May 2015 SL P1

Section A

1. Construct a truth table for the following Boolean expression.

(A or B) and (not C or B) [4]

*Award **[1 mark]** for each correct pair of rows.*

A	B	C	(A or B) and (not C or B)
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

2. Outline one example of the use of a virtual private network (VPN). [3]

*Award **[1 mark]** for a relevant example and **[2 marks]** for an elaboration.*
Example 1:
A business can let employees work at home / employees who travel a lot/external (non-employee) users;
Accessing the data and services (at the office);
Via secure login;
Example 2:
Using VPN, address is masked;
The location of the user is not known;
May be essential in delicate situations such as political protest groups working from their own country;
***Note:** Accept any legitimate reason for needing to be unknown.*

3. Outline how a sub-procedure can be considered an example of abstraction. [2]

*Award **[1 mark]** for details of a sub-procedure and **[1 mark]** for how it is used.*
For example:
A sub-procedure is a section of code in a program that does a specific job;
It can be called by name when needed without naming the details as these are wrapped in the procedure;

4. Trace the following algorithmic fragment for *N = 6*. Show all working in a trace table.

```
SUM = 0
loop COUNT from 1 to (N div 2)
     if N mod COUNT = 0 then
          SUM = SUM + COUNT
     end if
end loop
if SUM = N then
     output "perfect"
else
     output "not perfect"
end if
```

*Award **[4 marks]** as follows.*
*Award **[1 mark]** for going 3 times through the loop (with COUNT from 1 to 3).*
*Award **[1 mark]** for incrementing correctly SUM (when N mod COUNT = 0).*
*Award **[1 mark]** for the correct output ("perfect").*
*Award **[1 mark]** for showing all working in a trace table with at least three columns (eg COUNT, SUM, OUTPUT).*
*Award **the first** 3 marks for an evident trace but working not shown in a trace table.*

Example answer 1:

COUNT	N mod COUNT=0	SUM	SUM=N	output
1	TRUE	1		
2	TRUE	3		
3	TRUE	6		
			TRUE	perfect

Example answer 2:

COUNT	N mod COUNT	SUM	output
		0	
1	0	1	
2	0	3	
3	0	6	perfect

5. Outline **two** usability features in relation to the characteristics of a new laptop. [4]

*Award **[1 mark]** for each usability feature and **[1 mark]** for an elaboration clearly related to the needs of the user, taking into account that not all users have the same physical/technical capabilities, up to **[4 marks max]**.*

For example:

Larger screen;
Easier to view large amounts of data without excessive scrolling or squinting / reduced eyestrain / more accessible to those with weak eyesight;

Hotkeys to control brightness, sound volume, navigation, etc;
Quick access to frequently used adjustments that aid in viewing, listening, etc without first navigating to a software-based control panel;

Size and sensitivity of touchpad;
Those with mobility or coordination issues, or simply with large hands, may need a larger and/or less sensitive pad to control the cursor;

Standard accessibility for visually impaired;
Larger text option or text to speech;

6. Describe **one** way that software developers can ensure that the users are aware of any available updates for their products. [2]

*Award up to **[2 marks max]**.*
*Award **[1 mark]** for communication with user – email/ pop up etc.*
*Award **[1 mark]** for method of installation of update – automatic/ link/ in list for user to install etc.*

When the software is installed and registered (a cookie is placed on the machine);
This communicates with the software developer automatically on start up;
Messages about updates are sent back to the machine and alerts are given;

OR

Send an email;
With a link to the update;

7. Six students are planning their group 4 project, which is due in two days. They have to produce a scientific report and give an animated computer presentation based on their analysis of water samples. These water samples are to be taken from four local lakes.

   (a) Based on this information, identify **four** tasks that should be done by the students, listing the tasks in the order that they could be completed. [2]

*Award **[1 mark]** for the correct list and **[1 mark]** for the correct order. The last two can be in any order. Accept similar descriptions of individual tasks.*
Collect samples
Analyse samples
Write report
Prepare presentation

(b) Outline how **two** of the tasks identified in part (a) could be completed concurrently. [2]

*Award **[1 mark]** for the correct tasks and **[1 mark]** for outlining how they can be done concurrently.*

"Write report" and "prepare presentation" can be done at the same time as they can be performed by different students (using the same data).

(c) Draw a Gantt chart to show the tasks from part (a), indicating the concurrency outlined in part (b). You do not need to include the timings for the tasks. [2]

*Award **[1 mark]** for a correctly labelled chart illustrating the order of tasks from part (a) and **[1 mark]** for showing the concurrency from part (b).*
For example:

Task	Phase 1	Phase 2	Phase 3
Collect samples	———		
Analyse samples		———	
Write report			———
Prepare presentation			———

8. An insurance company holds a large database of information about its customers, including the date of their next payment.

Once a month the database is searched to compile the following lists:

- **list 1**: customers whose next payment date will be **within** the next 30 days
- **list 2**: customers whose payment date has passed by **more than** 14 days but **less than**, or **equal to**, 30 days
- **list 3**: customers whose payment date has passed by **more than** 30 days.

Customers who are in list 3 are flagged for deletion.

(a) Construct an algorithm to illustrate the monthly process described above. [6]

*Award marks as follows, **up to [6 marks max]**.*
*Award **[1 mark]** for looping through the database and accessing all records.*
*Award **[1 mark]** for correct calculation of date difference (eg = today – paymentDate OR paymentDate – today).*
*Award **[1 mark]** for each list correctly compiled, **x3** (correct conditional statements according to date difference used).*
***Note:** Accept date difference not calculated/stated but assumed as today – paymentDate OR paymentDate – today.*
*Award **[1 mark]** for successive if/else but wrong conditions.*
*Award **[1 mark]** for flagging correct records for deletion (do not accept deleting the records).*

Example:

```
set CURRDATE to current date (as a day number)
set LIST1, LIST2 and LIST3 to empty
loop through all CUSTREC in DATABASE
     DUEPERIOD = CURRDATE - CUSTREC.PAYMENTDATE
     if DUEPERIOD > 30 then
          add CUSTREC to LIST3
          flag CUSTREC to delete
     else if DUEPERIOD > 14 then
          add CUSTREC to LIST2
     else if  DUEPERIOD < - 30 then
          add CUSTREC to LIST1
     end if
end loop
```

[6]

After the lists have been compiled, the following messages are sent out to customers.

- A reminder is sent to customers in list 1.
- A warning that payments are more than 14 days overdue is sent to customers in list 2.
- cancellation of contract is sent to customers in list 3.

(b) Explain how the lists could be used to merge the data from the database with a word processor to create these messages automatically for sending either by post or by email. [4]

*Award up to **[4 marks max]**.*
(Using a mail merge facility);
Template for each type of reminder created in the word processor;
Lists created with customer ID;
Linked to customer details in database;
Appropriate details merged/inserted into template;
Email lists created and sent / letters printed and sent;

(c) Outline the consequences of data loss to customers and to the company. [2]

*Award **[1 mark]** for a consequence of data loss to customers and **[1 mark]** for a consequence of data loss to the insurance company.*

Example answer:
Customers would not be reminded when they needed to pay and some may overlook payment, hence not be insured;
The company could lose customers/ruin reputation;

(d) Describe **one** method that the company could use to prevent data loss. [3]

*Award marks as follows up to **[3 marks max]**.*
*Award **[1 mark]** for a suitable measure and **[2 marks]** for a description related to the insurance company.*

Example answers:
Mirror system;
All changes to the records made on two systems;
If one fails then the other holds all current data;

Off site backup;
Snapshots/backups made on a regular basis;
In the case of failure a dated/time stamped copy exists and the state up until then can be used to restore customer records;

9. Six lawyers and one secretary work together in the same building and are connected via a LAN to a central server. Each has their own workstation.

(a) Outline the concept of the Open Systems Interconnection (OSI) model in communication across a network. [3]

*Award up to **[3 marks max]**.*
The OSI is a standardized system/model for network connection;
Consists of (7) layers;
Each dealing with specific parts of network communication;
For example the physical layer which defines the physical connection;

***Note:** Award **[1 mark]** for the purpose of any of the 7 layers.*
*If candidate lists all 7 layers with no specific example award **[2 marks]** and a further **[1 mark]** if the purpose of at least one layer is given.*

(b) Outline, with an example, the function of protocols. [3]

*Award up to **[3 marks max]**.*
Protocols are a set of rules;
To facilitate a process being carried out correctly;
(Used in each layer to ensure communication;)
For example (in the physical layer) the protocols could define the methods for opening and closing communication;
***Note:** Do not accept examples which are not related to networks.*

The LAN has one server, which is connected to the internet. The workstations are connected to the server by cable. There is also a wireless connection..

(c) Outline **one** advantage and **one** disadvantage of allowing wireless access to the server. [4]

*Award **[2 marks]** for an advantage with an elaboration and **[2 marks]** for a disadvantage with an elaboration, up to **[4 marks max]**.*
For example:
An advantage is that lawyers can access quickly with mobile devices;
Anywhere in the building and do not need to be at the workstation;

Users can logon with their own devices (if properly configured);
More familiar with interface/functions;

One disadvantage is security as it could be possible to get to the server from a nearby neighbourhood if not very secure;
Less secure than the cabled system in the building;

Wireless signal could be weak in some parts of the building;
Leading to frustrated/ineffective employees;

Print jobs are sent to a shared printer from all workstations and added to the print queue in the order in which they are sent. A priority is given to each job based on the number of pages requested.

- The highest priority (1) is given to jobs with 1–3 pages.
- The lowest priority (4) is given to jobs with more than 50 pages.

The jobs sent to the printer are held in a collection of objects. Each object includes the priority that has been given and the time it was sent to be printed.

If any job has been waiting more than 10 minutes it is moved to the front of the queue and is the next to be printed.

(d) Outline the steps needed to search the collection and return the next job to be printed. [5]

*Award marks as follows up to **[5 marks max]**.*
*Award **[1 mark]** for looping through the collection.*
*Award **[1 mark]** for returning a job first if time>10 min.*
*Award **[1 mark]** for searching the loop again for each priority level.*
*Award **[1 mark]** for searching from 1 – 4 in order.*
*Award **[1 mark]** for ending when the highest priority level job is found.*

Note: *Accept algorithms, bullet points and text answers which are clear and in correct logical order.*

For example:

```
loop through all the jobs
  If job.time > 10 min return job
  else set priority = 1
    while priority< 5
      loop through all jobs
        if job.priority = priority return job
      endloop
      increment priority
    end while
  endif
endloop
```

[5]

10. (a) Identify **two** differences and **two** similarities between a bubble sort and a selection sort when sorting an array of 10 elements. [4]

*Award **[2 marks max]** for the similarities and **[2 marks max]** for the differences.*
Both use nested loops;
Each time reducing the inner loop;

Bubble sort swaps adjacent items each time it goes through the list;
Selection sort finds the next smallest each time it goes through the list;
Bubble sort can exit early if already sorted;

A cycling tour lasts for 15 days. The total time for each competitor is recorded in a one-dimensional array, *TIMES[].* After each day's race, the array entry for each competitor is increased by their time for that day.

There are 150 competitors and the 10 fastest times are transferred to the array *FASTEST[]* and displayed on a screen each day.

(b) Explain why a selection sort would be more efficient than a bubble sort in this case. [2]

*Award **[1 mark]** for reference to the size of the list and **[1 mark]** for stating why the selection sort is faster.*
It is possible that selection sort will only need 10 passes of the outer loop to find 10 fastest times;
But bubble sort will need to complete the procedure for the entire list every time;

OR

List is long;
Swapping takes longer than selecting;

(c) Construct an algorithm to transfer the 10 fastest times from the array *TIMES[]* to the array *FASTEST[].* Assume that the array *TIMES[]* is not sorted. [6]

*Award marks as follows up to **[6 marks max]**.*
*Award **[1 mark]** for setting all variables at start.*
*Award **[1 mark]** for correct double looping through `TIMES`.*
*Award **[1 mark]** for correct selection of `MIN`.*
*Award **[1 mark]** for transfer to `FASTEST`.*
*Award **[1 mark]** for successful swapping selected value.*
*Award **[1 mark]** for resetting `MIN` to value transferred.*
*Award **[1 mark]** for incrementing array index in `FASTEST`.*
*Award **[1 mark]** for transfer of exactly 10 elements.*

For example:

```
MIN = 0
TRANSFER = 0
loop while TRANSFER < 10
     MIN = 250000 //larger than first 10 fastest
     COUNT = TRANSFER
     loop while COUNT < 150
          if TIMES [COUNT] < MIN
               MIN = TIMES[COUNT]
               K = COUNT
          end if
          COUNT = COUNT + 1
     end loop
     FASTEST[TRANSFER] = TIMES[K]
     TEMP = TIMES[TRANSFER]
     TIMES[TRANSFER] = TIMES[K]
     TIMES[K] = TEMP
     K = K + 1
     TRANSFER = TRANSFER + 1
end loop
```

***Note:** Accept any reasonable value set as `MIN` – including `TIMES[0]` provided that this is not replaced by `MIN` after the first loop.*

Alternatively the array can be sorted and then transferred in which case award marks as follows:
*Award **[1 mark]** for creating the array `FASTEST`.*
*Award **[1 mark]** for correct double looping through `TIMES`.*
*Award **[1 mark]** for comparing adjacent values.*
*Award **[1 mark]** for correct swap if second value is lower.*
*Award **[1 mark]** for looping through `FASTEST`.*

The race organizers need to display the names of the 10 fastest competitors, as well as their times, on the screen. There is another array, *NAMES[],* which contains the names of all competitors in the same order as their times in *TIMES[]* (for example, *NAMES[5]* and *TIMES[5]* are the name and time of the same competitor).

(d) Compare the use of two arrays, to hold the competitor's times and names, with the use of objects. [3]

The problem with parallel arrays is the sorting/indexing/maintaining relationship;
An object would contain at least a name and a time (accept other descriptions of object);

Would only need to sort the array of objects / only one list to be sorted;