

Section A

1. Human interaction with the computer system includes a range of usability problems.

(a) Define the term *usability*.

[1]

Usability means making the computer systems easy to use, matching them more closely to user needs and requirements;

(b) Identify **two** methods that could be used to improve the accessibility of a computer system.

[2]

Award up to [2 max].

Voice recognition;

Text to speech;

Use of touch screen;

Braille keyboard; **[2]**

Etc.

2. By making direct reference to the technologies used, explain how a virtual private network (VPN) allows a travelling salesperson to connect securely to their company's network.

[4]

up to [4 max].

Tunnelling protocols;

Allows the data to be encapsulated/hidden whilst travelling across the internet;

Encryption protocols (IPSEC);

If hacked it will not be understandable;

The use of gateways;

Allows the salesperson to connect with the company's server;

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

$(A \text{ and } B) \text{ nor } C$

[3]

*Award [3] for completely correct table.
Award [2] if only 6 or 7 rows are correct.
Award [1] if only 4 or 5 rows are correct.
Award [0] otherwise, or if table does not contain 8 rows.*

A	B	C	(A AND B) NOR C
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

4. A small hotel buys a software package to manage their bookings.

- (a) Describe **two** types of documentation that should be provided with the software package.

[4]

Award [1] for each type and [1] for description, for two types, up to [4 max].

Technical documentation;
Describes how to install software;
Describes the hardware configuration needed;

User documentation;
Describes various functions of the software;
Helps users to learn how to use the software;

- (b) State **two** methods of delivering user training.

[2]

Award up to [2 max].

Formal classes;
Self-instruction;
Online training;

5. A school uses a local area network (LAN) which connects several computers and a printer to a server and allows access to the internet.

(a) Define the term *server*.

[1]

A computer system that serves as a central repository of data and programs and is shared by clients;

(b) Identify the different clients in this network.

[1]

Computer / Printer;

(c) (i) Identify **one** external threat to the security of the school's computer system.

[1]

Award [1 max].

Viruses;

Spyware;

Hackers who attempt to crack the system;

Note: Do not accept theft/vandalism/natural disasters

(ii) State one way to protect the computer system from the threat identified in part (c)(i).

[1]

Award [1 max].

Virus checker can be used to prevent viruses;

Spyware program run to check for spyware;

Firewall can be used to protect from hackers;

Note: Do not accept secure storage/guards/alarms to prevent theft in the building

6. A sub-program *all_even()* accepts a positive integer N and outputs *true* if all digits of N are even, otherwise it outputs *false*. For example, *all_even(246)* outputs *true* and *all_even(256)* outputs *false*.

The following algorithm is constructed for the sub-program *all_even(N)*.

```
EVEN = true
loop while (N > 0) and (EVEN = true)
    if (N mod 10) mod 2 = 1 then
        EVEN = false
    end if
end loop
output EVEN
```

(a) Explain why this algorithm does not obtain the correct result.

[2]

Award up to [2 max].

The value of N is never changed;

So the logical expression in the while loop always evaluates to true;

And loop repeats an infinite number of times;

(b) Outline what should be changed in the algorithm to obtain the correct result.

[3]

Statement $N = N \text{ div } 10$;
Should be written within the while loop;
After the if statement;

Section B

7. A hardware shop supplies a wide variety of bathroom equipment. There are 15 shop assistants who serve customers, 3 office staff who handle the administration, and a manager.

A specialized company is asked to design and implement a new computer system for the shop..

- (a) (i) Identify two different types of users of the system.

[2]

Award up to [2 max].

Customers;

Employees – shop assistants;

Employees – office staff;

Manager / Owner; [2]

Award [1] for “Employees”, if type of employee is not specified.

- (ii) Explain the role of users in the process of developing the new computer system.

[3]

Award up to [3 max].

Role of users is important because inadequate user involvement leads to project failure;

All users must participate and explain how they use the system;

All users must participate and explain what they think is wrong with the system;

Users (managers, owners) are involved in approval of projects and budgets;

All users are involved in testing of the system;

All users are involved in training;

Etc.

- (b) Describe why it is useful to produce more than one prototype of the new system.

[2]

More than one prototype allows the manager to choose the one that is the most suitable;
Which gives more flexibility and improves final system;

- (c) Outline **two** problems that may occur when transferring data from the old system to the new system.

[4]

Award [2] for a correct answer, [1] for an answer with some credit, for two problems.

Example answers:

The data records in databases could have different structures (fields);

The data files could be incompatible, from different hardware systems;

The key fields of different data types can exist;

The customer records could have same keys (IDS) so they cannot be uniquely identified;

The new system is implemented using parallel running.

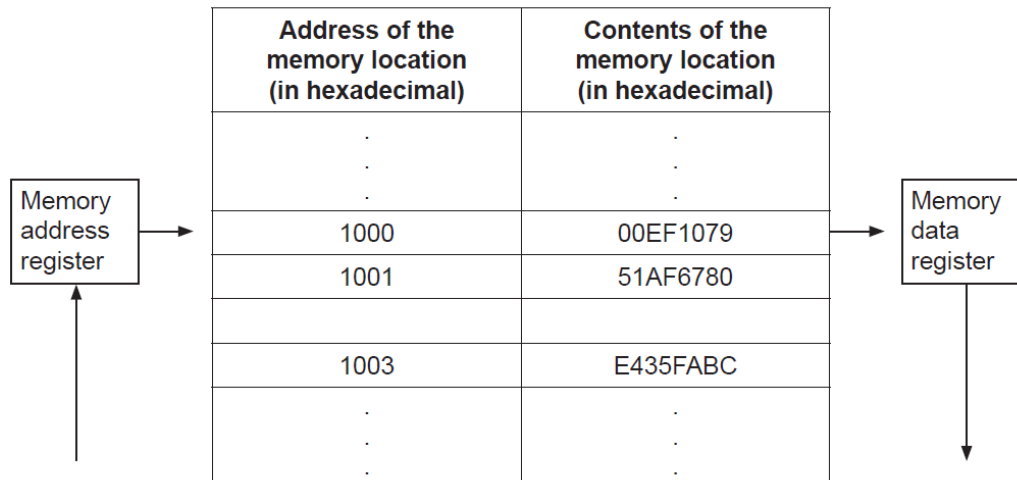
(d) (i) Outline what is meant by parallel running. [2]

Simultaneous operation;
Of the new and old system;

(ii) Outline one reason for choosing parallel running as opposed to a direct changeover. [2]

Award up to [2 max].
As the old system is still running;
The new system could be evaluated/used;
Without any consequences if the new system fails;

8. The following diagram shows the structure of the random access memory (RAM).



(a) Calculate the number of bits in each memory location. [1]

32

(b) Calculate the number of bytes in each address. [1]

2

(c) Outline the function of the:

(i) memory address register [2]

Award up to [2 max].
MAR is a register in the CPU;
Loaded with the address of the next instruction/data;
To be taken from the RAM;

(ii) memory data register.

[2]

Award up to [2 max].

MDR is a register in the CPU;
Holding the data which is most recently;
Taken from RAM

(d) (i) Identify two functions of the operating system.

[2]

Award up to [2 max].

Resource allocation;
Memory management;
Interrupt handling; [2]
Etc.

(ii) State where the operating system is held when the computer is turned off.

[1]

Award up to [1 max].

Hard disk;
ROM;
Solid state disk (SSD)

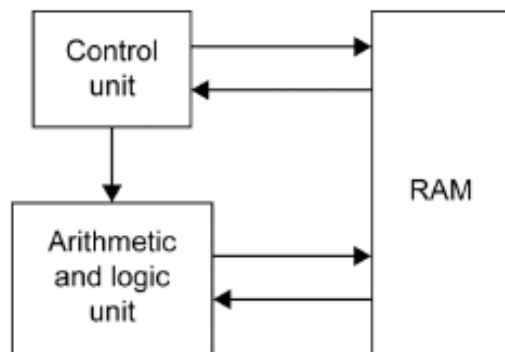
The machine instruction cycle refers to the retrieval of an instruction from the RAM, and subsequently decoding, executing and storing the result.

(e) (i) Construct a diagram to illustrate the structure of a central processing unit (CPU), clearly showing the flow of data within the CPU.

[4]

*Award up to [4 max] for any acceptable diagram.
Award [1] for each unit x3, [1] for showing the flow of data.*

Example answer:



(ii) Identify the part of the CPU which performs decoding.

[1]

Control Unit

(iii) Identify the part of the CPU which executes the instruction.

[1]

Arithmetic and Logic Unit (ALU)

9. A candy company manufactures 20 different kinds of candy, each identified by a product ID. An array, *Product_ID*, is used to store the product IDs, and another array, *Unit_Price*, is used to store the price per unit of each type of candy. The unit price of the product identified by *Product_ID[N]* is equal to *Unit_Price[N]* for any index *N*.

Product_ID		Unit_Price
Mints-1A	[0]	15.20
Choco-1B	[1]	18.10
Jelly-1Q	[2]	16.30
	...	
Choco-2A	[19]	11.90

(a) State the price of the candy identified by *Product_ID[2]*.

[1]

16.30;

(b) Explain the steps that would be needed in an algorithm to calculate the average unit price.

[3]

Set a variable (sum) to zero;
Loop through the array *Unit_Price*;
Add each array element to variable sum;
Divide sum by 20;

- (c) Construct the algorithm that will output the price of a candy after its product ID is entered by the user. The algorithm should output an appropriate message if the product ID entered does not appear in the array *Product_ID*.

[6]

Award marks as follows up to [6].
Award [1] for the input.
Award [1] for introducing the Boolean variable.
Award [2] for the correct loop, [1] for a minor error.
Award [1] for the correct comparison in if statement.
Award [1] for correct assignment.
Award [1] for the output of the price after the loop.
Award [1] for 'does not appear' message.

Example answer:

```
NUM = ENTERED ID
K = 0
FOUND = false
loop while K<20 and NOT FOUND
  if NUM = Product_ID[K] then
    FOUND = true
    PRICE = Unit_Price[K]
  end if
  K=K+1
end loop
if FOUND then
  output "The price is ", PRICE
else
  output NUM, " does not appear on the list of product numbers"
end if
```

The company maintains two warehouses each of which stocks a selection of the 20 types of candy indicated above.

The first warehouse stocks 15 items and their IDs are stored in an array, *One*. The second warehouse stocks 10 items and their IDs are stored in an array, *Two*.

All product IDs common to both warehouses will be placed in an array, *Three*.

- (d) (i) State the maximum number of common product IDs which can be placed in *Three*.

[1]

- (ii) Construct the algorithm that will place all product IDs common to both warehouses in *Three*.

[4]

Award marks as follows up to [4].

Award [1] for variable(Z) that keeps track of current position in array Three.

Award [1] for the correct outer loop.

Award [1] for the correct inner loop.

Award [1] for the condition.

Award [1] for the correct assignment.

Example answer:

```
Z = 0
loop K from 0 to 14
  loop J from 0 to 9
    if One[K] = Two[J] then
      Three[Z] = One[K]
      Z=Z+1
    end if
  end loop
end loop
```