# May 2014 SL P1

## Section A

1. Identify **two** features that need to be considered when planning a new computing system for an organization. [2]

> 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. Explain what is meant by *beta testing*. [2]

> 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);

3. Describe **one** advantage and **one** disadvantage of using observations to gather information when planning a new system. [4]

> *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.*
> *Advantages*
>
> *Quick/first hand/realistic information on data/software/hardware/users/procedures in the current system.*
> *Help better understand positive and negative features of the current system (for example problems in accessing or validating data/user errors/security issues, etc.).*
> *Can highlight aspects that are not detected in questionnaires/interviews so the observer can help produce more detailed reports.*
>
> *Disadvantages*
>
> *Time consuming / expense.*
> *The observer might need to observe a complete "cycle" which could last a significant amount of time.*
> *If the observations are made by only one person, they may be biased.*

4. Outline **one** usability issue associated with the design of mobile devices. [2]

> *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;

5. Distinguish between the use of **two** types of primary memory. [2]

> *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.)*

6. Outline, with an example, one benefit of using computer-aided design (CAD) applications. [2]

> *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;

7. Outline how a colour can be represented in a computer. [2]

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

8. Identify **two** key features of a peer-to-peer (P2P) network. [2]

> *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;

9. Define the term *data packet*. [2]

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".*

10. Explain why the speed of data transmission across a network can vary. [3]

*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;

11. Explain why an object is an example of abstraction. [2]

*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;

# Section B

12. Harry is Tired (T) depending on the following three variables:
    - *Work* (W)
    - *Hunger* (H)
    - *Sun* (S).

    Harry is tired if:
    - he works and he is hungry
    - he works and it is not sunny

    (a)  Represent, as a single logical expression, the conditions that cause Harry to be tired.                    [3]

    > *(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

    (b)  Construct the truth table to show when Harry is tired.                    [4]

    *Award [1 mark] for each correct pair of rows up to [4 marks max].*

    | 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 |

A professor notices that students are generally very tired and decides to investigate the relationship of tiredness with *Work*, *Hunger* and *Sun*.

Consider the following truth table which shows the conditions for *Tired* based on *Work*, *Hunger* and *Sun*.

| W | H | S | T |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

The conditions for one of the students to be tired can be expressed in the following array, *TIRED*, where the index is equivalent to the combination of *W*, *H* and *S* in the truth table.

TIRED

| [0] | [1] | [2] | [3] | [4] | [5] | [6] | [7] |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |

(c) Identify a relationship between the value of S and the index of the array TIRED. [1]

Odd index gives S = 1;

(d) Construct an algorithm, *TEST*, in pseudocode, to output the conditions *W*, *H* and *S* from the array *TIRED* for a student who is tired. [4]

```
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 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
```

A collection, *STUDENT*, is used to hold the name and the array *TIRED* for each student.

(e) Outline the way in which your algorithm could be used to output the names of all those students who are tired due to *Work* **and** *Hunger*. [3]

> *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
> ```
>
> *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;

13. An international organization has offices located across several countries. For some of its activities, for example human resource management, it has been decided to adopt a "Software-as-a-Service" (SaaS) solution in order to keep the running costs low.

(a) Describe the features of SaaS. [3]

> 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);

(b) Discuss the limitations of SaaS in relation to security. [6]

> *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;

Each office makes some data available to external customers through the use of an extranet and allows employees to work from home through a VPN.

(c)  Define the term extranet. [2]

An external extension to a company's local network;
Limited access;
Uses internet protocols;

(d)  Distinguish between a VPN and an extranet. [4]

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;

14. The faceplate of a car stereo has six buttons for selecting one of six preferred radio stations. As part of the internal representation of a microprocessor there is an array with six positions, carrying the information about the radio frequencies, as follows.

Radio

| [0] | [1] | [2] | [3] | [4] | [5] |
|---|---|---|---|---|---|
| 100.4 | 88.7 | 90.2 | 104.5 | 93.8 | 106.2 |

(a)  State the information at *Radio[2]*. [1]

90.2;

(b)  Outline how a numerical frequency could be stored in a fixed-length string. [2]

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.*

(c) Construct an algorithm in pseudocode that calculates the range of frequencies (*ie* the difference between the highest and lowest frequencies) of any set of six selected radio stations.  [6]

*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;
Correct loops;
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
```

*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
```

A display in the faceplate shows the name and frequency of the selected radio station. The name is automatically captured when storing a preference.

(d) Outline how a collection of objects could be used to store the name and frequency data in the radio.  [2]

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;

(e) Construct an algorithm, in pseudocode, to access and display the name and frequency of a station when a button is pressed. [4]

*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.*