![L-Università ta' Malta logo]

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2021 MAIN SESSION**

SUBJECT:          **Computing**
PAPER NUMBER:     I
DATE:             21st June 2021
TIME:             9:00 a.m. to 11:05 a.m.

## Directions to Candidates

Write your index number where indicated at the top of the page.
Answer **ALL** questions in the spaces provided. You are not allowed to use extra sheets other than those provided in this booklet.
Good English and orderly presentation are important.
The use of flowchart templates is permitted. The use of calculators is **not** permitted.
This paper carries 85 marks of the examination.

| Question Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | **FOR MARKERS' USE** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| For Markers' use only | Total number of Marks or Grade obtained by candidate | | | | | | | | | | | |
| **MARKS** | | | | | | | | | | | | |

1. Identify and describe the purpose of **TWO** input devices and **ONE** output device used in a supermarket Point of Sale (POS) system.

Input device 1:_____

Purpose: _____

_____

Input device 2:_____
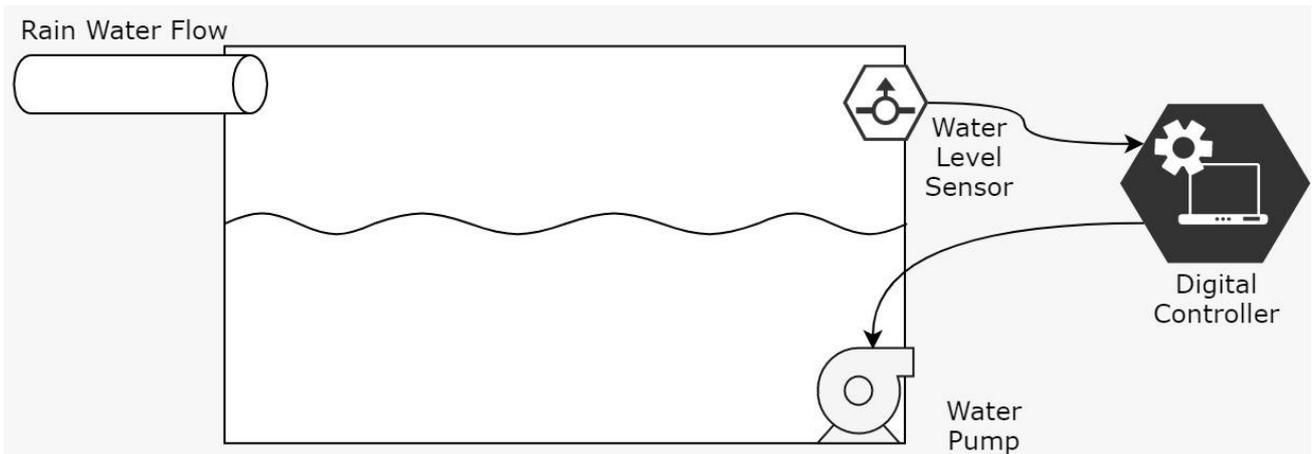
Purpose: _____

_____

Output device:_____

Purpose: _____

_____

**(Total: 6 marks)**

2. Local councils are investing in modern systems to store rain water. A water pump system is being installed to transfer extra rain water from one reservoir to another instead of wasting it.

When a water level sensor detects that the main reservoir is full with rain water, a pump is switched on to push the excess rain water to a secondary water reservoir. The sensor and pump are both connected to a digital controller.

Analyse the diagram below and answer the questions that follow.



a. Is this a general-purpose or a dedicated system? Explain.

_____

_____(2)

b. Mention **ONE** input component and **ONE** output device that make part of this system in the diagram.

_____

_____(2)

c. Information is said to be processed data. Provide a suitable example of data and information according to the scenario above.

_____

_____(2)

d. The water pump controller is a small digital system.

   i.  Mention **ONE** difference between analogue data and digital data.

_____

_____(1)

   ii. Mention **ONE** advantage and **ONE** disadvantage of digital data over analogue data.

_____

_____(2)

   iii. Describe where Analogue-to-Digital conversion is carried out in the scenario above.

_____(1)

**(Total: 10 marks)**

*Please turn the page.*

3. Five storage devices are described in the table below. Name the storage device being described and tick whether it is a primary or a secondary storage device.

| Description of Storage Device | Name of Storage Device | Primary Storage Device | Secondary Storage Device |
|---|---|---|---|
| An electronic storage device which is portable and connects through a USB port. | | ☐ | ☐ |
| A non-volatile storage device that contains the bootstrap loader. | | ☐ | ☐ |
| A read-only disc used to permanently store data files. It is widely used to distribute large software or full-length movies. | | ☐ | ☐ |
| A volatile device that holds working data and machine instructions. | | ☐ | ☐ |
| A serial access device, well-suited for archiving because of its high capacity, low cost and long durability. | | ☐ | ☐ |

**(Total: 10 marks)**

4. Choco Coffee is a local coffee shop that is introducing a promotional scheme that gives clients one point for every euro they spend. Clients can then redeem ten points against one euro from their bill.

Clients' details are stored in a database as shown below:

| CLIENT Table | | | | |
|---|---|---|---|---|
| **id** | **name** | **surname** | **contact_num** | **coffee_points** |
| 0987694L | Alexia | Brincat | 79125487 | 34 |
| 3216579M | Randolph | Axiaq | 99876532 | 19 |
| 0045504L | Matthew | Cilia | 99159753 | 8 |

a. Define the term database.

_____

_____(1)

b. Give **ONE** example of a Database Management System (DBMS).

_____(1)

c. Identify the primary key used in table CLIENT.

_____(1)

d. What data type should be assigned for the primary key mentioned in part c?

_____(1)

e. Explain why the data type for the field contact_num is set as Text rather than Number.

_____(1)

f. The owners of the coffee shop upgraded the system and introduced a smartphone app. The clients can use this app to log into their account and check their accumulated points.

   i. Mention **TWO** fields that the table CLIENT should include to allow the clients to log into their account via the smartphone app successfully.

_____(2)

   ii. Briefly describe **ONE** validation method for each field that you mentioned in part f (i).

_____

_____(2)

g. How is the Data Protection Act (DPA), which is now termed GDPR, related with this scenario?

_____(1)

**(Total: 10 marks)**

5. The COVID-19 pandemic has had significant social and economic impact across the globe. Businesses have been investing and upgrading their eCommerce systems to better reach their clients. Typically, eCommerce systems allow the users to shop online through a website or a smartphone app.

a. Mention **ONE** advantage and **ONE** disadvantage of eCommerce.

_____

_____

_____(2)

*This question continues on next page.*

b. How is EFT related to eCommerce?

_____

_____ (1)

c. The entire development of an eCommerce website or a smartphone app requires the expertise of different individuals. Identify **TWO** IT-related roles and briefly describe their job in the development of such systems.

_____

_____

_____(4)

d. Besides the business, commercial and economic areas, the use of computers reached also various other areas of society. For **each** of the following different areas, suggest a useful application:

- Education

_____(1)

- Industry / Manufacturing

_____(1)

- Travel

_____(1)

**(Total: 10 marks)**

6. Mention a suitable software for the following tasks. For **each** mentioned software, tick whether it is a system software or an application software.

| Task | Suitable Software | System Software | Application Software |
|---|---|---|---|
| a. Browse the Internet: | | ☐ | ☐ |
| b. Check for any possible viruses in the system: | | ☐ | ☐ |
| c. Check the device hardware and loads the Operating System (OS) into RAM: | | ☐ | ☐ |
| d. Develop an event flyer: | | ☐ | ☐ |
| e. Reduce the size of several files before sending via email: | | ☐ | ☐ |

**(Total: 5 marks)**

7. Serial and Direct are two methods of data access.

a. Tick whether the following situations require serial or direct access: (2)

| Situation | Serial Access | Direct Access |
|---|---|---|
| i.  Scanning a product barcode at a supermarket: | ☐ | ☐ |
| ii. Print a list of all gym members: | ☐ | ☐ |
| iii. Log into a food delivery app using a personal account: | ☐ | ☐ |
| iv. Issue the water and electricity bills of all residents: | ☐ | ☐ |

b. Which storage device can access data in serial mode only?

_____(1)

c. Identify and briefly describe **ONE** utility software that accesses data in serial mode.

_____(2)

**(Total: 5 marks)**

8. The owners of BePro Supermarket have lately noticed lack of sales in their shop when compared to previous years.  They decided to go for online shopping.  The owners contact an I.T. company who sends a Systems Analyst to discuss what they would like to do.

a. Why is it advisable to do an in-depth analysis of the existing system before developing a new system?

_____

_____(1)

b. List **THREE** methods the systems analyst could use to collect information about the existing system in the supermarket.

_____

_____

_____(3)

c. From the collected information, the System Analyst identifies the strengths and weaknesses of the old system. In which stage of Systems Analysis does this occur?

_____ (1)

*This question continues on next page.*

d. At a later stage, the Systems Analyst must decide on a suitable changeover method. Name and explain **ONE** changeover method ideal for the BePro Supermarket.

_____

_____(2)

**(Total: 7 marks)**

9. A computer uses 8-bit registers for storing data and instructions. Two unsigned binary string patterns A = 10110110 and B= 10001111 are input in the following logic circuit. The circuit is made up of two NOT gates and one OR gate.
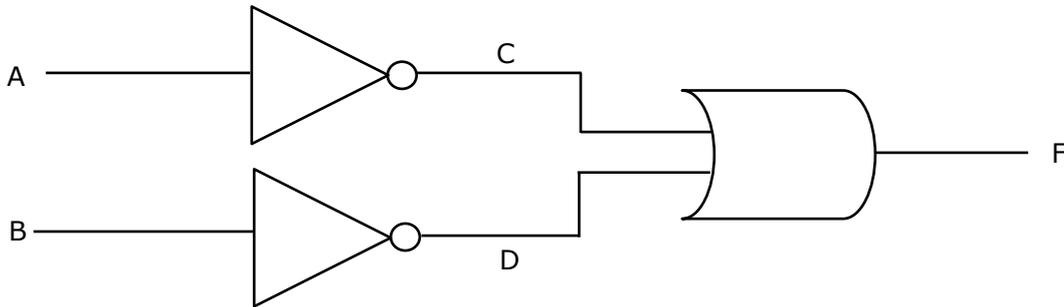


a. What is the value in decimal of binary string A?

_____ (1)

b. What is the value in decimal of the largest number that can be stored in this system?

_____ (1)

c. What is the value in hexadecimal of binary string B?

_____ (1)

d. Determine C, D and output F as 8-bit binary strings.

C - _____ (1)

D - _____ (1)

F - _____ (1)

e. Complete the truth table for the above circuit.

| A | B | F |
|---|---|---|
|   |   |   |
|   |   |   |
|   |   |   |
|   |   |   |

(3)

**(Total: 9 marks)**

10. Nikita is asked to write a JAVA program that asks the user to enter an integer number for a number of times until the user enters the value zero (0). The program then displays the sum of the integer numbers entered (excluding zero) and their average. She was also shown how the input and output should look, as indicated below.

A sample screenshot is shown below:

```
Input an integer number
4
Input an integer number
6
Input an integer number
0
```

The output part of the program when run:
```
Total_Sum = 10
Average = 5
```

a. Nikita has to declare the variables she is to use inside her program. Make a list of the variables that she might use. The declaration should include the name of the variable and its data type.

| Variable Name | Data Type |
|---|---|
|   |   |
|   |   |
|   |   |

(3)

b. Identify the **TWO** variables declared in part (a) that need to be initialised.

_____(1)

*This question continues on next page.*

c. Nikita is required to repeat the input for a number of times until the user enters the value zero (0).

   i.  Which loop is suitable for this part of the code? Explain.

_____

_____ (2)

   ii. Mention and explain another loop which is **not** suitable for this scenario.

_____ (1)

**(Total: 7 marks)**

11. A vending machine is an automated machine that provides items (such as snacks and beverages) to consumers, after they insert enough coins to pay for the chosen item. The vending machine accepts up to 10 coins only which are stored in an array called 'coins'. After each transaction, the array is reset so that all values are 0.

a. The diagram below shows the content inside the array `coins` after the user inserts 50c, 20c, 20c, 10c, 5c and 5c to purchase a packet of potato crisps that costs €1.10.

Array `coins`

| 50 | 20 | 20 | 10 | 5 | 5 | 0 | 0 | 0 | 0 |
|----|----|----|----|---|---|---|---|---|---|

What is the value in:
   i.  `coins[4]`-_____ (½)

   ii. `coins[9]`-_____ (½)

b. The code to reset the contents of the array `coins` after each sale is shown below.

```
Line 1              i = 1;
Line 2              do{
Line 3                  coins[i] = 0;
Line 4                  i = i + 1;
Line 5              }
Line 6              while (i == 10);
```

   i.  The code above contains a logical error. State what is a logical error.

_____ (1)

ii. Re-write the above code so that it works correctly.

_____

_____

_____

_____ (3)

iii. Name and explain another type of error a program may contain.

_____

_____

_____ (1)

**(Total: 6 marks)**

# Blank Page

L-Università ta' Malta

| | |
|---|---|
| SUBJECT: | **Computing** |
| PAPER NUMBER: | IIA |
| DATE: | 23rd June 2021 |
| TIME: | 9:00 a.m. to 11:05 a.m. |

## Directions to Candidates

Write your index number where indicated at the top of the page.

Answer **ALL** questions in the spaces provided. You are not allowed to use extra sheets other than those provided in this booklet.

Good English and orderly presentation are important.

The use of flowchart templates is permitted. The use of calculators is **not** permitted.

This paper carries 85 marks of the examination.

| Question Number | 1 | 2 | 3 | 4 | 5 | **FOR MARKERS' USE** |
|---|---|---|---|---|---|---|
| For Markers' use only | Total number of Marks or Grade obtained by candidate | | | | | |
| **MARKS** | | | | | | |

1. A medical company owns a chain of four hospitals around Malta and Gozo. Each hospital has several digital devices connected together via a LAN. Besides, all four hospitals are also connected together.

a. Mention **TWO** advantages of having a LAN within each hospital.

_____

_____(2)

b. What type of network is required to connect the four hospitals together?

_____(1)

c. Give **TWO** advantages of connecting the four hospitals together.

_____

_____(2)

d. A network performance is affected by its bandwidth. What is bandwidth and how is it related to transferring of data?

_____

_____

_____(2)

e. Data transmitted over the hospital network is encrypted. Give **ONE** example of data that should be encrypted and state **ONE** reason why data encryption is necessary in this case.

_____

_____(2)

f. Mention another software security measure that the hospital could use on the network to protect sensitive information from being spread.

_____(1)

g. Physical safeguards to protect data are also important. Describe **TWO** physical safeguards that the hospital could use.

_____

_____(2)

h. Data integrity is also important on such a network. What is data integrity and why is it important to maintain?

_____

_____(2)

i. The grandfather-father-son backup system is used. Briefly explain how this type of backup system works.

_____

_____(1)

**(Total: 15 marks)**

2. An Internet Protocol (IP) Camera is a camera that connects to an Internet connection and streams live video footage online that can be safely viewed from a remote location, such as a smartphone. From their smartphone, users can also access the camera's internal settings such as screen resolution, network connection, etc.

   IP Cameras are powered by a System on Chip (SoC) technology which incorporates the CPU, RAM, ROM, storage, network card and other components into one chip. The CW5631 SoC chip includes the below specifications:

   - 32-bit, 400 Mhz, 16-bit Cache CPU;
   - 128 KB RAM;
   - 512 KB ROM which is also the internal storage;
   - expansion slot for external flash memory (64 GB Maximum);
   - 10/100 Ethernet Network Card.

a. What is the speed of the CPU in GHz?

_____(1)

b. Should the IP Camera have 2 GB RAM instead of 128 KB? Explain.

_____

_____(2)

c. Is the function of the ROM in the IP Camera different than that in a personal computer? Explain.

_____

_____(2)

*This question continues on next page.*

DO NOT WRITE ABOVE THIS LINE

d. Explain why live HD video footage **cannot** be stored in the camera's internal storage and suggest an external storage medium.

_____

_____(2)

e. Can the above IP Camera connect to an Internet connection through WIFi (Wireless Network Communication)? Explain.

_____

_____(2)

f. The System Bus is what connects the CPU with RAM and other components.

   i.  How is the control bus different from the address bus?

_____

_____(1)

   ii. What is the word length of this IP Camera?

_____(1)

   iii. Which CPU register from the below list uses the address bus during the fetch and execute cycle? Explain.

| Instruction Register | Accumulator | Program Counter | Arithmetic & logic Unit |
|---|---|---|---|

_____

_____(2)

g. Why is the camera's Operating System (OS) programmed in Assembly language rather than a programming language such as JAVA?

_____(1)

h. Analyse the below Assembly instruction and answer the questions that follow:

   LDA #14;  _load value 14 into accumulator_.

   i.  Mention an opcode and an operand.

   Opcode: _____ (½)

   Operand: _____ (½)

ii. Is the ALU involved during the execution of this instruction? Explain.

_____

_____(2)

iii. Is it correct to state that the operand uses immediate addressing? Explain.

_____

_____(2)

**(Total: 19 marks)**

3. The OS is considered the most important piece of software on any computer system.

a. Explain the memory management function of an OS and how it is related to the running of application programs.

_____

_____(2)

b. List and briefly describe **TWO** other OS functions.

_____

_____

_____(3)

c. Mention **ONE** characteristic of a 'time-sharing' OS and mention **ONE** application in which this type of OS is suitable.

_____

_____(2)

d. Identify where the OS of a laptop is stored and briefly explain how it runs when the laptop is switched on.

_____

_____(2)

e. MS Windows 10 OS is usually installed on PCs and laptops. Which type of OS is MS Windows 10? Explain.

_____

_____(2)

*This question continues on next page.*

f. For **each** of the following processes, indicate which type of operating system is required and give a reason for your answer:

i. A central server connecting a number of ATMs.

Type of Operating System: _____

Reason:_____

_____(2)

ii. A nuclear powerstation that monitors nuclear waste leakage which is a dangerous substance.

Type of Operating System: _____

Reason:_____

_____(2)

**(Total: 15 marks)**

4. In a school council election, three candidates are contesting the election to be elected as president. A voting system has been introduced in which:
   - it allows all voters to enter a number between 1 and 3;
   - according to the number, the votes of the respective candidates are updated;
   - when the voting process is finished, the person in charge of the system enters '-1' to end the voting process;
   - once finished the system shows the result.

a. An array called `candidates_scores` is used to store the number of votes that each candidate accumulated during the voting process. How would you declare this array in JAVA?

_____(2)

b. Draw a flowchart that represents the algorithm of this voting system.
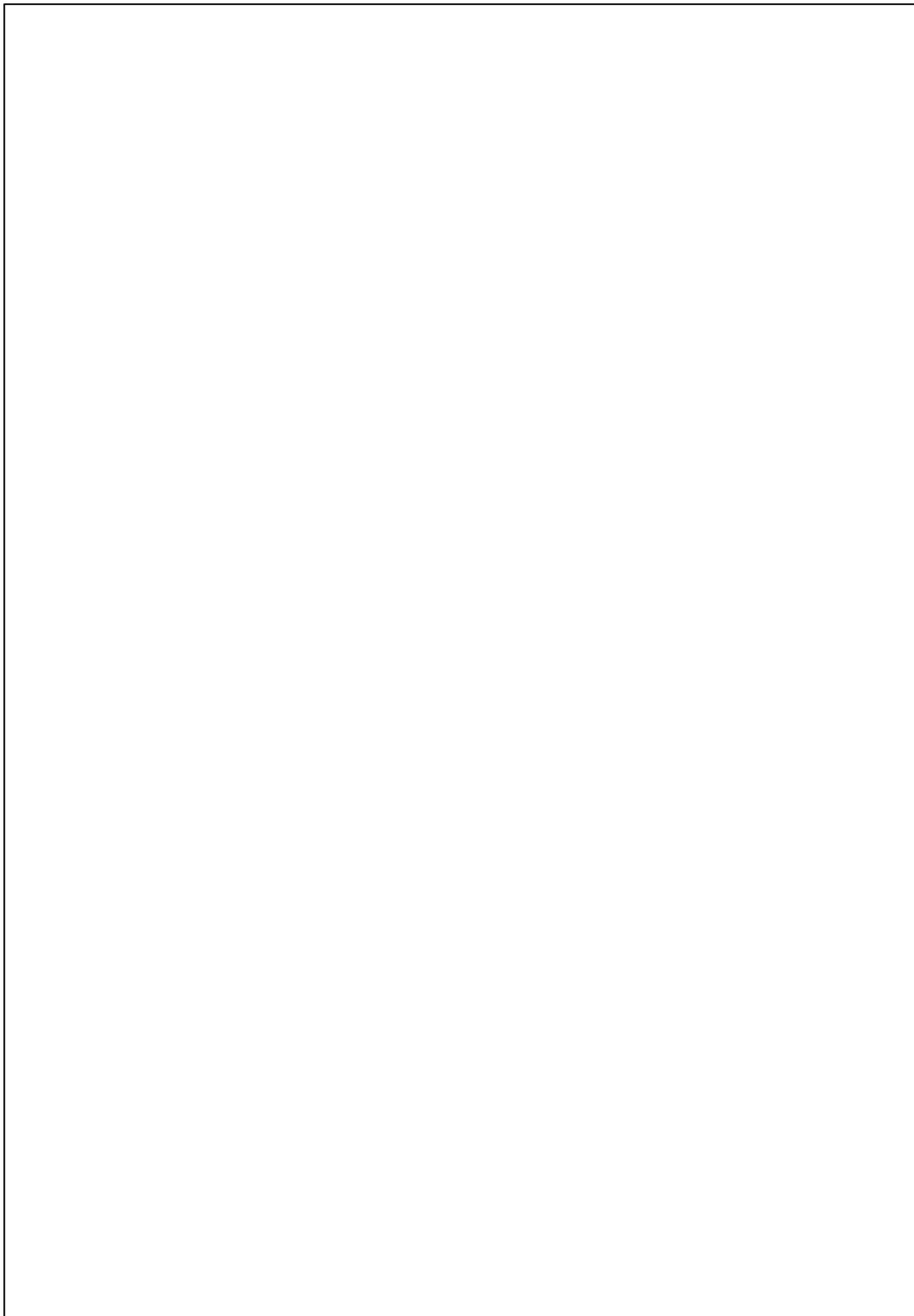
(8)

*This question continues on next page.*

c. The JAVA program snippet is intended to determine the winning candidate. Fill in the missing lines of code:

```
//determine the winning candidate

int winner_index = 0;

int max = 0;

for (int i = _____;i<_____;i++){

if(_____)

  max = _____;

  winner_index = ____;

}                                                        (5)
```

d. Write down a line of code that displays on screen the winning candidate, together with the respective number of votes.

_____(2)

**(Total: 17 marks)**

5. Lansdale Semiconductor Ltd, a chipset manufacturing company, produces the 8274E/F component which is a 10-bit shift register.

a. Find the range of values in decimal that this register can hold as:

   i.  unsigned numbers;

_____(1)

   ii. two's complement numbers.

_____(1)

b. Two unsigned binary patterns, 1011111001 and 1000001111 are placed in registers A and B respectively.

   i.  What bit-wise operation is required from the shift register to work out A multiplied by 2?

_____(1)

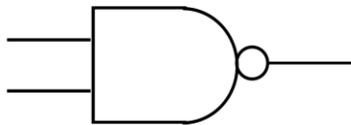   ii. What is the error of the result in part (i) called? Explain.

_____

_____(2)

iii. Find C in binary, when C = A/2 + B.

(2)

c. As all other circuitry, shift registers are made up of logic gates. The three basic logic gates are the NOT, AND and OR gates.

A NAND gate is another logic gate, which can take two or more inputs. The symbol for the NAND gate is as follows:



i. The logic of the NAND gate is that it produces an output of '0' if all inputs are '1', otherwise the output is '1'. Design a truth table for a NAND Gate with 2 inputs.

(2)

*This question continues on next page.*

ii. NAND gates are said to be functionally complete gates. This means that the AND, OR and NOT logic gates can be implemented using NAND gates only, as shown in the logic circuits below:
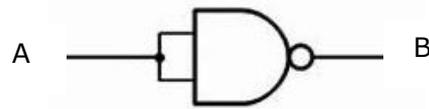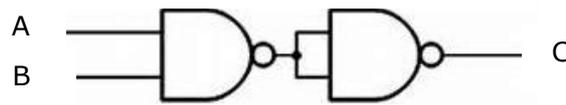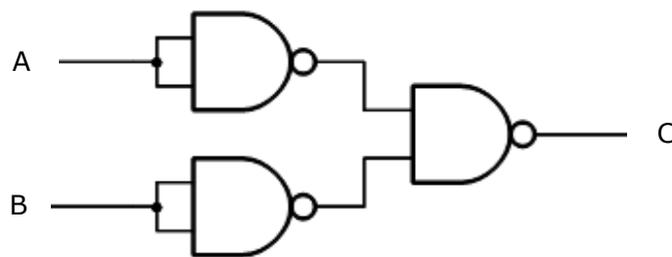


Figure 1: NOT gate



Figure 2



Figure 3

The function of the logic circuit in Figure 1 is that of a NOT gate (B = NOT A). By using truth tables, determine the function of the logic circuits in Figure 2 and Figure 3. (Hint: In cases where there is one input for a two-input gate, the same input should be used twice.)

Figure 2:

Truth Table

Function: _____                                                    (2)
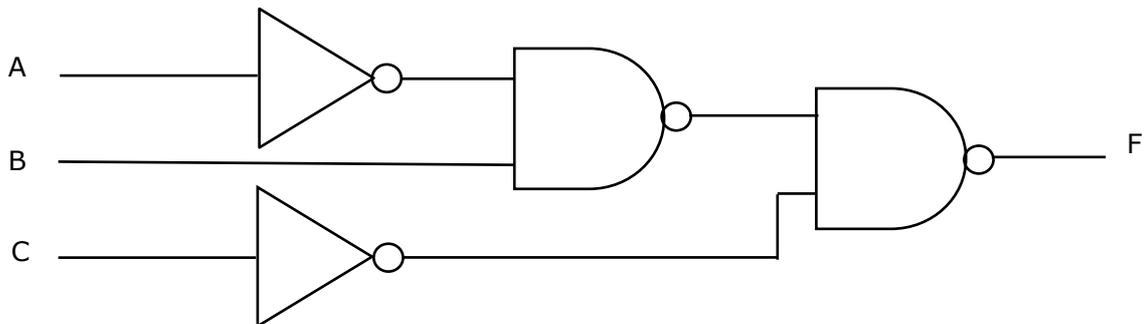
Figure 3:

> Truth Table

Function: _____ (2)

d. The following logic circuit uses **TWO** NAND gates and **TWO** NOT gates.



i. Draw a truth table to represent the above scenario.

(4)

ii. Hence extract the Boolean expression of F in terms of A, B and C.

_____ (2)

**(Total: 19 marks)**

# Blank Page

L-Università ta' Malta

| | |
|---|---|
| SUBJECT: | **Computing** |
| PAPER NUMBER: | IIB |
| DATE: | 23rd June 2021 |
| TIME: | 9:00 a.m. to 11:05 a.m. |

## Directions to Candidates

Write your index number where indicated at the top of the page.

Answer **ALL** questions in the spaces provided. You are not allowed to use extra sheets other than those provided in this booklet.

Good English and orderly presentation are important.

The use of flowchart templates is permitted. The use of calculators is **not** permitted.

This paper carries 85 marks of the examination.

| Question Number | 1 | 2 | 3 | 4 | 5 | **FOR MARKERS' USE** |
|---|---|---|---|---|---|---|
| For Markers' use only **MARKS** | Total number of Marks or Grade obtained by candidate | | | | | |
| | | | | | | |

1. A medical company owns a chain of four hospitals around Malta and Gozo. Each hospital has several digital devices connected together via a LAN. Besides, all four hospitals are also connected together.

a. What is a LAN?

_____

_____(2)

b. Mention **TWO** advantages of having a LAN within each hospital.

_____

_____(2)

c. What type of network is required to connect the four hospitals together?

_____ (1)

d. Give **TWO** advantages of connecting all four hospitals together.

_____

_____(2)

e. It was decided that each hospital is equipped with a wireless LAN (WLAN) and so different devices can connect to the hospital network without the use of ethernet cables. Give **TWO** reasons why wireless connectivity was the preferred option.

_____

_____(2)

f. Certain data which is transferred from one hospital to another require it to be encrypted. Give **ONE** example of data that require encryption and briefly explain why encryption is necessary.

_____

_____ (2)

g. Mention another software security measure that the hospital could use on the network to protect sensitive information from being spread.

_____ (1)

h. Physical safeguards to protect data are also important. Mention **TWO** physical safeguards that the hospital could use.

_____

_____(2)

i. Data integrity is also important on such a network. What is data integrity and why is it important to maintain?

_____

_____(2)

**(Total: 16 marks)**

2. An Internet Protocol (IP) Camera is a camera that connects to an Internet connection and streams live video footage online that can be safely viewed from a remote location, such as a smartphone. From their smartphone, users can also access the camera's internal settings such as screen resolution, network connection, etc.
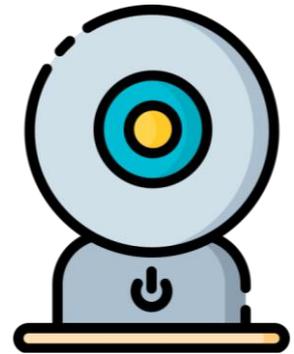
   IP Cameras are powered by a System on Chip (SoC) technology which incorporates the CPU, RAM, ROM, storage, network card and other components into one chip. The CW5631 SoC chip includes the below specifications:

   - 32-bit, 400 MHz CPU;
   - 128 KB RAM;
   - 512 KB ROM which acts also as an internal storage;
   - expansion slot for external flash memory.

a. What is the speed of this CPU?

_____ (1)

b. Mention and briefly describe the function of the **TWO** main units of a CPU.

_____

_____

_____(4)

c. List the steps of the CPU Fetch and Execute cycle.

_____

_____

_____(3)

*This question continues on next page.*

d. The System Bus is what connects the CPU with RAM and other components.

   i. Tick whether the below statements are true or false.

| Statement | True | False |
|---|---|---|
| The Control Bus determines whether the CPU requires a read or a write operation from the RAM. | ☐ | ☐ |
| The address bus is used by the CPU to determine the exact memory location from where to fetch the instruction required. | ☐ | ☐ |
| The Control Bus is used to store the result of an arithmetic operation in the accumulator. | ☐ | ☐ |
| The size of the address bus is called the address space. | ☐ | ☐ |
| The Data Bus is used by the CPU to transfer data or instructions to and from the RAM. | ☐ | ☐ |
| The address space determines the maximum amount of RAM that a device can hold. | ☐ | ☐ |

(6)

   ii. Explain briefly how the Program Counter uses the Address Bus.

_____

_____(1)

   iii. Explain briefly how the Instruction Register uses the Data Bus.

_____

_____(1)

   iv. The wordlength of this IP Camera is 32 bits. Briefly describe the term wordlength.

_____

_____(1)

e. Explain briefly why this IP Camera is equipped with a 128 KB RAM only.

_____

_____(1)

f. One minute of HD video footage takes 18 MB of storage and therefore cannot be stored in the camera's internal storage. Suggest an external storage medium where the camera can store the video footage.

_____(1)

**(Total: 19 marks)**

3. a. The table below gives a number of input/output devices, their description and their application. Match each device to its correct description and application by writing the roman number (e.g. i, ii, etc.) of the device corresponding to the description and application.

| | Device | | Description | | Application |
|---|---|---|---|---|---|
| i. | Microphone | | Copies paper documents and converts them into text and pictures into a computer readable form. | | Bank cheques validation |
| ii. | Scanner | | Device that allows audio signals to be converted into electrical signals which are understood by the computer. | | Technical Drawing |
| iii. | MICR | | A vector printing device. | | Speech Recognition |
| iv. | Graphics Tablet | | Digitises magnetic ink. | | Large-scale printing |
| v. | Plotter | | An input device that enables a user to hand-draw images, animations and graphics. | | Digitising old photos |

(5)

b. The Operating System (OS) is considered the most important piece of software on any computer system.

   i. Explain the importance of the memory management function of an Operating System.

_____

_____(2)

   ii. Mention and explain another OS function.

_____

_____(2)

c. Besides the operating system, there is a number of application software which can be installed on a computer system.  Software has a copyright; however, it is sometimes pirated.

   i. Distinguish between software piracy and copyright.

_____

_____(2)

*This question continues on next page.*

ii. Briefly explain **TWO** techniques used by software houses to minimise the risk of piracy.

_____

_____(2)

iii. Considering that piracy is illegal, mention **TWO** factors why it is still carried out.

_____

_____(2)

iv. What is the purpose of the Data Protection Act?

_____

_____(1)

**(Total: 16 marks)**

4. Vinny designs a program to calculate how much it costs to get her cat groomed. The design is shown below.

```
Line 1          int total = 0;
Line 2          int allCost[] = {30,32,35,40,44}; //price paid per visit
Line 3          for  (int i = 0; i < 5; i++)
                {
Line 4              total = total + allCost[i];
                }
Line 5          System.out.println("The total cost =" +total);
```

a. Which data structure is used in the program snippet above?

_____ (1)

b. In which line number is the data structure mentioned in part (a) declared?

_____ (1)

c. Which data type is used for this data structure?

_____ (1)

d. In line 1 the variable `total` is initialised to 0. Why?

_____ (1)

e. Vinny's program works and a correct total of 181 was displayed on screen.  Briefly explain **each** line of code.
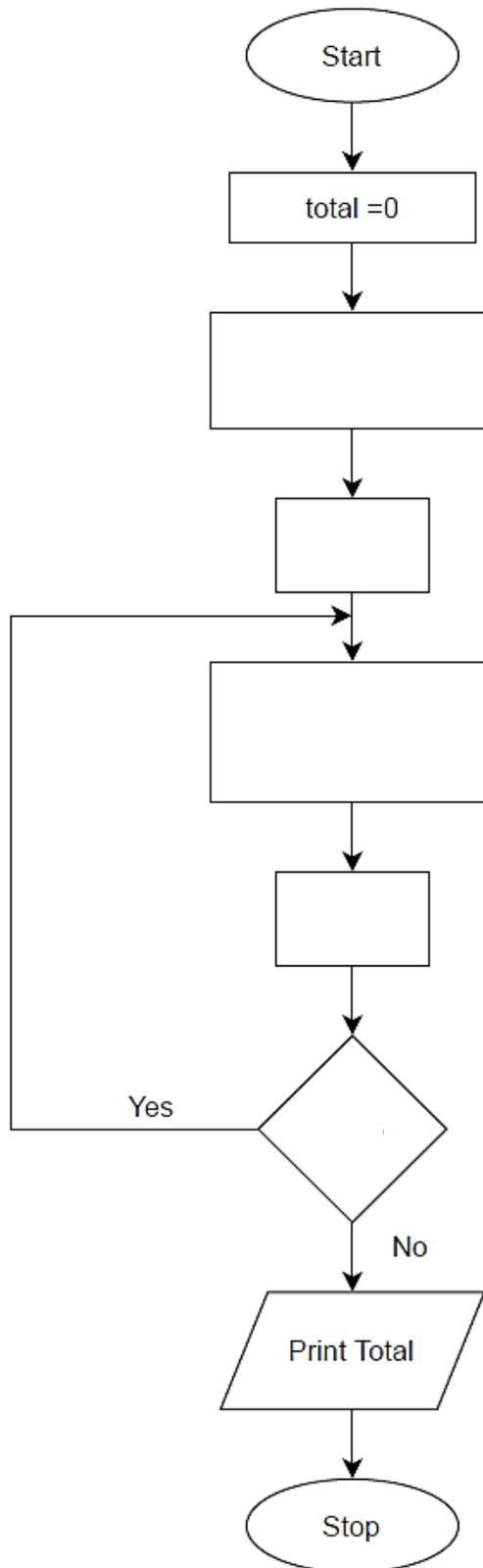
Line 1: _____

Line 2: _____

Line 3: _____

Line 4: _____

Line 5: _____  (5)

*This question continues on next page.*

f. Fill in the following flowchart with the keywords below to represent the above program.

| is i<5? | initialise allCost array | total = total +allCost[i] | i++ | i=0 |
|---------|--------------------------|---------------------------|-----|-----|

```
              ( Start )
                 |
                 v
           +-----------+
           | total =0  |
           +-----------+
                 |
                 v
           +-----------+
           |           |
           +-----------+
                 |
                 v
           +-----------+
           |           |
           +-----------+
                 |
    +----------->v
    |      +-----------+
    |      |           |
    |      +-----------+
    |            |
    |            v
    |      +-----------+
    |      |           |
    |      +-----------+
    |            |
    |            v
    |          /    \
 Yes|         <      >
    +---------<       >
              \      /
                 |
                 | No
                 v
            / Print Total /
                 |
                 v
             ( Stop )
```

(5)

g. Another value was added in the array `allCost`, as shown below. However, the output after running the program remained that of 181.

```
Line 2          int allCost[] = {30,32,35,40,44,45};
```

i. Explain why the output is still showing a total cost of 181.

_____

_____ (1)

ii. Identify the line of code that contains the error.

_____ (1)

iii. Provide a solution to fix this error.

_____ (1)

**(Total: 17 marks)**

5. a. A CPU uses an 8-bit register.

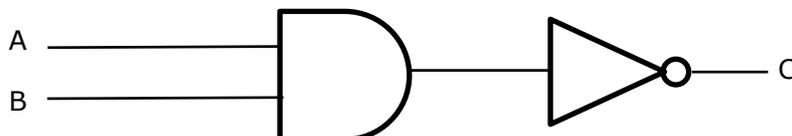i. Define the term bit.

_____ (1)

ii. What is a group of 8 bits called?

_____ (1)

b. A logic circuit is a circuit made of logic gates. What is a logic gate?

_____ (1)

c. The logic diagram below shows a system made up of two connected logic gates.



i. Give the names of the **TWO** gates in the diagram above.

_____ (2)

*This question continues on next page.*

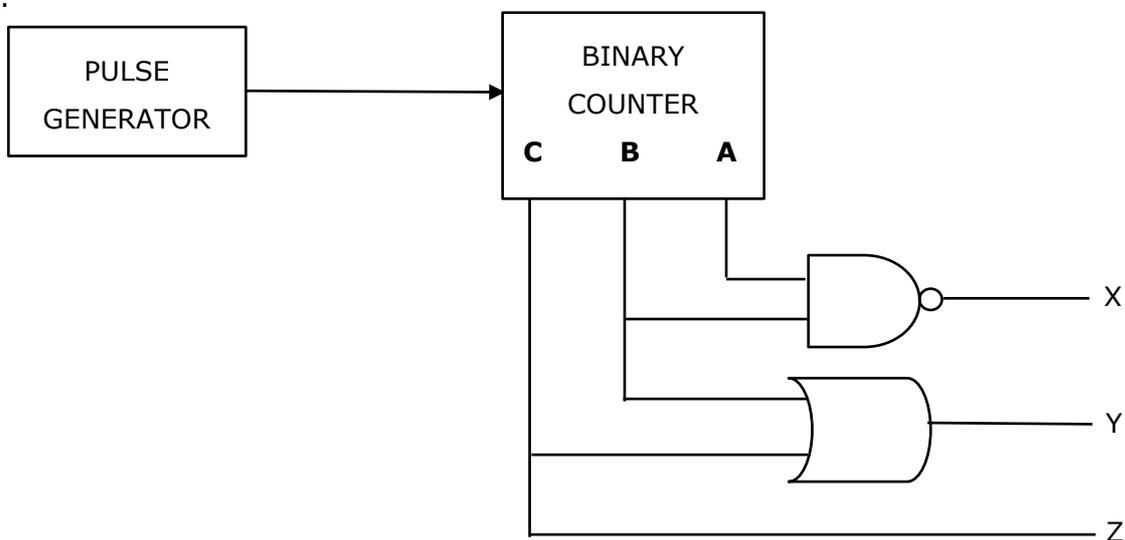ii. Complete the truth table to show the output of the above system.

| A | B | C |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

(2)

iii. The above system is also referred to as the NAND gate.  The symbol for the NAND gate is as follows.



The following circuit diagram shows part of a lighting control that uses a NAND gate and an OR gate.



Complete the truth table below.

| Pulse Generator | Counter Outputs | | | X | Y | Z |
|---|---|---|---|---|---|---|
| | C | B | A | | | |
| 0 | 0 | 0 | 0 | | | |
| 1 | 0 | 0 | 1 | | | |
| 2 | 0 | 1 | 0 | | | |
| 3 | 0 | 1 | 1 | | | |
| 4 | 1 | 0 | 0 | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |

(10)

**(Total: 17 marks)**

# Blank Page

# Blank Page