

SECTION A

Total: [25 marks]

1. Award up to [2 marks max].

Roles/activities of the users (*eg* permissions, security, partitions, collaborative work);
Resources (HW and SW equipment) appropriate for the organization;
Costs/budget limits;
Delivery time;
Compatibility with the old system (data);

(Other acceptable answers are possible, from the economic, operational and technical perspective.)

[2 marks]

2. Award up to [2 marks max].

Testing prior to product's full release / last stage of testing;
To see if it works properly / complete functionality / usability;
Performed by end users (not by designers);

[2 marks]

3. Award up to [4 marks max].

Award [1 mark] for the identification of an advantage and [1 mark] for explaining the advantage.

Award [1 mark] for the identification of a disadvantage and [1 mark] for explaining the disadvantage.

Example Advantages:

Can highlight aspects that are not detected in questionnaires/interviews;
So the observer can help produce more detailed reports;

Observations may be more reliable than interviews;
Because they can reveal what people actually do instead of what they say they do;

Example disadvantages:

Time consuming / expense;
The observer might need to observe a complete cycle *etc* which could last a significant amount of time;

If the observations are made by only one person, they may be biased;

Observations may be unreliable;
Because people act differently when they know they are being watched.

(Accept formulations that express similar or plausible ideas.)

[4 marks]

4. Award **[1 mark]** for identifying an issue and **[1 mark]** for an explanation.

Size of screen;

Therefore difficult to see / use (in poor light);

Size of keys;

Therefore difficult to access functions;

Battery life;

May need to recharge regularly;

Touch screen keys on tablets *etc*;

Lack of tactile feedback;

[2 marks]

5. Award up to **[2 marks max]**.

Award **[1 mark]** for identifying **two** types of primary memory.

Award **[1 mark]** for the use of **each** type of the memory identified $\times 2$.

RAM stores data and instructions currently in use

ROM stores permanent instructions

Cache stores frequently used instructions

(Award **[1 mark]** if only general scheme of CPU is given.)

[2 marks]

6. Initially compare with node pointed to by the head;
(If not correct place) move through list using pointers until correct alphabetical position is found;
Adjust pointers accordingly;

(Drawings are acceptable, but award marks only if they clearly show how pointers are correctly rearranged, following the three guidelines above.)

[3 marks]

7. A colour will be split into three components (Accept RGB as an example);
Each component will be assigned a certain number of bytes;

[2 marks]

8. Award up to **[2 marks max]**.

Examples of features:

No central server;

Resources are more widely available (storage, bandwidth, computing power);

Redundancy/recovery;

Supports file sharing for collaborative work;

[2 marks]

9. *Award up to [2 marks max].*

It is used in the formation of virtual memory / use of secondary memory;
To increase the amount of primary memory;
Memory divided into (tagged) “pages”;
Which are then transferred in and out as required;

[2 marks]

10. *Award [1 mark] for a feature and [1 mark] for a description, for two features, up to [4 marks max].*

Feature: Autonomy;

Description:

Agents *activate* alone for a task and are not invoked for a task;
Agents can *select the task* themselves (based on priorities or goal-directed search) without human intervention;

Feature: Reactive behavior;

Description:

Agent senses the environment in which it is, and decides what to do reacting on its perceptions;

Feature: Concurrency/sociality;

Description:

Agents can interact with other agents through communication, in different modes: coordination, cooperation, competition;

Feature: Persistence;

Description:

The code describing an agent runs continuously like a process, and is not executed on demand;

[4 marks]

SECTION B

Total: [75 marks]

11. (a) *Award up to [2 marks max].*

Elderly;
Disabled;
Commuters;
Accept other reasonable answers.

[2 marks]

- (b) *Award [1 mark] for advantage and [1 mark] for explanation, for two items, up to [4 marks max].*

Improved convenience;
One can better control times of functioning, hence costs;

Improved comfort;
One can program the functions according to their specific needs;

Energy efficiency;
One can program/plan the functions based on the surrounding environment and reduce energy waste (interconnected systems);

Safety;
Programmed in a way to avoid electric overload and faults;

Accept other reasonable answers.

[4 marks]

- (c) *Award up to [6 marks max].*

Award up to [3 marks max] for each of the two ways.

Award [1 mark] for the way of access and up to [2 marks] for two additional points, which could be advantages or disadvantages.

Examples include fixed/non-fixed installations, digital/analogue.

Computer based/TV-based control;
The user always knows where the control is;
Because the device may not be portable;
Inconvenient if computer/TV already being used by someone else;

Touch screen/keypads in fixed installation;
Ergonomic gadget/small dimensions/cheap device;
Wide range of different designs to fit different locations in a house;
Difficult to lose;
Inconvenient to operate some devices by having to go to a fixed panel/not suitable for extended use to operate TVs etc;

Smartphone;
Portable/useful for some groups of users (limited mobility);
Can be easily extended to include other devices;
Could be lost or misplaced;
Requires internet/Wi-Fi/signal to operate;

Accept other suitable answers.

[6 marks]

continued ...

Question 11 continued

- (d) *Award up to [3 marks max].*

Transmission: integrated wiring or internet or wireless;

Requires: extended/dedicated network and hw/sw for protocols/transmissions and sensors/actuators;

Use: The farmer can vary the parameters/environmental conditions from home at any time and better concentrate on other activities (eg trade with KFC);

[3 marks]

Total: [15 marks]

12. (a) Data is in the cloud/computing infrastructure;
SW necessary for the activities is in the cloud;
Access to SW is with thin client (terminal/computers) by web browsing (on the extranet);

[3 marks]

- (b) *Award up to [6 marks max].*

Security in storage;

Data is stored in the server of the service provider;

The organization has no direct control of its data;

Legislation in the country of the provider may be weaker than in the user's country;

Cases of provider's corruption/bankruptcy/data loss are a risk to the organization;

Security in transmission;

Applications running in-site may require data in SaaS;

Hence longer transmission times and higher risk of failure/attack/interception;

[6 marks]

- (c) *Award up to [2 marks max].*

An external extension to a company's local network;

Limited access;

Uses internet protocols;

[2 marks]

- (d) VPN authenticates the sender before (establishing the tunnel);
VPN access is always encrypted, whereas extranet has limited encryption;
VPN transmission is always encrypted;
VPN users have access to everything whereas extranet users only have access to (enabled) specific services;

[4 marks]

Total: [15 marks]

13. (a) 90.2 **[1 mark]**

(b) Frequencies less than 100 take a 0 on the left (eg 88.7 becomes 088.7);
Convert each digit into a char to get a string;
Allow the “dot” to be omitted in the interpretation. There is always only one decimal in the example. **[2 marks]**

(c) *Award up to [6 marks max].*

Example answer (searches for the min and max, and then the range is calculated)

Award [1 mark] for each of the following

Initialization;

Loop;

Correct if statement (min);

Correct if statement (max);

Compute the range;

Output the range;

```
MIN = Radio[0]
MAX = Radio[0]
K=1
loop while K<=5
    if Radio[K]<MIN then
        MIN=Radio[K]
    else if Radio[K]>MAX then
        MAX=Radio[K]
    endif
    K=K+1
endloop
RANGE=MAX-MIN
output RANGE
```

Example answer (sorts the array Radio, and then the range is calculated, any sorting algorithm is acceptable)

Award [1 mark] for each of the following

Idea of nested loops;

One correct loop;

Correct comparison;

Correct exchange;

Compute the range;

Output the range;

```
loop for K=0 to 4
    loop for J=0 to 4
        if Radio[J]> Radio[J+1]
            then
                swap Radio[J]and Radio[J+1]
            endif
        endloop
    endloop
RANGE= Radio[5]- Radio[0]
output RANGE
```

[6 marks]

continued ...

Question 13 continued

(d) *Award up to [6 marks max].*

Possible solution below, marks to be awarded following the comments in code (there are 7 marks at least).

```
// Q is given and initially empty
I=0
loop while I<6                //across all rows
    ITEM=Stats[I,0]           //retrieve the button
    Q.enqueue(Radio(ITEM))    //enqueue the frequency
    I=I+1
endloop

if input(Flick) then          //if a flicking occurs
    TEMP=Q.dequeue()          //dequeue an element from Q
    output(TEMP)              //to output it and
    Q.enqueue(TEMP)           //circular use of the queue
endif
```

[6 marks]

Total: [15 marks]

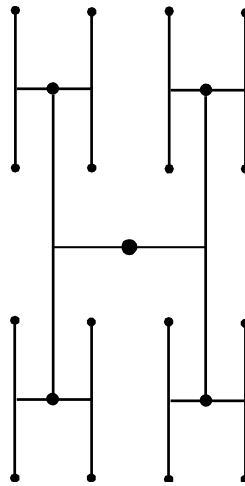
14. (a) *Award up to [3 marks max].*
Award [1 mark] for a loop (while).
Award [1 mark] for correct condition/logical expression.
Award [1 mark] for correct operations.

```
loop while NOT POINTS1.isEmpty()
  CENTRE = POINTS1.pop()
  drawH(CENTRE, SIZE)

end loop
```

[3 marks]

- (b) *Award [1 mark] for correct number and placement of H's;*
Award [1 mark] for reasonable attempt to show reduced size of successive H's;



[2 marks]

continued ...

Question 14 continued

- (c) *Award up to [6 marks max] as follows:*

[1 mark] for the idea that there needs to be a loop that executes once for each generation, **with an additional [1 mark]** if it is implemented correctly, for **[2 marks max]**.

[1 mark] for the idea that the endpoints returned while drawing one generation must be stored for use in drawing the subsequent generation, **with an additional [1 mark]** if correctly implemented, for **[2 marks max]**. **Note:** Any valid storage mechanism is permissible ie it does not have to be a stack.

[1 mark] for correctly drawing a generation of H's.

[1 mark] for correctly scaling the size for each generation.

Example answer:

```

////////////////////
SIZE = 20                                     //do not award marks
CENTRE = the middle of the user's display
POINTS1 is a stack, initially empty          //for this part of the
ENDPOINTS = drawH( CENTRE, SIZE )           // of the algorithm
loop COUNT from 0 to 3
    POINTS1.push( ENDPOINTS[COUNT] )       // it is given
end loop
SIZE = SIZE / 2                             // in the question paper
////////////////////////////////

POINTS2 is a stack, initially empty
loop GENERATION from 1 to 3
    loop while NOT POINTS1.isEmpty()
        CENTRE = POINTS1.pop()
        ENDPOINTS = drawH(CENTRE, SIZE)
        loop COUNT from 0 to 3
            POINTS2.push( ENDPOINTS[COUNT] )
        end loop
    end loop
    POINTS1 = POINTS2
    empty the POINTS2 stack
    SIZE = SIZE / 2
end loop

```

[6 marks]

- (d) *Accept any expression appearing in the following equivalences*

$$4*4*4*4 = 4^4 = 256;$$

[1 mark]

continued ...

Question 14 continued

- (e) Award up to **[3 marks max]** for:
 identifying that the recursive algorithm proceeds downwards (showing on one parameter will suffice);
 base case of recursion;
 recursive call;

The recursive algorithm would use the parameters centre, size, generation counting down (not up);

When the generation reached is 0 no drawing is done;

Otherwise draws an H and calls recursively itself on the endpoints of a lower generation;

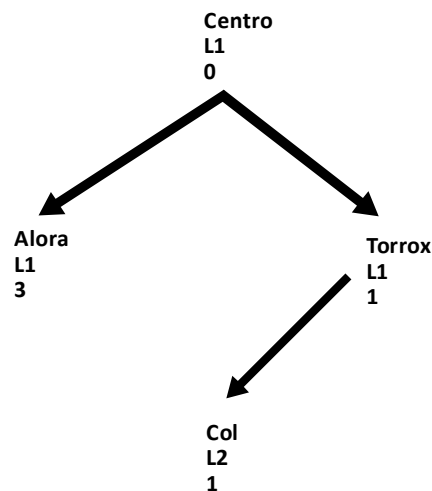
[3 marks]

Total: [15 marks]

15. (a) 8;

[1 mark]

- (b) Centro as root;
 Station names in correct position;
 All 3 items of data for each node;



[3 marks]

- (c) David;

[1 mark]

- (d) 5.00 (Euros);
 Accept 5.

[1 mark]

continued ...

Question 15 continued

(e) Award **[1 mark]** for each of the following 11 points, up to **[9 marks max]**.

- use of nested loops;
- use of nested loops with indices that avoid repeating calculations (as shown);
(**Note:** outer loop can be to 11 if repeat calculations are avoided, with an IF statement)
- correct values retrieved from tree;
- check for same line;
- check if one of the stations is “Centro”;
- check and change if negative/ use of absolute value;
- correct calculation for same line/one station is “Centro”;
- correct calculation for different line;
- assign value to array;
- assign mirror value;
- assign value to diagonal;

```

loop N from 0 to 10
  STATION1 = STATION[N]
  AZ = TREE.getZone[STATION1]
  AL = TREE.getLine[STATION1]
  loop M from N+1 to 11 //start index changed so as not to repeat
    //code
    STATION2 = STATION[M]
    BZ = TREE.getZone[STATION2]
    BL = TREE.getLine[STATION2]
    if AL = BL or STATION1 = "Centro" or STATION2 = "Centro"
      then //on same line or passing through "Centro"
        X = AZ - BZ //number of zones where the travel takes
        //place can be negative
        if X<0 then //allow use of absolute
          X = -X //or equivalent, e.g. X = abs(AZ-BZ)
        endif
        X = X+1
      else //on different lines
        X = AZ+BZ+1
      endif
      FARES[N][M]=X //assigns value to 2D array
      FARES[M][N]=X //assigns mirror value
    endloop
    FARES[N][N]=0 //leading diagonal
  endloop
  FARES[11][11]=0 //final entry

```

[9 marks]

Total: [15 marks]