Markscheme

May 2018

Computer science

Standard level

Paper 1

10 pages

Section A

1. (a) *Award **[2]** for one method that is suitable for the given scenario.*

Answers may include:
Interviews could be held (with the librarian/stakeholders);
To establish the functions required by the system;

Direct observation could be made of the users/students using the present system;
To gain an insight on how the library is being used; **[2 max]**

(b) Allows stakeholders to gain an idea of how the system would be/work/look; so they can provide feedback / suggest improvements; **[2]**

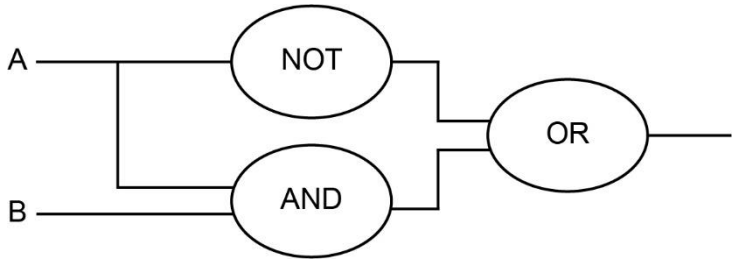
2. Holds (a copy of) the contents of the memory;
Which are to be transferred from/to memory to/from other CPU components;
Allowing the processor and memory to act independently/processor not affected by differences in the speed of operation; **[2 max]**

3. 2 hex = 4 + 4 = 8 bits;
hence 2^8/16^2/256 colours;
***Note:** Allow **[2]** for 16^2 = 256 colours with no workings and also ONLY 256* **[2]**

4. *Award **[3]** as follows:*
The function of the memory management **[1]**.
An example if its use **[1]**.
Reason for the importance **[1]**.

Example:
Allocates and de-allocates memory/ assignes blocks of memory to programs;
Ensures a program has sufficient memory to run/manages virtual memory if needed;
To avoid overwriting /clashing of programs/optimise system performance/maximise memory usage **[3]**

5. *Award **[3]** as follows:*
Clearly a logic diagram with 2 inputs, 1 output and 3 logic gates **[1]**;
OR gate has two inputs one of which is NOT A **[1]** and the other is A AND B **[1]**



[3]

6. It contains a set amount of data;
It contains a fixed structure (or identify elements of the structure other than data);
It contains data that is to be sent via a communications channel;
It contains specific details for transmission e.g. address of sender and receiver, error codes *etc*.; **[2 max]**

*Award 2 marks if **two** of the contents of a packet are given and expanded*

7. Protocols are a set of rules;
(That are used) so that both sender and receiver are using/expecting the same formats/methods;
To allow data to be transmitted successfully / without errors; **[3]**

8. 47, 23, 11
*Award **[1]** per output.*
***Note:** Allow FT if either of the first two outputs are wrong.* **[3]**

9. *For example, [**2 max]** if no application given;*
Searching through a database of names;
That contains a large amount of data;
That is already sorted;
And needs to be searched in the least amount of time;
Is faster because binary search divides and searches smaller blocks of data/does not have to compare each element in the list; **[3 max]**

Section B

10. (a) Award marks for a response which indicates the logical steps that have to be followed.

*Award **[5 max]** as follows*:
Iterate through the appointments file;
Check for correct day;
Repeat for each appointment on that day;
Using the patient ID for that appointment;
Iterate through the patients file until record for that ID found;
Retrieve phone number and send out SMS;

Example:

```
loop for every appointment in the appointments file
    if the appointment is for the correct day
        Store patient ID
            loop until found in the patients file
                if patient ID (patients file) = patient ID (appointments file)
                    get phone number from patient's file to send SMS
                end if
            end loop
    end if
end loop
```

***Note:** Candidates are not requested to construct the (algorithm in) pseudocode.* **[5 max]**

(b) *Award **[1]** for method and **[1]** for description – only accept TWO methods.*
*Mark as **[2]** and **[2]**.*

Backup;
Data files on a regular basis;

Printed copies;
Printouts can be kept of transactions;

Transaction Log file;
Written for each transaction can be used to restore;

Accept any reasonable methods described including second server and cloud use. **[4 max]**

(c) *There are 2 possible issues here: who has what level of access to the data in the hospital and whether storing in the cloud is safer than storing locally.*

*For each of these 2 issues award **[3 max]** as follows:*
*Award **[1]** for identifying the issue.*
*Award **[1]** for some valid development of the issue.*
*Award **[1]** for a suitable discussion.*

*Example answers **could** include reference to the following but this is not an exclusive list. Award marks for any two reasonable issues discussed – one of which is access and the other security.*

Official access to the data [3 max]:
Access to this sensitive data must be restricted.
Only those directly concerned can be able to access it.
Even less people should be able to edit it.
Therefore access levels should be set up, with strong levels of authentication.
Physical access to servers should be controlled if using the local system;

Data security [3 max]:
Is the data safer stored locally or on the cloud?
Cloud service providers are professionals – they should have stronger security than a hospital system.
What track record / reputation does the cloud service provider have?
If patient data could be sold/inspected, then both the patient and hospital could suffer serious consequences.
Is the cloud governed by appropriate privacy laws?
Is it located internationally or is it governed by the laws of the country in question?
Could be intercepted in transmission; **[6 max]**

11. (a) Processes/task are carried out simultaneously/at the same time; **[1]**

(b) Install connectors on wall of server room AND Install connector on wall of new office space;

OR

Test the cabling AND Connect the new computers with the cabling; **[1 max]**

(c) *Any pair of tasks that are NOT a correct answer to part (b)*; **[1 max]**

(d) *Award **[1]** for stating an advantage, **[1]** for expansion/example in context. Mark as **[2]** and **[2]***

Answers may include:
Use on the move;
More versatile staff encouraged to collaborate *etc.*;

Allows BYOD:
Which could lead to greater productivity (as familiarity with device);

No extra equipment is needed for expansion after initial set-up;
Which will save the company time and money;

Reduces wiring;
Therefore improved safety for employees; **[4 max]**

(e) *Mark as **[2]** and **[2]**.*

The data can be intercepted as it goes through "the air";
Can be resolved by strong encryption/protocols;
WPA-2 / a description of WPA-2;
Use of trusted MAC addresses;
Regular changes of router password; **[2 max]**

BYOD issues leading to insecure devices;
Clear company policy regarding use;
Use of sand-box;
Only approved devices allowed;
MAC addresses – only adding clean and tested devices brought in by staff;
Installation of MDM services;
Authentication (user ID + password on all devices including BYOD);
Security features added by company; **[2 max]** **[4 max]**

(f) A VPN/tunneling allows the employee's device to appear to be part of / a node of the internal company network;
Thus affording him/her full access to the network resources;

Data that passes through a VPN can be encrypted;
So any unauthorized access will not be able to understand the data;

Tunnelling allows the company's own protocols to be used/IPsec/TSL ensure security;
Even though the data is passing over an outside network;

Multiple exit nodes / hidden IP addresses/encrypted connections;
Make it hard to distinguish where the data was generated; **[4 max]**

12. (a)

X	ARRAY[X]	COUNTER	SUM	output
		0	0	
0	2	1	2	
1	4	2	6	
2	1	3	7	
3		3	7	
4		3	7	
5	1	4	8	
6		4	8	2

*Award **[1]** for each correct column (excepting the first). If the first row is not completed, mark as follows:*
*All 4 correct except for first row: **[3]***
*3 correct except for first row: **[2]***
*2 correct except for first row: **[1]***
*1 correct except for first row: **[0]**.*

Follow through for an output that is correct from their incorrect `COUNTER` or `SUM` columns. **[4]**

(b)
```
P_ARRAY // array declaration
X = 0
(PASSENGERS.resetNext())
while PASSENGERS.hasNext()
  P_ARRAY[X] = PASSENGERS.getNext()
  X = X + 1
end while
```

*Award **[1]** for evidence of the idea of a loop (for or while etc.).*
*Award **[1]** for correct while/until loop with correct condition.*
*Award **[1]** for correct reading of collection into array.*
*Award **[1]** for declaring and incrementing X.* **[4]**

(c) The following are two alternative approaches. Most solutions should fit one or the other markscheme. Do not penalise those who introduce separate variables instead of arrays.

Example 1:

```
MAXAV = 0
  X = (P_ARRAY.length) - 1
  MAXDAY
  loop for DAY from 0 to 6
    SUM = 0
    COUNTER = 0
    loop for C from DAY to X  //loop while C < X
      SUM = SUM + P_ARRAY[C]
      COUNTER = COUNTER + 1
      C = C + 6  // C = C + 7 or allow step 7 in the loop
    end loop
    if SUM/COUNTER > MAXAV
      MAXAV = SUM/COUNTER
      MAXDAY = DAY
    end if
  end loop
output convert(MAXDAY)
```

*Award **[1]** for correct initialization of numerical variables (eg `MAXAV, COUNTER, SUM`).*
*Award **[1]** for correct loop through each day.*
*Award **[1]** for correct for loop through array.*
*Award **[1]** for incrementing array position by 7 each time.*
*Award **[1]** for calculation of average (`SUM/COUNTER`).*
*Award **[1]** for comparing this with `MAXAV`.*
*Award **[1]** for adjusting `MAXAV` and `MAXDAY` if necessary.*
*Award **[1]** for correct use of `CONVERT` sub-procedure.* **[7 max]**

Example 2:

```
MAXDAY = 0
DAYSUM ARRAY
WEEKS ARRAY
COUNT = 0

while COUNT < P_ARRAY.length //loop through p.array
  DAY = COUNT MOD 7
  WEEKS[DAY] = WEEKS[DAY] + 1 //add number of weeks for this day
  DAYSUM[DAY] = DAYSUM[day] + P_ARRAY[COUNT]
  COUNT = COUNT + 1
end while
COUNT = 0 //reinitialize
while COUNT < DAYSUM.length //loop through dayArray can also be
                            //a for loop as there are 7 days.
  if DAYSUM[COUNT] / WEEKS[COUNT] > MAXDAY //find maxDay
    MAXDAY = COUNT
  end if
  COUNT = COUNT + 1
end while
output convert(MAXDAY)
```

*Award **[1]** for correct initialisation of variables/arrays.*
*Award **[1]** for correct loop through array.*
*Award **[1]** mark for incrementing day.*
*Award **[1]** mark for incrementing sum for each day.*
*Award **[1]** mark for incrementing number of weeks for each day.*
*Award **[1]** mark for correct calculation of average for each day.*
*Award **[1]** mark for finding MAXDAY.*
*Award **[1]** mark for correct use of CONVERT procedure.* **[7 max]**