<td>19.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Pomegranate</td>
<td>12.95</td>
<td>No</td>
<td>18.95</td>
<td>Yes</td>
<td>34.95</td>
<td>No</td>
</tr>
<tr>
<td>Quince</td>
<td>34.95</td>
<td>Yes</td>
<td>44.95</td>
<td>Yes</td>
<td>84.95</td>
<td>No</td>
</tr>
</tbody>
</table>

(a) State whether any of the fields shown would be suitable as a primary key. Explain your answer [2]
(b) Complete the table to show the most appropriate data type for each of the fields based on the data shown in the table at the start of question 6.

<table>
<thead>
<tr>
<th>Field</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Type</td>
<td></td>
</tr>
<tr>
<td>Size 3</td>
<td></td>
</tr>
<tr>
<td>Size 2 In</td>
<td></td>
</tr>
</tbody>
</table>

(c) Show the output that would be given by this query-by-example.

<table>
<thead>
<tr>
<th>Field</th>
<th>Table</th>
<th>Sort</th>
<th>Show</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Type</td>
<td>TREETAB</td>
<td></td>
<td></td>
<td>&lt;10.00</td>
</tr>
<tr>
<td>Size 1</td>
<td>TREETAB</td>
<td>Descending</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size 2 In</td>
<td>TREETAB</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(d) Using the following query-by-example grid, write a query to identify all types of the fruit trees that are out of stock for all three sizes. Make sure the type of the tree and the various ‘in stock’ fields are shown. The trees should be listed in alphabetical order by type.

<table>
<thead>
<tr>
<th>Field</th>
<th>Table</th>
<th>Sort</th>
<th>Show</th>
<th>Criteria</th>
</tr>
</thead>
</table>

Solution:

6(a) 1 mark for correct answer; No
1 mark for correct explanation; No field in this table contains unique identifier
1 mark for each correct answer

6(b) 1 mark for each correct row (max 3) and
1 mark for the correct order

<table>
<thead>
<tr>
<th>Field</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Type</td>
<td>Text</td>
</tr>
<tr>
<td>Size 3</td>
<td>Number</td>
</tr>
<tr>
<td>Size 2 In</td>
<td>Boolean/Text</td>
</tr>
</tbody>
</table>

6(c) 1 mark for each correct row (max 3) and
1 mark for the correct order

<table>
<thead>
<tr>
<th>Tree Type</th>
<th>Size 3</th>
<th>Size 2 In</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peach</td>
<td>9.25</td>
<td>No</td>
</tr>
<tr>
<td>Plum</td>
<td>8.95</td>
<td>Yes</td>
</tr>
<tr>
<td>Nectarine</td>
<td>8.50</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Oct/Nov 2018 P22

6 A database table, PORTRAIT, is used to keep a record of the portraits available from a photographic studio. Each portrait has a unique reference number PICnnn, where n is a single digit, for example PIC123. The studio keeps a record of the size (for example 20 × 15), the type (black and white or colour), and the price in dollars.

(a) Complete the table to show the most appropriate data type for each of the fields.

<table>
<thead>
<tr>
<th>Field</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Number</td>
<td>Text</td>
</tr>
<tr>
<td>Size</td>
<td>Text</td>
</tr>
<tr>
<td>Type</td>
<td>Text/Boolean</td>
</tr>
<tr>
<td>Price in $</td>
<td>Number/Currency</td>
</tr>
</tbody>
</table>

(b) The results from the query-by-example grid should show the reference number, price, type and size of all portraits under $50. Identify the three errors in the query-by-example grid.

Field: Reference No, Price in $, Type, Size
Table: PORTRAIT, PORTRAIT, PORTRAIT, PORTRAIT
Sort: Ascending
Show: Yes, Yes, No, Yes
Criteria: >50.00

Solution:

8(a) Many correct answers, an example is given. 1 mark for each correct row (max 4).

<table>
<thead>
<tr>
<th>Field</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference Number</td>
<td>Text</td>
</tr>
<tr>
<td>Size</td>
<td>Text</td>
</tr>
<tr>
<td>Type</td>
<td>Text/Boolean</td>
</tr>
<tr>
<td>Price in $</td>
<td>Number/Currency</td>
</tr>
</tbody>
</table>

8(b) 1 mark per bullet:

- Incorrect field name for Reference Number
- Incorrect criteria for Price in $ should be <
- Type not checked
May/June 2019 P21

The table, BEVERAGES, shows the number of calories in 100 ml of a range of popular beverages. It also shows the availability of these drinks in a can, a small bottle and a large bottle.

<table>
<thead>
<tr>
<th>BevNo</th>
<th>BevName</th>
<th>Calories</th>
<th>Can</th>
<th>Small Bottle</th>
<th>Large Bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bev01</td>
<td>Cola</td>
<td>40</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bev02</td>
<td>Lime</td>
<td>45</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Bev03</td>
<td>Energy Drink 1</td>
<td>52</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bev04</td>
<td>Energy Drink 2</td>
<td>43</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bev05</td>
<td>Mango</td>
<td>47</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Bev06</td>
<td>Lemon Iced Tea</td>
<td>38</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Bev07</td>
<td>Lemonade</td>
<td>58</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bev08</td>
<td>Orange Juice</td>
<td>46</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bev12</td>
<td>Apple Juice</td>
<td>50</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Bev15</td>
<td>Chocolate Milk</td>
<td>83</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

(a) Give a reason for choosing BevNo as the primary key for this table. [1]

(b) State the number of records shown in the table BEVERAGES. [1]

(c) List the output that would be given by this query-by-example.

<table>
<thead>
<tr>
<th>Field:</th>
<th>BevNo</th>
<th>BevName</th>
<th>Can</th>
<th>Small Bottle</th>
<th>Large Bottle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>BEVERAGES</td>
<td>BEVERAGES</td>
<td>BEVERAGES</td>
<td>BEVERAGES</td>
<td>BEVERAGES</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td>Descending</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>✔</td>
<td>✔</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Criteria:</td>
<td>= &quot;Yes&quot;</td>
<td>= &quot;Yes&quot;</td>
<td>= &quot;Yes&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(d) Complete the query-by-example grid to output a list showing just the names and primary keys of all the beverages with a calorie count greater than 45. The list should be in alphabetical order of names.

<table>
<thead>
<tr>
<th>Field:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Criteria:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Solution:

5(a) Each data value is unique
5(b) 10 records
6. A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

<table>
<thead>
<tr>
<th>Flight number</th>
<th>Plane</th>
<th>Notes</th>
<th>Departure time</th>
<th>Passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>FN101</td>
<td>Caravan 1</td>
<td>Private passenger flight</td>
<td>08:00</td>
<td>Y</td>
</tr>
<tr>
<td>CN101</td>
<td>Caravan 2</td>
<td>Freight only</td>
<td>08:30</td>
<td>N</td>
</tr>
<tr>
<td>CN102</td>
<td>Piper 1</td>
<td>Freight only</td>
<td>09:00</td>
<td>N</td>
</tr>
<tr>
<td>FN104</td>
<td>Piper 2</td>
<td>Passengers only</td>
<td>09:20</td>
<td>Y</td>
</tr>
<tr>
<td>FN105</td>
<td>Piper 1</td>
<td>Freight and passengers</td>
<td>10:00</td>
<td>Y</td>
</tr>
<tr>
<td>FN106</td>
<td>Caravan 1</td>
<td>Passengers only</td>
<td>10:30</td>
<td>Y</td>
</tr>
<tr>
<td>CN108</td>
<td>Caravan 2</td>
<td>Freight only</td>
<td>08:00</td>
<td>N</td>
</tr>
<tr>
<td>CN110</td>
<td>Lear</td>
<td>Private passenger flight</td>
<td>08:00</td>
<td>Y</td>
</tr>
</tbody>
</table>

(a) State the field that could have a Boolean data type. [1]

(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field: Flight number, Passengers, Departure time
Table: FLIGHT
Sort: None
Show: None
Criteria: = Y, = 10:00

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation
A database table, SALES, is used to keep a record of items made and sold by a furniture maker.

### Solution:

#### 8(a) Passengers

#### 8(b) Explanation:
- **Three from:**
  - Flight number not displayed
  - Passengers displayed when should not be
  - Departure time ≠ not >
  - "Freight and passengers" flight not excluded

Revised QBE – answers shown are examples only

1 mark per bullet
- correct field and table names (either 3 or 4 columns) must include
  - Notes, Flight number and Departure time
- correct show
- correct time criteria for the candidate’s QBE grid
- use of criteria to select planes with passengers only

<table>
<thead>
<tr>
<th>Field:</th>
<th>Flight number</th>
<th>Passengers</th>
<th>Departure time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>FLIGHT</td>
<td>FLIGHT</td>
<td>FLIGHT</td>
<td>FLIGHT</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria:</td>
<td>=Y</td>
<td>&gt;10:00</td>
<td></td>
<td>&quot;Freight and passengers&quot;</td>
</tr>
<tr>
<td>or:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>Field:</th>
<th>Flight number</th>
<th>Departure time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table:</td>
<td>FLIGHT</td>
<td>FLIGHT</td>
<td>FLIGHT</td>
</tr>
<tr>
<td>Sort:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show:</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria:</td>
<td>&gt;10:00</td>
<td></td>
<td>&quot;Passengers only&quot;</td>
</tr>
<tr>
<td>or:</td>
<td></td>
<td>&gt;10:00</td>
<td>&quot;Private passenger flight&quot;</td>
</tr>
</tbody>
</table>
(a) Explain why the field Item number could not be used as a primary key. [1]

(b) A query-by-example has been written to display only the order number and item numbers of any items in progress or not started.

<table>
<thead>
<tr>
<th>Item number</th>
<th>Order number</th>
<th>Notes</th>
<th>Amount</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH001</td>
<td>1921</td>
<td>Smith – six dining chairs</td>
<td>6</td>
<td>Delivered</td>
</tr>
<tr>
<td>TB003</td>
<td>1921</td>
<td>Smith – large table</td>
<td>1</td>
<td>In progress</td>
</tr>
<tr>
<td>CH001</td>
<td>1924</td>
<td>Hue – extra chairs</td>
<td>4</td>
<td>In progress</td>
</tr>
<tr>
<td>CH003</td>
<td>1925</td>
<td>For stock</td>
<td>2</td>
<td>Cancelled</td>
</tr>
<tr>
<td>BN001</td>
<td>1927</td>
<td>Patel – replacement bench</td>
<td>1</td>
<td>Not started</td>
</tr>
<tr>
<td>ST002</td>
<td>1931</td>
<td>Sola – small table</td>
<td>1</td>
<td>Delivered</td>
</tr>
<tr>
<td>CH003</td>
<td>1927</td>
<td>Patel – eight dining chairs with arms</td>
<td>8</td>
<td>Not started</td>
</tr>
<tr>
<td>TB003</td>
<td>1927</td>
<td>Patel – large table</td>
<td>1</td>
<td>Not started</td>
</tr>
</tbody>
</table>

Explain why the query-by-example is incorrect, and write a correct query-by-example.

**Explanation**

Field:

Table: SALES

Sort:

Show: [ ] [ ] [ ] [ ]

Criteria: Not Like "Delivered"

or: [ ] [ ] [ ] [ ]

**Solution:**

7(a) [ ] Number is repeated/not unique

7(b) [ ] Item number not displayed/Amount column not required
    [ ] Not Like "Delivered" will also show cancelled items

Field: Item number, Order number, Status

Table: SALES

Sort:

Show: [ ] [ ] [ ] [ ]

Criteria: Like "Not started"

or: Like "In progress"
Oct/Nov 2019 P23

A teacher has decided to use a database table as her mark book for her Computer Science class, which she has called MARKBOOK. For each student, the following data will be recorded: first name, last name, their year 10 test score and their year 11 test score. The class has 32 students.

(a) State the number of fields and records required for this database.

Number of Fields ........................................................................................................... 4

Number of Records ................................................................................................. 32

(b) The data in MARKBOOK is stored under category headings: LastName, FirstName, Y10TestScore and Y11TestScore. State, with a reason, whether any of these headings would be suitable as a primary key. [2]

(c) Complete the query-by-example grid to only display the first name, last name and year 10 test score of each student who achieved 50 or more in their year 10 test. The output should be in test score order with the highest marks at the top of the list.

Solution:

7(a) • Number of Fields: 4
     • Number of Records: 32

7(b) • No field is suitable as a primary key ...
     • ... because none of the data would be unique // duplicates could occur

7(c) | Field: | FirstName | LastName | Y10TestScore |
     | Table: | MARKBOOK | MARKBOOK | MARKBOOK |
     | Sort: |            |          | Descending |
     | Show: | ✓         | ✓        | ✓       |
     | Criteria: | | | >=50 |
     | or: | |

One mark for each completely correct column down to and including “Show” row
(maximum three marks)

One mark for correct search criteria rows