



L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2020 MAIN SESSION**

SUBJECT: **Computing**
 PAPER NUMBER: I
 DATE: 24th September 2020
 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	12	13	14	15	FOR MARKERS' USE
For Markers' use only	Total number of Marks or Grade obtained by candidate															
MARKS																

1. Young people prefer smartwatches rather than the normal watches since they offer portability, ease of use, more health features to their wrist and have features such as those of a smartphone.



<https://bit.ly/2S20d8j>

a. Name the input/output component that provides interface to the smartwatch.

_____ (1)

b. Tick (✓) the appropriate answer. The input/ output component is a:

vector device;

raster device.

Give **ONE** reason for your answer.

_____ (2)

One can download applications to be used on smartwatches. However, one should be careful about the software licence these applications carry.

c. What is software licence?

_____ (1)

d. Distinguish between freeware and shareware licences.

_____ (2)

(Total: 6 marks)

2. State whether each of the following statements is true or false.

a. Barcodes are capable of holding a considerable amount of data.	
b. Laser printers produce better quality prints than inkjets.	
c. MICR is often used on cash register receipts.	
d. An OMR is most often used to read multiple choice tests.	

(Total: 2 marks)

3. The following are a few responsibilities of several careers/roles in an IT department. Name the job which corresponds to the responsibilities mentioned below.

<p>a. Job: _____</p> <p>Responsibilities:</p> <ul style="list-style-type: none"> • Inspect and rewrite programs; • Compile and write documentation of program development; • Test programs to ensure successful operation. 	<p>b. Job: _____</p> <p>Responsibilities:</p> <ul style="list-style-type: none"> • Plan, prepare, and research lessons; • Organise and promote courses in I.T.; • Develop and deliver programs of learning activities.
<p>c. Job: _____</p> <p>Responsibilities:</p> <ul style="list-style-type: none"> • Provide technical support to users and maintenance to various systems, hardware and software applications; • Install, maintain and repair computer equipment and peripherals; • Diagnose and solve computer hardware, software, network access issues. 	<p>d. Job: _____</p> <p>Responsibilities:</p> <ul style="list-style-type: none"> • Perform periodic analysis of computer hardware and software using available technology and testing tools; • Stay up-to-date with the latest technologies and incorporate new technology into existing units; • Plan and manage the production of computer hardware equipment.

(Total: 4 marks)

4. A company uses a spreadsheet program to keep track of its monthly expenses.

a. List **TWO** advantages of using a spreadsheet program rather than a word processing program to record such data.

_____ (2)

b. Give **ONE** other example of where a spreadsheet application may be used.

_____ (1)

c. Mention **TWO** advantages of having a spreadsheet program as part of an integrated package rather than as a standalone application.

_____ (2)

(Total: 5 marks)
Please turn the page.

5a. List **THREE** backing storage devices and their typical use in the following table. The first one has been done for you.

Backing Storage	Typical Use – Suitability
(i) CD-ROM	Stores a music album
(ii)	
(iii)	
(iv)	

(6)

b. Can a high definition (HD) movie be stored in a CD-ROM? Give **ONE** reason for your answer?

(2)

(Total: 8 marks)

6. Most computer systems have a main memory that consists of both volatile memory and non-volatile memory.

a. Explain what is volatile memory.

(1)

b. What is normally stored in the non-volatile part of a computer’s main memory?

(1)

c. Explain why having cache memory can improve the performance of the Central Processing Unit (CPU).

(1)

- d. State **TWO** characteristics, other than the size of cache memory, that can improve the performance of CPUs.

(2)

(Total: 5 marks)

7. A real estate agency has a relational database with three tables. One table stores details of properties, the other table stores details of clients and the third table stores the sales. The table below displays all the fields required for this database.

Transaction ID
Property Code
Property Type
ID Number
Location
Name and Surname
Number of Bedrooms
Email address
Number of Bathrooms
Garage Included
Contact Number
Price in €

- a. Categorise the fields in the appropriate tables.

Properties Table	Clients Table	Sales Table

(7)

This question continues on next page.

b. The list below shows a number of datatypes used in databases. From the list above, mention one field you would set as:

i. Text - _____

ii. Number - _____

iii. AutoNumber - _____

iv. Yes/No - _____ (4)

c. Describe a query a user can perform on this database.

_____ (1)

d. The following two validation rules may be applied to fields in a database. Mention a field from this database on which such validation is appropriate. In your answer, give an explanation on how the validation could be applied.

i. Range Check

_____ (2)

ii. Type Check

_____ (2)

(Total: 16 marks)

8. An airline company needs its own tailor-made software to manage its operations.

a. What is tailor-made software?

_____ (1)

b. Application software is usually bought off-the-shelf. Mention **TWO** advantages of buying software off-the-shelf.

_____ (2)

c. Give **ONE** reason why a company chooses a tailor-made software package rather than off-the-shelf.

(1)

(Total: 4 marks)

9. Claire had an accident which limited her mobility. Her boss has agreed that she works from home, sends work via email and reports back weekly through a video-conference.

a. At home, Claire already has a desktop computer. Mention **THREE** other hardware items needed to do the video-conference.

(3)

b. Since Claire will be using Internet frequently, her boss has suggested that she installs a good antivirus software. Why is this necessary?

(1)

(Total: 4 marks)

Please turn the page.

10a. Explain how the operating system:

- manages the printing;

(1)

- manages the processor;

(1)

- manages RAM.

(1)

b. Mention and briefly explain another operating system function.

(2)

(Total: 5 marks)

11. A computer program that calculates the sum of two numbers can be written in a high-level language and can also be written in a low-level language.

- a. Give **TWO** reasons why computer programs are most commonly written in high-level languages instead of low level languages.

(2)

- b. Explain why programmers might still use low-level language.

(1)

- c. Give **ONE** reason why it is better for a programmer to use assembly language instead of machine code.

(1)

(Total: 4 marks)

12a. The NOR gate, as shown in Figure 1, is made up of an OR and a NOT gate, as shown in Figure 2. Draw the truth table for the NOR gate.

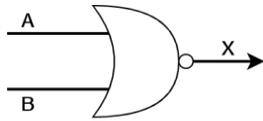


FIGURE 1

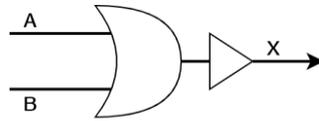


FIGURE 2

Truth table here:

--

(1)

b. Similarly, the NAND gate is made up of an AND gate and a NOT gate. **Draw** the logic circuit and the truth table of the NAND gate.

Logic Circuit here:	Truth Table here:

(2)

c. Find X, if $X = 10011101_2 \text{ NOR } 00110101_2$

(1)

d. Find X, if $X = 00111000_2 \text{ NAND } 11100101_2$

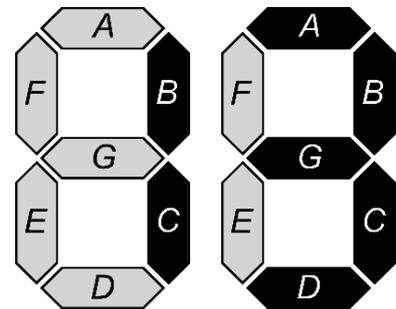
(1)

(Total: 5 marks)

Please turn the page.

13. A 7-segment display shows all the digits from 0 to 9. It lights up different segments according to the 8-bit binary signal received. For example:

H	G	F	E	D	C	B	A	Number displayed
0	0	0	0	0	1	1	0	1
0	1	0	0	1	1	1	1	3



Number 1 Number 3

a. What number will the 7-segment display show if the following signals are received:

i. 00111111_2

_____ (1)

ii. $6D_{16}$

_____ (2)

iii. 102_{10}

_____ (1)

b. List **ONE** binary bit pattern that is not a valid command for the 7-segment display.

_____ (1)

c. Explain why the 8th bit of the signal is not required.

_____ (1)

(Total: 6 marks)

14. The JAVA program snippet below works as follows:

- user enters ten integer numbers in array called listOfNums[];
- the largest number from the list is found;
- the largest number is displayed.

Analyse the code and answer the following questions:

```
1:  public static void main(String[] args){
2:      //declare an integer array of ten numbers - listOfNums
3:      _____
4:      int max = 0;
5:
6:      //user enters ten numbers and the largest is found
7:      for ( _____ ) {
8:          System.out.print("Num " + i + ": ");
9:          listOfNums[i] = Keyboard.readInt();
10:         if max < listOfNums[i]
11:             _____
12:         }
13:         System.out.println("Largest Number is max");
14:     }
```

a. Fill in the blanks in lines 3, 7 and 11.

Line 3: _____ (1)

Line 7: _____ (1)

Line 11: _____ (1)

b. The program has a logical error in line 13. Provide a solution to this error.

_____ (1)

c. Explain why substituting array listOfNums[] with an integer variable (int userNum;) would not change the end result.

_____ (1)

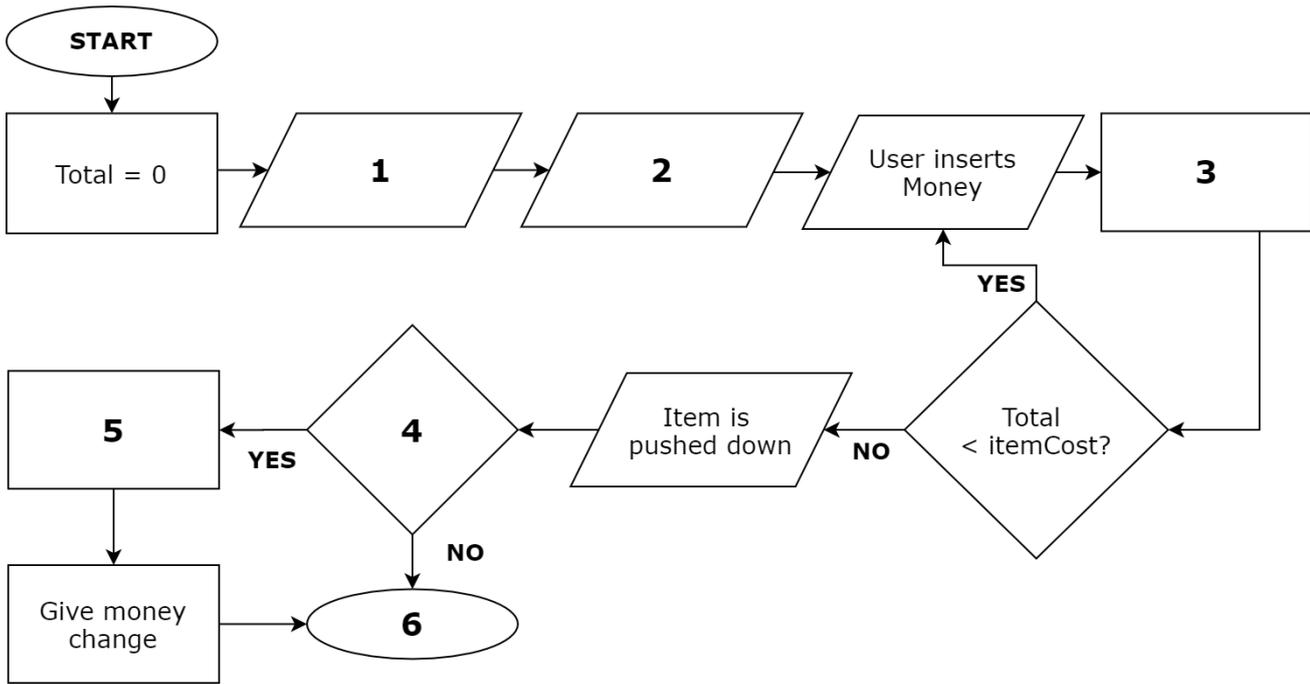
(Total: 5 marks)

Please turn the page.

15. A food & beverage vending machine operates as follows:

- User chooses an item;
- The vending machine displays the price of the item;
- User inserts money until the price is reached;
- Vending machine pushes the selected item down; and
- If necessary, vending machine gives money change.

Complete the flowchart below that represents the vending machine



- 1: _____ (1)
- 2: _____ (1)
- 3: _____ (1)
- 4: _____ (1)
- 5: _____ (1)
- 6: _____ (1)

(Total: 6 marks)



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SUBJECT: **Computing**
 PAPER NUMBER: IIA
 DATE: 25th September 2020
 TIME: 9:00 a.m. to 11:05 a.m.

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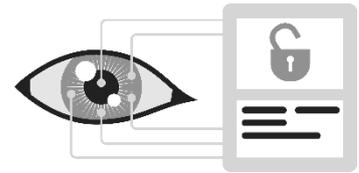
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MARKS						

1. A scientific lab is secured with a two-stage security system. Scientists must first use retina scanner and then enter a four-digit pin code (numbers only) to enter this lab.



a. Explain how the system can recognise the individual’s details such as name and surname, who is trying to access the lab by the scanning of the retina.

(1)

- b. Draw the flowchart that:
- displays "Access Granted" on an LCD display if both the retina scan and the pin code are correct; and
 - displays "Access NOT Granted" on the LCD display if the scanned retina shape is not found or the pin code is incorrect.

Flowchart here:

(8)

c. Mention **ONE** testing procedure that you would perform on this system.

(1)

d. Would you expect the program for this security feature to be coded in Assembly language? Explain your answer.

(2)

e. The JAVA program snippet below allows the user to enter up to three incorrect pin codes. It exits from method checkPinCode() if:

- a correct pin code is entered; or
- after three incorrect pin codes are entered.

Analyse the program snippet below and answer the following questions:

```
1:    boolean checkPinCode(){
2:        //define required variables
3:        int userPin;
4:        int count = 0;
5:
6:        //check pin entered by the user
7:        do{
8:            System.out.print("Enter Pin Code: ");
9:            userPin = Keyboard.readInt();
10:           if (userPin != 1234){
11:               System.out.println("Access NOT Granted");
12:               count++;
13:           } else {
14:               System.out.println("Access Granted");
15:           }
16:       } while (count < 3);
17:       return false;
18:   }
```

i. What would happen if the user enters a non-number character?

(1)

This question continues on next page.

ii. Would the program snippet compile? Explain your answer.

(1)

iii. Explain why the program snippet does not function properly.

(1)

iv. Provide a solution according to your answer in part iii.

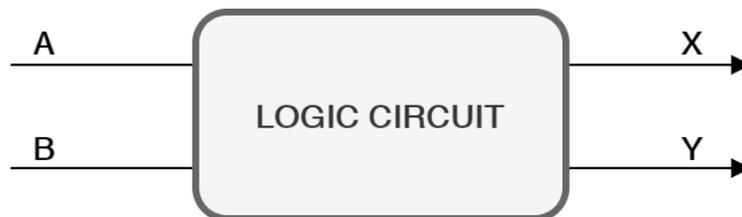
(1)

v. The JAVA program snippet above needs to be translated into machine code for the CPU to process. Would you recommend the translation to be carried out by a compiler or an interpreter during program development and testing? Explain your answer.

(2)

(Total: 18 marks)

2. The diagram below has two inputs (A and B) and two outputs (X and Y). X is one (1) when A and B are not the same, whilst Y is one (1) when both A and B are one (1).



a. Complete the truth table for this logic circuit.

A	B	X	Y

(3)

f. Nowadays digital devices use the two's complement method for arithmetic operations. Mention **ONE** advantage of the two's complement method.

_____ (1)

g. Using a two's complement 8-bit register:

i. Calculate $10000000_2 + 00111111_2$

_____ (1)

ii. Convert your answer in part (i) to decimal.

_____ (1)

h. Explain why performing one left shift operation on the result of part g(i) would cause a numerical overflow.

_____ (1)

(Total: 17 marks)

3. SECURE Ltd. is an insurance company. It has 20 computers and other peripheral devices connected through a LAN.

a. State **ONE** main feature of a LAN.

_____ (1)

b. Describe **TWO** advantages that the company has in using a LAN instead of 20 standalone computers.

_____ (2)

c. The insurance company employees require Internet access.

i. Name the device which allows computers to access the Internet.

_____ (1)

ii. Explain the function of this device.

_____ (2)

d. The insurance company is looking at a local Internet Service Provider (ISP) to provide the Internet service. The ISP has offered a bandwidth of either 500 Mbps or 1000 Mbps. Which bandwidth should the company choose? Give **TWO** reasons for your answer.

_____ (2)

e. The company is considering updating its website so that clients can pay their bills online. A systems analyst has been engaged to update the system. The job of the systems analyst is to perform a Software Development Life Cycle (SDLC).

i. Mention and explain briefly the first and last stage of the SDLC.

_____ (4)

ii. Explain **TWO** tasks that should be carried out before the new computer system can be fully implemented.

_____ (2)

This question continues on next page.

f. In order to ensure a high level of security the systems analyst suggests that each client should have a means of username and password to access certain parts of the website. He also suggested that important data should be encrypted and that a log and audit trail should be kept.

Explain the following terms:

i. username and password;

_____ (1)

ii. encryption;

_____ (1)

iii. log and audit trail.

_____ (1)

(Total: 17 marks)

4. The Arithmetic Logic Unit (ALU) is that part of the processor which performs both arithmetical and logical operations on data. Two instructions in the ALU are ADD and AND.

a. Using 1101_2 and 0101_2 , explain the difference between the ADD and the AND instructions.

_____ (4)

b. Where are the results of the ADD and AND instruction stored when executed?

_____ (1)

c. Storing these results in this location rather than in main memory is more efficient. Explain why.

_____ (2)

d. Describe each of the following addressing modes.

i. immediate addressing;

_____ (2)

ii. direct addressing;

_____ (2)

iii. symbolic addressing.

_____ (2)

e. Storage locations 100 onwards hold the values as shown below.

Memory Address	Value
100	1
101	2
102	3
103	4
104	5

The following instructions are part of a program. If the accumulator and register X both initially hold the value zero, what value would each hold after each instruction in the program is executed?

Instruction	Accumulator	Register X
At start	0	0
LDX #5; load value 5 into register X		
LDA #100; load value 100 into Accumulator		
ADD 103; add value in memory location 103 into Accumulator		
AND 104; logical AND the value in memory location 104 into Accumulator (bitwise operation)		

(4)

(Total: 17 marks)

Please turn the page.

5. Kai buys a laptop with two secondary storage devices, a magnetic hard disk and a 128 GB solid state drive. The solid state drive is an electronic type of backing storage.

a. Calculate how many megabytes there are in 128 GB? Show your working.

(1)

b. State **TWO** advantages of solid state storage compared to magnetic storage.

(2)

c. Kai has to decide which second storage device to use to store:

- the operating system;
- backups of pictures and videos.

Giving a reason in each case, state which device would be the most suitable for storing each of the above.

- the operating system _____

- backups of pictures and videos _____

(4)

d. Suggest an alternative storage that Kai can use as a backup. Give **ONE** reason for your answer.

(2)

e. The operating system on Kai’s laptop is Microsoft Windows 10 which is a multi-programming Operating System. How does this differ from a single-programming Operating System?

(2)

f. Kai has some photo files which were originally 2 Mb each but were changed to 1.7 Mb without editing the photos. Name the system utility used.

(1)

g. Mention and explain **TWO** other system utilities.

(4)

(Total: 16 marks)

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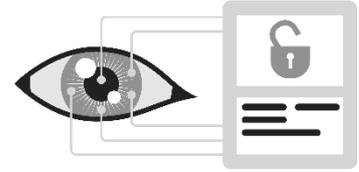
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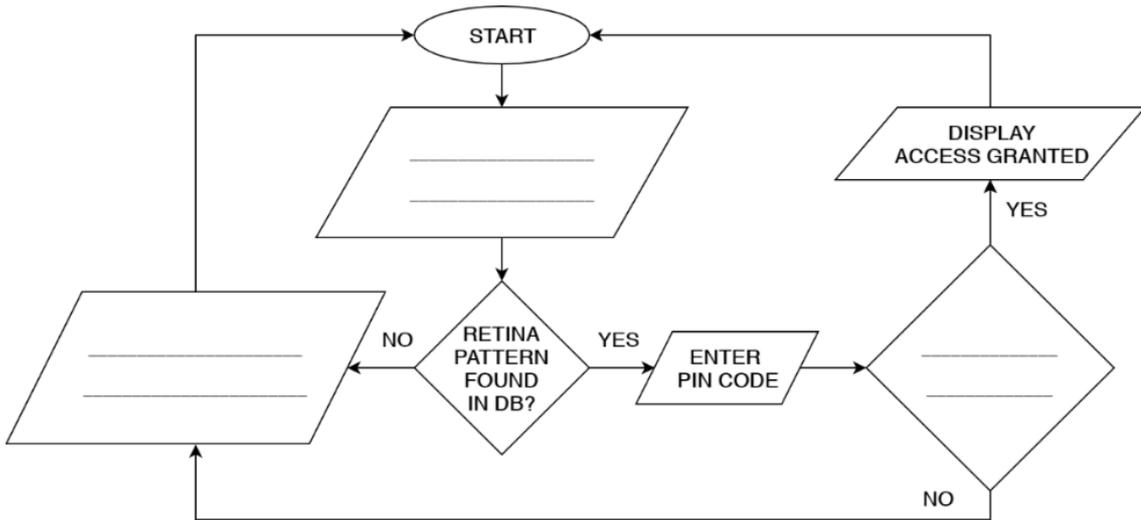
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1. A scientific lab is secured with a two-stage security system. Scientists must first use retina scanner and then enter a four-digit pin code (numbers only) to enter this lab.



a. Complete the flowchart that:

- displays "Access Granted" on an LCD display if both the retina scan and the pin code are correct; and
- displays "Access NOT Granted" on the LCD display if the scanned retina shape is not found or the pin code is incorrect.



(3)

b. Name **TWO** input devices and **ONE** output device used.

(3)

c. The JAVA program snippet below allows the user to enter a pin code and checks if it is correct or not. Analyse the program snippet below and answer the following questions:

```
1:    public static void main(String[] args)
2:        //define required variables
3:        int userPin;
4:
5:        //start program
6:        System.out.print("Enter Pin Code: ");
7:        userPin = Keyboard.readInt();
8:        if (userPin == 1234)
9:            System.out.println("Access NOT Granted");
10:       } else
11:           System.out.println("Access Granted");
12:   }
```

- i. The testing team wanted to check whether the pin code entered by the user causes a runtime error. What is a runtime error?

(1)

- ii. Which one of the following two test data would cause a runtime error? Tick the correct answers.

1568 2As4 65278 34y1 (2)

- iii. Why is testing an important part of software development?

(1)

- iv. In which line of the JAVA program is there the following constructs:

Construct	Line
Comments:	
Decision Statement:	
Input Statement:	
Method Declaration:	
Output Statement:	
Variable declaration:	

(3)

- v. The program snippet has a logical error. What is a logical error?

(1)

- vi. Which single line of code should be changed to fix the logical error?

(1)

- vii. Provide a solution according to your answer in part vi.

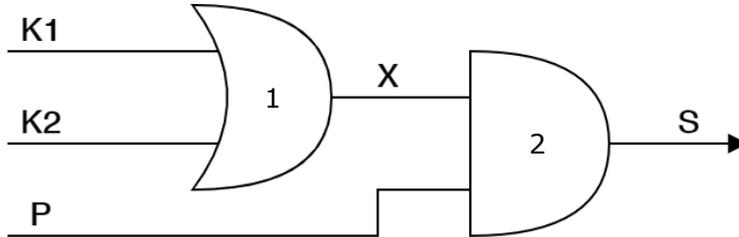
(1)

(Total: 16 marks)

Please turn the page.

2. A bank safe deposit box can only be opened using the following logic circuit. K1 and K2 are two keys and P is a pin code.

Analyse the logic circuit below and answer the following questions:



a. Name the **TWO** logic gates included in the circuit.

_____ (2)

b. Draw the truth table for each gate mentioned in part a.

<i>Truth Table 1:</i>	<i>Truth Table 2:</i>
-----------------------	-----------------------

(2)

c. Complete the truth table according to the logic circuit above.

K1	K2	P	X	S
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

(2)

d. The bank safe deposit box should only open (S=1) if:
 - two keys are used simultaneously (K1 = 1 and K2 = 1); and
 - the correct pin code is entered (P = 1).
 Is the logic circuit above working properly? Explain your answer.

 _____ (2)

e. What needs to be changed in the circuit above to fix the problem?

_____ (1)

f. Draw the logic circuit according to your answer in part e.

Logic Circuit here:

_____ (1)

g. The safe deposit box uses 10-bit registers:

i. Work out the following computation: 0111100010_2 OR 1000001000_2

_____ (2)

ii. What is the pin code of the safe deposit box if it is the decimal equivalent of your answer in part (i)?

_____ (1)

iii. If the pin is a 4-digit code, what would be the pin code if one right shift operation is performed on your answer in part g(i)?

_____ (2)

iv. What is the outcome of a left shift operation on your answer in part g(i)?

_____ (1)

v. Is it possible for your answer in part (iv) to be the pin code of the safe deposit box? Explain.

_____ (2)

(Total: 18 marks)

Please turn the page.

3. SECURE Ltd. is an insurance company which has its offices set in Ta' Xbiex, with 20 computers and other peripheral devices connected through a LAN.

a. What does LAN stand for?

_____ (1)

b. State **ONE** main feature of a LAN.

_____ (1)

c. Describe **TWO** advantages that the company has in using a LAN instead of 20 standalone computers.

_____ (2)

d. The insurance company employees require access to the Internet. A modem is required for this purpose.

i. Explain the function of the modem.

_____ (2)

ii. Mention **TWO** uses of Internet for this company.

_____ (2)

e. What do the following abbreviations stand for?

i. URL - _____ (1)

ii. www - _____ (1)

f. The company is considering updating its website to allow clients to pay their bills online. A systems analyst has been engaged to update the system. The job of the systems analyst is to perform a Software Development Life Cycle (SDLC).

i. Name the first stage of the SDLC.

_____ (1)

ii. Mention **ONE** task the system analyst does during the first stage.

(1)

iii. The last stage of the SDLC is system maintenance. Explain why this stage is important.

(1)

g. In introducing the new system, a direct changeover method is selected.

i. What is direct changeover?

(1)

ii. Name **ONE** advantage and **ONE** disadvantage of this changeover method.

(2)

(Total: 16 marks)

4. The CPU is one of the hardware components of a computer system.

a. Define the term CPU.

(1)

b. Name the **TWO** main units which make up the CPU.

(2)

c. Which of the units mentioned in part b fetches instructions from RAM?

(1)

d. Which of the units mentioned in part b performs calculations?

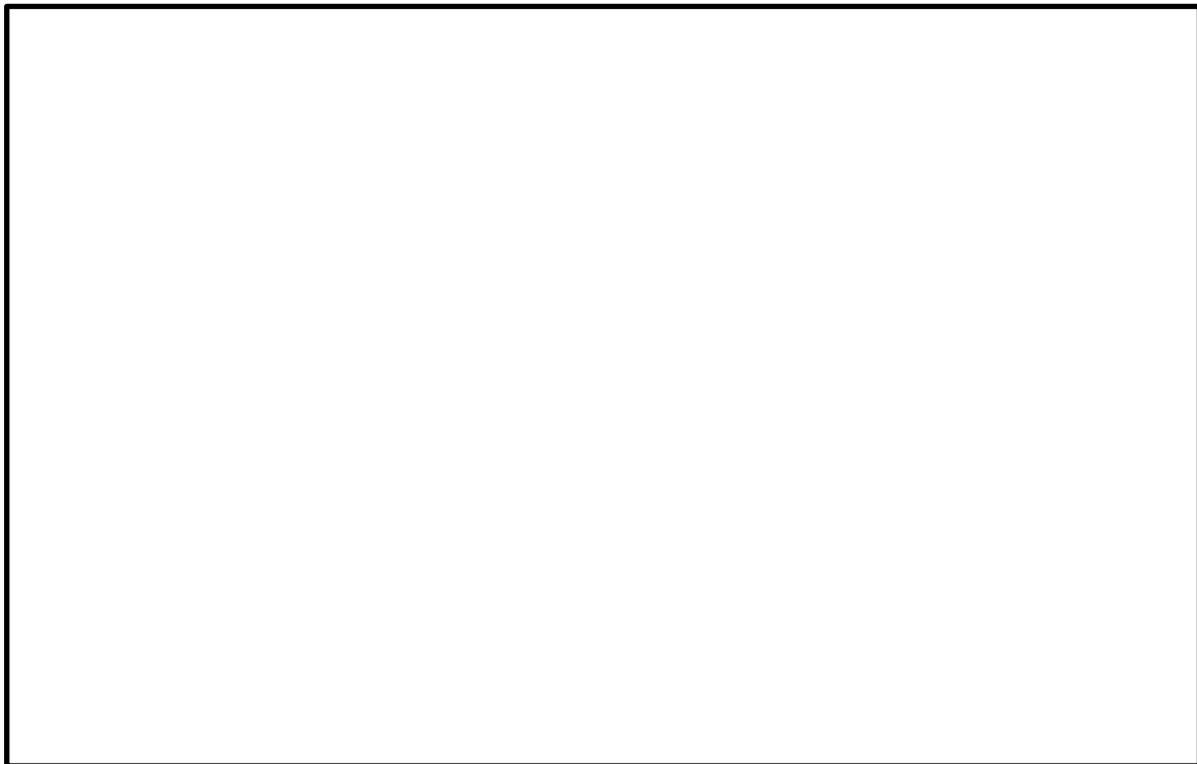
(1)

This question continues on next page.

- e. Two of the following statements are false. Identify and correct them.
 - i. A bus is a set of lines on which data and instructions are transmitted.
 - ii. The address space is the number of memory locations which the data bus can locate.
 - iii. The width of the address bus is referred to as the word length of the CPU.
 - iv. The control bus is used to specify a read or a write operation.

(4)

- f. Draw a diagram which illustrates the CPU with the units mentioned in part b, the address bus, the data bus and the control bus, and the main memory.



(6)

- g. Fill in the blanks:

- i. The _____ register contains the address of the next instruction.
- ii. To start processing, the CPU first _____ the opcode from memory location indicated by the register in part i.
- iii. The Control Unit places the opcode in the _____.
- iv. Control Unit fetches any required _____.

(4)

(Total: 19 marks)

5. Kai owns a tablet. One characteristic of a tablet is that it has a number of built-in physical devices to input data, such as a touchscreen.

a. State **TWO** other input built-in physical components found in the tablet.

(2)

b. A tablet has a **graphical user interface**. Explain the term in bold.

(1)

Kai wants to take his tablet with him while on holiday in order to take photos. The memory in his tablet is full and he needs to buy an SD card for additional storage. He purchases a 32 GB SD card to use as secondary storage in his tablet.

c. What is a secondary storage device?

(2)

d. An SD card is an electronic type of storage. Give **TWO** reasons why such storage is better than magnetic storage.

(2)

Kai would like to perform a backup of all his data by transferring them to his laptop.

e. Why is it important for Kai to do a backup?

(2)

f. Name the utility software that is used to reduce the file size of a photo file without editing it.

(1)

g. Mention and explain another software utility.

(2)

This question continues on next page.

All tablets come with an operating system.

h. What is an operating system?

(2)

i. Tick (✓) the appropriate answer. A tablet has:

- general-purpose computer system;
- dedicated computer system.

Give **ONE** reason for your answer.

(2)

(Total: 16 marks)

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