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 ×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. *Award **[1 mark]** for an example and **[1 mark]** for reason of use/functionality, up to **[2 marks max]**.*
Support design/layout/development/rapid prototyping in engineering/manufacturing /biomechanics/architecture;
Save time/costs associated to drawing/development;

Photorealistic rendering/photo simulation in architecture/video games/visual effects/simulators;
eg shading, radiosity, reflection, refraction, illumination for modelling and simulation; ***[2 marks]***
Do not accept software CASE tools.

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. A unit of data for transmission;
With a format;
Accept answers that expresses the idea that the packet is the fundamental unit of data transmission on a network (IP is assumed).
Accept answers that suggest the student understands there is a format for the packet, including "contains address and data". ***[2 marks]***

10. *Award up to **[2 marks max]** for identifying causes of speed differences.*
Different parts of network use different media;
Network congestion;
Packets may take different routes;
The receiver may be busy;
Physical size of the network;

*Award the final **[1 mark]** for any explanation of a cause may affect the speed*
Fiber is faster than coax;
Some packets may be delayed by congestion;
There may be longer transmission times over large distances; ***[3 marks]***

11. *Award up to **[2 marks max]**.*
An object hides the details;
Yet preserves the functionality;
OR
Objects combine abstractions of data and code;
While hiding away implementation of details; ***[2 marks]***

SECTION B *Total: [45 marks]*

12. (a) *(Notation: * is **and**, + is **or**, – is **not**)*
*Award **[1 mark]** for each correct sub-expression in the "+" relation, up to **[3 marks max]**.*

W*H + W*-S + -W*-H

Alternative equivalent solution:
W*(H+-S) + -W*-H ***[3 marks]***

(b) *Award **[1 mark]** for each correct pair of rows up to **[4 marks max]**.*
Accept correct rows in any order.

W	H	S	T
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

[4 marks]

(c) Odd index gives S = 1; ***[1 mark]***

continued ...

Question 12 continued

(d) *Award **[1 mark]** for correct looping **and** output;*
*Award **[1 mark]** for testing condition `TIRED[INDEX]=1;`*
*Award **[1 mark]** for condition for H;*
*Award **[1 mark]** for condition for W;*

```
loop INDEX from 0 to 7
     if TIRED[INDEX] = 1 then
          if INDEX mod 2 = 1 then
               S=1
          else S=0
          end if
          if (INDEX div 2) mod 2 = 1 then
               H=1
          else H=0
          end if
          if INDEX div 4 = 1 then
                W=1
          else W=0
          end if                  //alternative: INDEX>3
          output W, H, S
     end if
end loop
```

Alternative:

```
loop INDEX from 0 to 7
     if TIRED[INDEX] = 1 then
          TEMP = INDEX //TEMP is a new local var
          S = TEMP mod 2
          TEMP = TEMP div 2
          H = TEMP mod 2
          TEMP = TEMP div 2
          W = TEMP mod 2
          output  W, H, S
     end if
end loop
```

[4 marks]

(e) *Award **[1 mark]** for looping through the collection;*
*Award **[1 mark]** for getting **both** name and `TIRED` array;*
*Award **[1 mark]** for using a variant of `TEST` that returns values for W **and** H (explanation expected);*

```
while not end of STUDENT collection
     get next NAME, get TIRED
     newTest(TIRED)    //it must be able to return values for W and H
     if W = 1 and H = 1
          output NAME
     end if
end while
```

Alternative:

```
loop while STUDENT.hasNext()
     TEMP = STUDENT.getNext()
     NAME = Temp.name
     newTest(Temp.tired) //it must be able to return values for W and H
     if W = 1 and H = 1
          output name
     end if
end while
```

continued ...

Question 12 continued

Accept answers not pseudocode, for example:
For each element in the collection `STUDENT`;
Retrieve **both** Names and Tired;
Use a variant of `TEST(TIRED)` and **returns** values for `W` **and** `H` to output the corresponding name when both are 1; ***[3 marks]***

Total: [15 marks]

13. (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]

14. (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 14 continued

(d) Upon selection, two new objects are created in the collection one with the name, the other with the frequency / Upon selection, a new object is created containing both name and frequency;
Where the name is obtained from the radio station; ***[2 marks]***

(e) *Award **[1 mark]** for reading input and storing it (in temporary variable);*
*Award **[1 mark]** for searching item in the collection that matches the content of temporary variable;*
*Award **[1 mark]** for outputting name and frequency;*
*Award **[1 mark]** for using the methods proper of the collection;*

```
//case of two objects
KEY= read(k)   // store selected button in a variable
COLLECTION.resetNext() // COLLECTION given pointer set at start
loop while COLLECTION.hasNext()
     ITEM =COLLECTION.getNext()
     if ITEM=RADIO[KEY] then
          output (ITEM.getFrequency())  // output frequency
          output(ITEM.getName())        // output name
     endif
endloop
```

Accept variants where a single object carrying both name and frequency is stored in the collection. ***[4 marks]***

Total: [15 marks]