



L-Università
ta' Malta

MATSEC
Examinations Board



Sample Papers
SEC 09 Computing

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Specimen Assessments

Specimen Assessments: Controlled Paper MQF 1-2



L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
SAMPLE PAPER**

SUBJECT: Computing
PAPER: Level 1 – 2
DATE:
TIME: 2 Hours

Directions to Candidates

Answer **all** questions in the space provided.

You are **not** allowed to use any 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.

Section A

1. The tech giant, Apple, has recently released the iPhone 11 Pro, a flagship smartphone that was announced in late 2019. Some of this phone's specifications are listed below.



<https://www.shanethegamer.com/iphone-11/>

Type	Super AMOLED capacitive touchscreen, 16M colours
Size	6.5 inches
Resolution	1242 x 2688 pixels (458 ppi)
Processor	A13 Bionic
Operating System	iOS 13
Features	<ul style="list-style-type: none"> - Tri-Camera (12 megapixels) - Dual Flash LED - Noise Cancelling Microphone - 64GB Internal Storage

- a. List **ONE** input and **ONE** output component of this phone.

(2)

b. What is the colour depth of this display?
_____ (1)

c. Identify **ONE** specification which determines the quality of images displayed on this mobile.
_____ (1)

d. This phone has 64GB internal storage. If 4GB are used by the software installed on this mobile, how many MP3s can be stored on this phone if the average size of each MP3 is 4MB?

_____ (2)

(Total: 6 marks)

2. The iPhone 11 Pro is powered by the A13 Bionic processor which is based on System on Chip (SoC) technology. It comes with 4GB of RAM and 256GB internal storage which are not expandable.

a. Define the term SoC technology.

_____ (1)

b. Unlike this phone, some other smartphones come with a fixed internal storage capacity and the possibility to expand storage.

Mention **ONE** storage medium that is used as expandable storage for smartphone devices.
_____ (1)

c. Identify the capacity of the primary storage and secondary storage of this smartphone.
_____ (2)

d. Define RAM.

_____ (1)

e. Besides RAM, mention **ONE** other memory component inside a smartphone.
_____ (1)

f. Mention **TWO** other devices/gadgets that use SoC technology.
_____ (2)

(Total: 8 marks)

3. Smartphones users can access the Internet from their phone. While waiting for her bus home, Emma connected to the Internet to access her cloud storage called 'MyCloudStorage' on <https://www.mycloudstorage.com>.

a. Explain the difference between the client and the server role in terms of accessing MyCloudStorage.

(1)

b. MyCloudStorage uses an https protocol.

i. Define the need for network protocols.

(1)

ii. Why does MyCloudStorage require a secure (https) protocol?

(1)

iii. How is https different from an ftp protocol?

(1)

c. The hostname is translated to 172.217.9.238 IPv4 address.

i. Why is there the need to have the hostname translated to an IP address?

(1)

ii. How does IPv4 differs from IPv6?

(1)

iii. How does an IP address differ from a MAC address?

(1)

d. Besides MyCloudStorage, Emma has a 'ShabaFilm' account and its app installed on her smartphone. 'ShabaFilm' is an online streaming service that allows customers to watch a wide variety of TV shows, movies, documentaries, and more.

What do MyCloudStorage and ShabaFilm have in common?

(1)

(Total: 8 marks)

4. A robotic arm is used to install the car windscreen. The robotic arm is controlled by a 6-bit signal. Each bit in the signal activates a component of the robotic arm when that bit is set to 1.

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
Move arm UP	Move arm DOWN	Move arm IN	Move arm OUT	Apply force to stabilize windscreen in place	Activate vacuum suckers to lift windscreen

- a. Identify the number bases used for Binary, Decimal and Hex.

_____ (3)

- b. For each of the numbers, tick the correct number system/s. You may tick more than one.

	Binary	Hex	Decimal
12			
2E			
10			

(3)

- c. What happens when the following bit pattern is entered?

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
1	0	0	1	0	0

_____ (1)

- d. What happens when the system receives the value 24_{10} ? Show your working.

_____ (2)

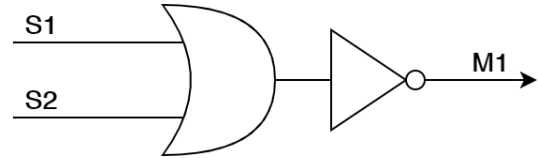
(Total: 9 marks)

5. An automatic floor vacuum cleaner has a set of sensors and functions as listed below:

Sensors			Functions	
S1	S2	S3	M0	M1
detects dirt	detects obstacles in vicinity	indicates robot's low battery	activates mopping brush	moves motor wheels forward

The following is a logic circuit designed to activate the motor wheels ($M1 = 1$) if:

- S1 does not detect dirt ($S1 = 0$), or
- S2 does not detect an obstacle ($S2 = 0$)



a. Draw the truth table for the above logic circuit.

(2)

b. Derive the Boolean expression of the above logic circuit.

(2)

c. The logic circuit designed to activate the motor wheels ($M1$) can be represented using only one universal gate. Name it and draw its symbol.

Logic gate: _____ (2)

d. The robot can activate the mopping brush ($M0 = 1$) if battery is charged ($S3 = 0$), and dirt is detected ($S1 = 1$). The Boolean expression representing this function is $M0 = \text{NOT}(S3) \text{ AND } S1$.

Develop the logic circuit for this Boolean expression.

(3)

(Total: 9 marks)

Section B

6. A University library holds a large stock of books that are available for loan to University students. The library requires a database to support the processing of these loans. Examine the sample records in Figure 1 and the database assumptions in Figure 2 shown below.

Title: Prisoners of Geography	ISBN: 1783962437	Category: Science
Published: 2013	Shelf Num: C100	Date Acquired: 12-APR-2016
Borrower ID	Loan Date	Return Date
0007694M	12-MAY-2018	24-MAY-2018
0434691M	26-MAY-2018	31-MAY-2018
0678598A	03-JUN-2018	12-JUN-2018

Figure 1: Three loan records displayed in a report.

1. The library acquires one hardcopy of each book.
2. A book has a:
 - unique ISBN (an international 13 numbered book code);
 - title;
 - date it was published;
 - category;
 - shelf number;
 - date it was acquired.
3. A borrower may have more than one book on loan at any time.
4. A book may be out on loan many times or it may never be loaned out.
5. Each loan transaction is made by one borrower for one book.

Figure 2: List of Rules

- a. Provide **TWO** advantages for this library to use a digital database instead of manual records.

(2)

- b. Use the keywords in table below to fill in the blanks. Each keyword can be used more than once.

database	records	record	fields	primary key
-----------------	----------------	---------------	---------------	--------------------

A _____ stores information in a series of _____. Each _____ is made up of a group of _____. A _____ uniquely identifies a _____.

(3)

c. Define the term Database Management System (DBMS).

(1)

d. Fill in the missing fields or data types for the BOOK table below:

BOOK Table	
Fields	Data Types
Title	Text
ISBN	Text
	Date/Time
Category	
Date Acquired	Date/Time

(2)

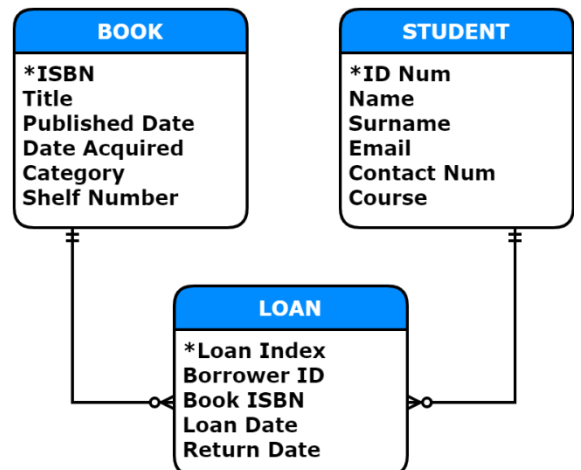
e. What would be a suitable field length for that the field 'Category'?

(1)

f. Which process refers to the checking of the data entered by users to ensure data quality, that it is correct and useful. Tick the correct answer.

- Data Check
 Data Analysis
 Data Validation
 (1)

g. Analyse the below Entity Relationship Diagram (ERD) and answer the following questions:



i. What field uniquely identifies records in the STUDENT table and the LOAN table?

(2)

ii. What is the minimum number of books that a student can borrow?

(1)

iii. What is the minimum and maximum number of books that a loan can include?

(2)

h. Analyse the list of records in the table below and answer the following questions:

Title	Published Date	Author
The Philosopher's Stone	01-Feb-97	J.K. Rowling
The Chamber of Secrets	01-Mar-98	J.K. Rowling
The Prisoner of Azkaban	01-Jan-99	J.K. Rowling
The Goblet of Fire	01-Jun-00	J.K. Rowling
The Order of the Phoenix	10-Jan-03	J.K. Rowling
The Half-Blood Prince	01-Apr-05	J.K. Rowling
The Deathly Hallows	15-Nov-07	J.K. Rowling
The Fellowship of the Ring	29-Jul-54	J. R. R. Tolkien
The Two Towers	11-Nov-54	J. R. R. Tolkien
The Return of the King	20-Oct-55	J. R. R. Tolkien

i. What would be the first record returned by the following SQL statements:

(a) `SELECT Title FROM Book ORDER BY Title Desc` _____ (1)

(b) `SELECT Title FROM Book ORDER by Title` _____ (1)

ii. How many records would be returned by the following SQL Statements:

(a) `SELECT * FROM Books`
_____ (1)

(b) `SELECT * FROM Books WHERE published_date > '1 Jan 2000'`
_____ (1)

(c) `SELECT *
FROM Books
WHERE published_date > '1 Jan 2000' AND Author='J.R.R. Tolkien'`
_____ (1)

(d) `SELECT *
FROM Books
WHERE published_date > '1 Jan 2000' AND published_date < '1 Jan 2005'`
_____ (1)

(Total: 21 marks)

7. A smart Air-Conditioner can connect to the Internet and the user can control it from his smartphone through an app.

The AC contains various components, some of which are the:

- **humidity sensor:** input device which reads the amount of water in the air.
- **front display screen:** output device which shows controls, properties, etc.
- **heating element:** output device which heats up the air.
- **blower:** output device which circulates air in the room.

- a. What is the difference between data and information?

(1)

- b. Mention an example of data and an example of information in terms of controlling the AC through the smart phone.

(2)

- c. The diagram shown below displays how the temperature sensor controls the AC.



- i. Distinguish between analogue and digital data.

(1)

- ii. Define the term ADC.

(1)

- iii. Besides the Air Conditioner, other household devices, such as a microwave, are powered by a microcontroller. Define the term microcontroller.

(1)

d. The AC displays the ambient temperature in Celsius (C) or Fahrenheit (F).

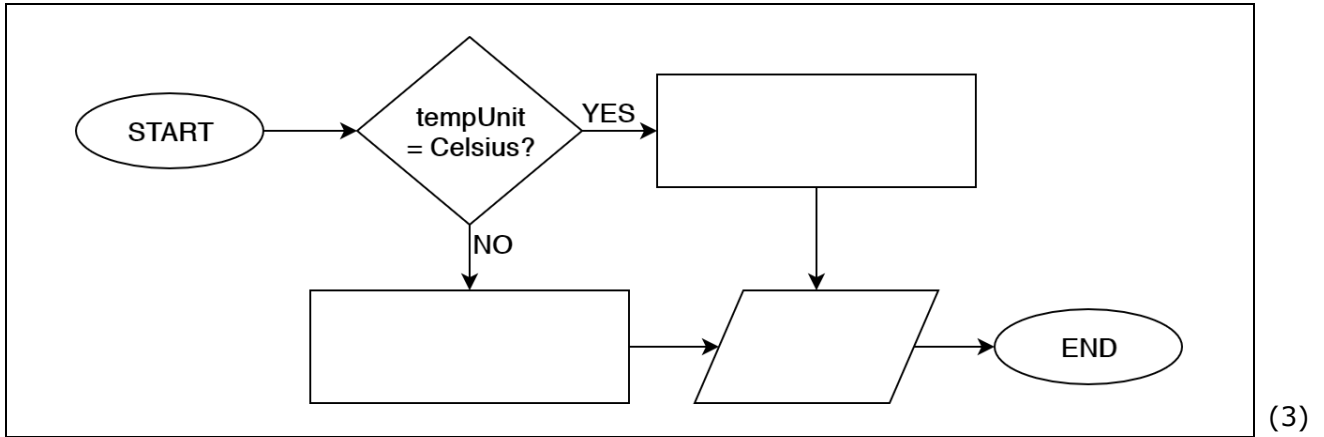
First it reads the temperature value in Fahrenheit or Celsius, then it converts it and displays the converted temperature on the LCD display.

Complete the flowchart below that represents the algorithm for this function.

The conversion formulas are:

- $C = (F - 32) \times 0.56$

$F = (1.8 * C) + 32$



e. The smartphone app called 'AirTouch 3' is an app that can be downloaded for free from Google Play and App Store.

i. AirTouch 3 is an off-the shelf type of software, define off-the-shelf software.

(1)

ii. How is off-the-shelf software different from tailor-made software?

(1)

iii. 'AirTouch 3' uses a freeware license. Define freeware license.

(1)

f. 'AirTouch 3' is coded in Java programming language, whilst the AC is programmed in Assembly language.

i. Provide **TWO** differences between JAVA and Assembly language.

(2)

ii. Complete the sentence below by filling in the words using the following terms:

Assembler	Compiler	Interpreter
-----------	----------	-------------

When coding the 'Air Touch 3' in JAVA, a/an _____ is used to translate the source code into executable code, however a/an _____ is used to translate the AC in assembly language into executable code.

(2)

g. Define the concept of the IoT.

(1)

(Total: 17 marks)

8. Android announced their latest Embedded Operating System (OS), Android 9 PIE, in August 2018. Android OS is generally used on smartphones, smartwatches and tablets.



<https://www.androidjungles.com/android-p/>

a. Mention **THREE** functions of an OS.

(3)

b. Define the term Embedded OS.

(1)

c. Android 9 makes use of a Natural User Interface (NUI). What is NUI?

(1)

d. Android OS is an open source OS. How is this different from a shareware license?

(1)

e. Android 9 PIE’s minimum system requirements are as follows:

64-bit Quad Core 1 GHz CPU	512MB RAM	8GB Storage
-----------------------------------	------------------	--------------------

i. Distinguish between single-core and multi-core CPU.

(2)

ii. Does Android 9 PIE require a single-core or a multi-core CPU?

(1)

iii. Briefly explain the roles of the CPU components ALU and CU.

(2)

iv. The word length of this CPU is 64bit. Define the term word length.

(1)

v. The internal storage of any device equipped with an Android OS must be **formatted** with an 'Ext4' **Filing System**. Briefly explain the use of the terms in bold.

(2)

f. One of Android 9 PIE’s new upgrade is a better navigation between running apps. Briefly describe how the OS manages the running of several apps.

(1)

g. According to Android developers, Android OS does not use virtual memory, but the user can enable virtual memory from the device settings. Briefly explain the purpose of virtual memory.

(1)

h. Usually Android apps are programmed in Java.

i. Is Java considered a Low-Level Language or a High-Level Language?

(1)

ii. Define Low and High-level languages.

Low-Level Language: _____

_____ (1)

High-Level Language: _____

_____ (1)

iii. Mention **THREE** characteristics of High-Level Language.

_____ (3)

(Total: 22 marks)

END OF PAPER

Specimen Assessments: Controlled Paper MQF 1-2 – Marking Scheme



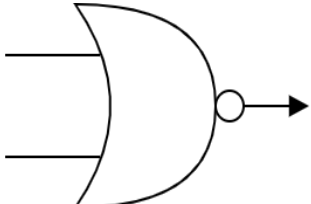
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ta' Malta

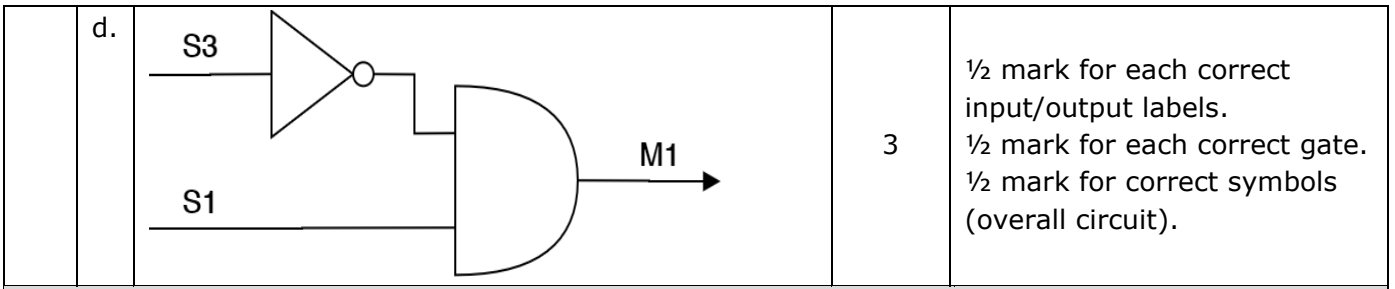
MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION LEVEL
MARKING SCHEME FOR SAMPLE CONTROLLED PAPER**

SUBJECT: Computing
PAPER: Level 1-2
DATE:
TIME: 2 Hours

Section A			Marks	Comments	
1.	a.	Input: Microphone OR Camera; Output: Flash LED OR Speaker etc.	2	1 mark each. Accept relevant answers.	
	b.	16 million colours.	1		
	c.	Resolution.	1	Accept also bit depth or ppi or image compression.	
	d.	$(60 \times 1024) / 4$	2	½ mark for getting 60GB remaining space. ½ mark for converting GB to MB. 1 mark for dividing by 4.	
Total: 6 marks					
2.	a.	SoC is a system which includes the various components that make up an entire system into one chip, including: CPU, ROM, RAM, Storage, GPU, Sensors, Network cards, etc.	1	Accept relevant answers.	
	b.	Memory card.	1	Do not accept online or cloud storage.	
	c.	4GB Primary and 256GB Secondary.	2	Accept relevant answers.	
	d.	RAM – Random Access Memory that is a volatile type of memory used to store instructions required by the CPU.	1	Accept relevant answers.	
	e.	ROM.	1		
	f.	Air Conditioner, Car ECU, Smart Tv, Smartphone, tablet etc...	2	Accept relevant answers.	
Total: 8 marks					
3.	a.	The server stores the google drive's interface and data, whilst the client is the app or the website from where the user accesses personal data.	1	Accept relevant answers.	
	b.	i.	Network protocols are the mechanisms for devices to identify and make connections with each other.	1	Accept relevant answers.
		ii.	Because cloud storage requires a secure protocol that safeguards the transferring of	1	Accept relevant answers.

		personal data/files to and from servers from being hacked.																	
	iii.	http is the protocol used for the transferring and viewing of websites, whilst ftp is the protocol used for the transferring of files to/from server.	1	Accept relevant answers.															
c.	i.	Because all Internet hosts are identified by an IP address and not hostnames.	1	Accept relevant answers.															
	ii.	IPv4 is a 32-bit address, whilst Ipv6 is a 128-bit address.	1	Accept relevant answers.															
	iii.	IP uniquely identifies a connection on a network (assigned by the ISP), whilst the MAC address uniquely identifies the device on a network (assigned by the NIC manufacturer).	1	Accept relevant answers.															
d.	Both are Software as a Service (SaaS).	1	Accept relevant answers.																
Total: 8 marks																			
4.	a.	Binary = 2; Decimal = 10; Hex = 16	3	1 mark each.															
	b.	12 = Hex and Decimal. 2E = Hex. 10 = Binary, Hex and Decimal.	3	1 mark each.															
	c.	Move arm UP and OUT.	1																
	d.	$24_{10} = 011000_2$ which means that the arm moves down and in.	2	1 mark for converting to binary. 1 mark for action.															
Total: 9 marks																			
5.	a.	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>S1</th> <th>S2</th> <th>M1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	S1	S2	M1	0	0	1	0	1	0	1	0	0	1	1	0	2	1 mark for input combinations. 1 mark for correct output.
	S1	S2	M1																
	0	0	1																
0	1	0																	
1	0	0																	
1	1	0																	
b.	$M1 = \text{NOT}(S1 \text{ OR } S2)$	2	½ mark for OR gate. ½ mark for NOT gate. 1 mark for overall expression.																
c.	 NOR GATE	2	1 mark for symbol. 1 mark for gate.																



Total: 9 marks

Section B		Marks	Comments															
6.	a.	Less data redundancy and more flexibility in accessing data.	2	Accept relevant answers.														
	b.	database, records, record, fields, primary key record.	3	½ mark each.														
	c.	DBMS is the software used to create and modify a database.	1	Accept relevant answers.														
	d.	<p>BOOK Table</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Fields</th> <th style="text-align: left;">Data Types</th> </tr> </thead> <tbody> <tr> <td>Title</td> <td>Text</td> </tr> <tr> <td>ISBN</td> <td>Text</td> </tr> <tr> <td>Date Published</td> <td>Date/Time</td> </tr> <tr> <td>Category</td> <td>Text</td> </tr> <tr> <td>Shelf Number</td> <td>Text</td> </tr> <tr> <td>Date Acquired</td> <td>Date/Time</td> </tr> </tbody> </table>	Fields	Data Types	Title	Text	ISBN	Text	Date Published	Date/Time	Category	Text	Shelf Number	Text	Date Acquired	Date/Time	2	½ mark for each correct answer
	Fields	Data Types																
	Title	Text																
	ISBN	Text																
	Date Published	Date/Time																
	Category	Text																
	Shelf Number	Text																
	Date Acquired	Date/Time																
	e.	20.	1	Accept reasonable lengths.														
	f.	Data Validation.	1															
g.	i.	STUDENT = ID Num LOAN = Loan Index	2	1 mark each.														
	ii.	0 books.	1															
	iii.	MIN: 1 Book and MAX: 1 Book	2															
h.	i. (a)	The Two Towers.	1															
	i. (b)	The Chamber of Secrets.	1															
	ii. (a)	10	1															
	ii. (b)	3	1															
	ii. (c)	0	1															
	ii. (d)	1	1															

Total: 21 marks

7.	a.	Data is raw, unorganized facts that need to be processed. Information is processed, organised or structured data that is useful to the user.	1	Accept relevant answers.
	b.	Data: values gathered from Humidity Sensor Information: Info displayed on the front display screen.	2	Accept relevant answers.
	c.	i.	Analogue is raw data, real data, and digital data is a sample extracted from the real data.	1

	ii.	Analogue to Digital Conversion, when analogue data are converted to digital signals.	1	Accept relevant answers.
	iii.	A microcontroller is designed to power an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip.	1	Accept relevant answers.
	d.	<pre> graph TD START([START]) --> Decision{tempUnit = Celsius?} Decision -- YES --> Process1[Temperature = (tempValue * 1.8) + 32] Decision -- NO --> Process2[Temperature = (tempValue - 32) * 0.56] Process1 --> Output[/Display Temperature/] Process2 --> Output Output --> END([END]) </pre>	3	1 mark each.
	e. i.	A readymade software common to all users.	1	Accept relevant answers.
	ii.	Tailor made is a software which is custom made from scratch according to specific needs.	1	Accept relevant answers.
	iii.	Freeware is a license that lets users to use the software for free but cannot distribute against profit.	1	Accept relevant answers.
	f. i.	JAVA is a high-level language whilst Assembly is a low-level language. Java is easier to code with and allows the possibility for software portability and Assembly language is machine dependent.	2	1 mark for each correct difference.
	ii.	compiler, assembler	2	1 mark each.
	g.	IoT is the concept of having digital devices connected to the Internet.	1	Accept relevant answers.
Total: 17 marks				
8.	a.	User Interface OR File Management OR Process Management OR Memory Management OR Input & Output Management.	3	1 mark each. Accept relevant answers.
	b.	Embedded OS is a type of OS used for specific functions in embedded systems.	1	Accept relevant answers.
	c.	NUI is a type of interface that allows users to interact with the device using natural gestures, voice commands, etc.	1	Accept relevant answers.
	d.	Open Source lets the user use and modify the code for free, while shareware allows the user to use the software for a limited time only.	1	
	e. i.	Single Core has one internal CPU. Multi Core has more than one internal CPUs.	2	Accept relevant answers.
	ii.	Multi-Core.	1	

	iii.	ALU performs arithmetic and logical operations when the CU requires it to execute instructions. CU controls the fetching and the executing of instructions.	2	Accept relevant answers.	
	iv.	Word length refers to the number of bits of data that the CPU can handle per cycle.	1	Accept relevant answers.	
	v.	Formatting is done by a specialised software utility that creates the storage device's file structure that is compatible with the OS. The Filing Structure is where the OS stores the files and their properties.	2	Accept relevant answers.	
	g.	The OS gives time slices to each app and uses a technique to manage the different slices, such as Round Robin or Priority-scheduling.	1	Accept relevant answers.	
	h.	Virtual memory is used as an extension of RAM when the CPU requires more memory space than is available.	1	Accept relevant answers.	
	i.	i.	Low Level Language.	1	Accept relevant answers.
		ii.	Low Level: contain basic instructions understood by the computer, thus more difficult to program with. High Level: more level of abstraction from the processor, thus more user friendly.	2	
		iii.	English-like statements, require translation to Machine Language, produces portable software.	3	Accept relevant answers
Total: 22 marks					

Specimen Assessments: Controlled Paper MQF 2-3



MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
SAMPLE PAPER**

SUBJECT: Computing
PAPER: Level 2 – 3
DATE:
TIME: 2 Hours

Directions to Candidates

Answer **all** questions in the space provided.

You are **not** allowed to use any 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.

Section A

1. The tech giant, Apple, has recently released the iPhone 11 Pro, a flagship smartphone that was announced in late 2019. Some of this phone's specs are listed below.



<https://www.shanethegamer.com/iphone-11/>

Type	Super AMOLED capacitive touchscreen, 16M colours
Size	6.5 inches
Resolution	1242 x 2688 pixels (458 ppi)
Processor	A13 Bionic
Operating System	iOS 13
Features	<ul style="list-style-type: none"> - Tri-Camera (12 megapixels) - Dual Flash LED - Noise Cancelling Microphone - 64GB Internal Storage

- a. List **TWO** input and **TWO** output components of this phone.

(2)

- b. Explain the term bit depth.

(1)

c. What is the colour depth of this display? _____ (1)

d. Given that a phone uses 24-bit depth, how many bits are sent to the screen to light it up once? _____ (1)

e. Which device would have the best picture quality? The iPhone 11 Pro or a tablet with a 9.7-inch display with the same resolution of that of the iPhone 11 Pro? Explain your answer. _____ (2)

f. Older mobile devices such as the Nokia 3310 or Siemens M35 had a menu-driven interface while modern smartphones use a graphical user interface. Which type of user interface do you prefer and why?



(1) <https://bit.ly/2wTuUUX>
<https://amzn.to/387OWYG>

(Total: 8 marks)

2. The iPhone 11 Pro is powered by the A13 Bionic processor which is based on System on Chip (SoC) technology. It comes with 4GB of RAM and a choice of 64GB or 256GB or 512GB internal storage which are not expandable.

a. Explain why users generally favour devices with more RAM. _____ (1)

b. Unlike this phone, some other smartphones come with a fixed internal storage capacity and the possibility to expand storage.

Mention **ONE** storage medium that is used as expandable storage for smartphone devices.

_____ (1)

c. The smartphone's ROM stores the operating system, the applications and the user's personal data. ROM is the smartphone's internal storage. How does this differ from the ROM in a personal computer?

_____ (1)

d. Mention **TWO** reasons why smartphones are equipped with SoC.

(2)

e. Mention **TWO** other devices/gadgets that use SoC technology.

(2)

(Total: 7 marks)

3. Smartphones users can access the Internet from their phone. While waiting for her bus home, Emma connected to the Internet.

a. What type of connection did Emma use? Explain your answer.

(2)

b. Emma has a free account with 'MyCloudStorage' to use as cloud storage. Mention **ONE** advantage and **ONE** disadvantage of using cloud storage.

(2)

c. Explain the difference between the client and the server role in terms of accessing MyCloudStorage.

(1)

d. The address to access MyCloudStorage is <https://www.mycloudstorage.com>

i. Mention **ONE** reason why MyCloudStorage has an https protocol.

(1)

ii. The hostname is translated to 172.217.9.238 IP address. How does this differ from IPv6?

(1)

iii. Why is there the need to have the hostname translates to an IP address?

(1)

- e. Besides MyCloudStorage, Emma has a 'ShabaFilm' account and its app installed on her smartphone. ShabaFilm is an online streaming service allows customers to watch a wide variety of TV shows, movies, documentaries, and more.

What do MyCloudStorage and ShabaFilm have in common?

_____ (1)

(Total: 9 marks)

4. A robotic arm is used to install the car windscreen. The robotic arm is controlled by a 6-bit signal. Each bit in the signal activates a component of the robotic arm when that bit is set to 1.

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
Move arm UP	Move arm DOWN	Move arm IN	Move arm OUT	Apply force to stabilize windscreen in place	Activate vacuum suckers to lift windscreen

- a. What happens when the following bit pattern is entered?

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5
1	0	0	1	0	0

_____ (1)

- b. What happens when the system receives the value 24_{10} ? Show your working.

 _____ (2)

- c. Is $4B_{16}$ a valid entry? Explain. Show your working.

 _____ (3)

(Total: 6 marks)

5. The robotic arm mentioned in question 4, does not allow the user to input conflicting commands. For example, move arm up and move arm down cannot be activated at the same time. Conflicting bits produce a '1' in the error bit (E).

a. Draw the truth table for bit 0 (B0), bit 1 (B1) and output (E) only.

	(2)
--	-----

b. Develop the logic circuit to represent the truth table in part a.

	(1)
--	-----

c. Derive the Boolean expression according to your answer in part b.

(1)

d. Besides the conflicting commands, an error can also happen if the robotic arm's diagnostic procedure detects a mechanism malfunction.

Revise the truth table, logic circuit and the Boolean expression in parts a, b and c with bit0 (B0), bit1 (B1), malfunction (M) and Error Output (E).

<i>Truth Table here</i>	<i>Logic Circuit here</i>	(4)
-------------------------	---------------------------	-----

Boolean Expression: _____ (2)

(Total: 10 marks)

Section B

6. A University library holds a large stock of books that are available for loan to University students. The library requires a database to support the processing of these loans. Examine the sample records in Figure 1 and the database assumptions in Figure 2 shown below.

Title: Prisoners of Geography	ISBN: 1783962437	Category: Science
Published: 2013	Shelf Num: C100	Date Acquired: 12-APR-2016
Borrower ID	Loan Date	Return Date
0007694M	12-MAY-2018	24-MAY-2018
0434691M	26-MAY-2018	31-MAY-2018
0678598A	03-JUN-2018	12-JUN-2018

Figure 1: Three loan records displayed in a report

1. The library acquires one hardcopy of each book.
2. A book has a:
 - unique ISBN (an international 13 numbered book code);
 - title;
 - date it was published;
 - category;
 - shelf number;
 - date it was acquired.
3. A borrower may have more than one book on loan at any time.
4. A book may be out on loan many times or it may never be loaned out.
5. Each loan transaction is made by one borrower for one book.

Figure 2: List of Rules

- a. Provide **TWO** advantages for this library to use a digital database instead of manual records.

(2)

- b. Fill in the missing fields or data types for the Book table on the right:

BOOK Table

Fields	Data Types
Title	Text
ISBN	Text
	Date/Time
Category	
Date Acquired	Date/Time

(2)

- c. Considering that the field 'ISBN' is a thirteen-digit number, why is it set to Text and **not** Number?

(1)

- d. Besides the 'Book' table, which **TWO** other tables would you create for the University library database?

(2)

- e. State the primary key you would assign for the three tables.

(3)

- f. Describe **ONE** validation method you would assign to one of the fields in the BOOK table. Justify your answer.

(2)

- g. By using SQL instructions, create a simple query to produce a list showing only the book titles under the category 'Technology'.

(2)

- h. Draw an Entity Relationship Diagram (ERD), using the Crow's Foot notation, that includes:

- tables together with their fields;
- indication of the primary keys and foreign keys;
- relationships between the tables showing their cardinality and optionality constraints.

[Entity Relation Diagram here]

(6)

(Total: 20 marks)

7. Up until recently, the Internet was only used by users. Nowadays, appliances, gadgets and other digital devices can communicate together, through the Internet of Things (IoT).

For example, the user can have an app on his smartphone that is connected to the Air Conditioner (AC) at home. The AC is connected to the home's Internet account and so can respond to commands coming from the user's app.



<https://bit.ly/3a8zEV2>

The AC contains various components, some of which are the:

- **humidity sensor:** input device which reads the amount of water in the air;
- **front display screen:** output device which shows controls, properties, etc.;
- **heating element:** output device which heats up the air;
- **blower:** output device which circulates air in the room.

- a. What is the difference between data and information?

(1)

- b. By using the scenario of controlling the AC through the smart phone, provide suitable examples to justify your answer in part a.

(2)

- c. The diagram shown below displays how the temperature sensor controls the AC.



- i. Temperature is said to be analogue data. Distinguish between analogue and digital data.

(1)

- ii. Why is the ADC step required?

(1)

- iii. Mention **ONE** advantage and **ONE** disadvantage for having a low sampling rate during the ADC step.

(2)

- d. The AC has an option to display the ambient temperature in Celsius (C) or Fahrenheit (F).

This feature is programmed in a user-defined function called:

```
temp_convert (String tempUnit, float tempValue)
```

This function accepts a temperature value in Fahrenheit (F) or Celsius (C), converts it and displays the converted temperature.

Design a flowchart that represents the algorithm for this function.

The conversion formulas are:

- $C = (F - 32) \times 0.56$
- $F = (1.8 \times C) + 32$

Flowchart here

(6)

- e. The smartphone app called 'AirTouch 3' is an app that can be downloaded for free from Google Play and App Store.

- i. Is AirTouch 3 an off-the shelf or a tailor-made type of software? Explain your answer.

(2)

- ii. What type of software license is required for the Air Touch 3? Explain your answer.

(2)

- f. 'AirTouch 3' is coded in Java programming language, whilst the AC is programmed in Assembly language.

- i. Provide **ONE** difference between JAVA and Assembly language.

(1)

ii. Would you recommend coding the smartphone app in Assembly language? Explain your answer.

(2)

g. Besides the scenario mentioned above, mention and briefly describe another example of the IoT.

(2)

(Total: 22 marks)

8. Android announced their latest Embedded Operating System (OS), Android 9 PIE, in August 2018. Android OS is generally used on smartphones, smartwatches and tablets.



<https://www.androidjungles.com/android-p/>

a. Distinguish between General-Purpose and Embedded OS.

(1)

b. Would you suggest a desktop computer used by a professional video editor to be equipped with an embedded OS? Justify your answer.

(2)

c. Android 9 makes use of a Natural User Interface (NUI) that includes a new gesture navigation and an improved voice assistance. Explain why this user interface is appropriate for a smartphone.

(1)

d. Android OS is an open source OS. How is this different from a shareware license?

(1)

e. Android 9 PIE's minimum system requirements are as follows:

64-bit Quad Core 1 GHz CPU	512MB RAM	8GB Storage
-----------------------------------	------------------	--------------------

i. Explain the specifications **Quad Core** and **1GHz** in terms of CPU performance.

(2)

ii. Briefly explain the roles of the CPU components ALU and CU.

(2)

iii. Mention and briefly explain another factor that impacts CPU performance.

(2)

iv. Would a system with an 8-bit Address Bus be able to run Android 9 PIE? Explain your answer.

(2)

v. The internal storage of any device equipped with an Android OS must be **formatted** with an 'Ext4' **Filing System**. Briefly explain the use of the terms in bold.

(2)

vi. Mention **ONE** reason why one would choose a Solid-State Drive for storing an OS rather than a Hard Disk Drive.

(1)

- f. One of Android 9 PIE's new upgrade is a better navigation between running apps. Briefly describe how the OS manages the running of several apps.

(1)

- g. According to Android developers, Android OS does not use virtual memory by default for battery power conservation. However, the user can enable virtual memory from the device settings.

Briefly explain the purpose of virtual memory.

(1)

(Total: 18 marks)

END OF PAPER

Specimen Assessments: Controlled Paper MQF 2-3 – Marking Scheme



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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
MARKING SCHEME FOR SAMPLE CONTROLLED PAPER**

SUBJECT: Computing
PAPER: Level 2-3
DATE:
TIME: 2 Hours

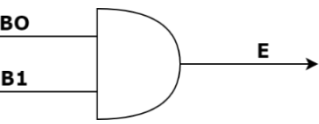
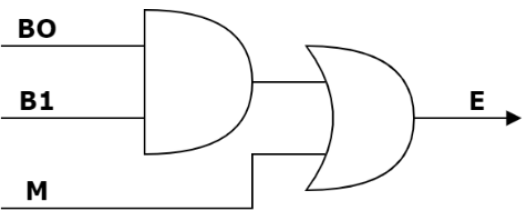
Section A			Marks	Comments
1.	a.	Input: Microphone and Camera; Output: Flash LED, Speaker.	2	½ mark each. Accept relevant answers.
	b.	Number of colours that each pixel can represent.	1	Accept relevant answers.
	c.	16 million colours.	1	
	d.	24x1242x2688 bits.	1	
	e.	The iPhone 11 Pro because it has a higher pixel density.	2	1 mark for iPhone 11 Pro, 1 mark for explanation. Accept any answer showing an understanding of pixel density.
	f.	Both types of user interfaces are correct if a reasonable explanation is given.	1	½ mark for choosing an interface, ½ mark for explanation.
Total: 8 marks				
2.	a.	More RAM allows users to run more applications concurrently OR allows for the smooth running of more resource hungry application like games, etc.	1	Accept relevant answers.
	b.	Memory card.	1	Do not accept online or cloud storage.
	c.	PC's ROM is used only to store start-up functions such as the BIOS.	1	Accept relevant answers.
	d.	Device limited dimensions (more portable) and battery consumption.	2	Accept relevant answers.
	e.	Air Conditioner, Car ECU, Smart TV, Smartphone, tablet, etc...	2	Accept relevant answers.
Total: 7 marks				
3.	a.	Mobile Data (3G/4G) because probably there was no WIFI hotspot nearby.	2	Accept relevant answers.
	b.	It can be accessed from all devices which are synced with the account, but a periodic fee must be paid for high storage capacity.	2	Accept relevant answers.

c.	The server stores the google drive's interface and data, whilst the client is the app or the website from where the user accesses personal data.		1	Accept relevant answers.
d.	i.	Cloud storage must be secured from any unauthorised access / hacking.	1	Accept relevant answers.
	ii.	IPv4 is a 32-bit address, whilst Ipv6 is a 128-bit address.	1	Accept relevant answers.
	iii.	Due to IoT, more combinations of different IP addresses are required.	1	Accept relevant answers.
e.	Both are Software as a Service (SaaS).		1	Accept relevant answers.

Total: 9 marks

4.	a.	Move arm up and out.	1	
	b.	$24_{10} = 011000_2$ which means that the arm moves down and in.	2	1 mark for converting to binary, 1 mark for action performed.
	c.	$4B_{16}$ is not a valid command because it causes a numerical overflow.	3	1 mark for converting to binary, 1 mark not a valid action, 1 mark for numerical overflow.

Total: 6 marks

5.	a.	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>B0</th> <th>B1</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	B0	B1	E	0	0	0	0	1	0	1	0	0	1	1	1	2	1 mark for input combinations, 1 mark for correct output.																				
	B0	B1	E																																				
	0	0	0																																				
	0	1	0																																				
1	0	0																																					
1	1	1																																					
b.		1																																					
c.	$E = B0 \cdot B1$	1	Accept also $E = B0$ and $B1$																																				
d.	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>B0</th> <th>B1</th> <th>M</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>  $E = (B0 \cdot B1) + M$	B0	B1	M	E	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	0	0	1	1	1	1	6	<p>1 mark for correct input combinations in truth table, 1 mark for correct output in truth table, 1 mark for correct inputs and output in circuit, 1 mark for correct gates used, 1 mark for correct inputs and output in Boolean expression, 1 mark for correct derived overall expression.</p> <p>Accept also $E = (B0 \text{ and } B1) \text{ or } M$.</p>
B0	B1	M	E																																				
0	0	0	0																																				
0	0	1	1																																				
0	1	0	0																																				
0	1	1	1																																				
1	0	0	0																																				
1	0	1	1																																				
1	1	0	0																																				
1	1	1	1																																				

Total: 10 marks

Section B			Marks	Comments														
6.	a.	Less data redundancy and more flexibility in accessing data.	2	Accept relevant answers.														
	b.	<p>BOOK Table</p> <table border="1"> <thead> <tr> <th>Fields</th> <th>Data Types</th> </tr> </thead> <tbody> <tr> <td>Title</td> <td>Text</td> </tr> <tr> <td>ISBN</td> <td>Text</td> </tr> <tr> <td>Date Published</td> <td>Date/Time</td> </tr> <tr> <td>Category</td> <td>Text</td> </tr> <tr> <td>Shelf Number</td> <td>Text</td> </tr> <tr> <td>Date Acquired</td> <td>Date/Time</td> </tr> </tbody> </table>	Fields	Data Types	Title	Text	ISBN	Text	Date Published	Date/Time	Category	Text	Shelf Number	Text	Date Acquired	Date/Time	2	½ mark for each correct answer.
Fields	Data Types																	
Title	Text																	
ISBN	Text																	
Date Published	Date/Time																	
Category	Text																	
Shelf Number	Text																	
Date Acquired	Date/Time																	
	c.	ISBN is not a field which can be arithmetically processed.	1															
	d.	Student and Loan tables.	2	Accept relevant answers.														
	e.	ISBN for books, ID OR Mob Number for Members, Loan Index for Loans.	3	Accept relevant answers.														
	f.	Date acquired cannot be more than current date OR ISBN must be a 13 digit only number etc.	2	1 mark for validation method. 1 mark for rational explanation.														
	g.	SELECT Title FROM Book WHERE Category = "Technology"	2	½ mark for using correct SQL commands. ½ mark for using proper fields. 1 mark for proper condition.														
	h.		6	½ mark each table with proper fields. ½ mark each Primary Key. ½ mark each cardinality. ½ mark each optionality. Accept alternative but correct fields in the STUDENT and LOAN tables.														
Total: 20 marks																		
7.	a.	Data is raw, unorganized facts that need to be processed. Information is processed, organised or structured data that is useful to the user.	1	Accept relevant answers.														
	b.	Data: values gathered from Humidity Sensor; Information: Info displayed on the front display screen.	2	Accept relevant answers.														
	c.	i. Analogue is raw data, real data, and digital data is a sample extracted from the real data.	1	Accept relevant answers.														

	ii.	Because the AC's CPU can only process digital data.	1	Accept relevant answers.
	iii.	Low sampling rate results in low quality digital data which however takes less storage capacity.	2	Accept relevant answers.
d.	<pre> graph TD START([START]) --> Decision{tempUnit = Celsius?} Decision -- YES --> Process1[Temperature = (tempValue*1.8) + 32] Decision -- NO --> Process2[Temperature = (tempValue - 32) * 0.56] Process1 --> Output[/Display Temperature/] Process2 --> Output Output --> END([END]) </pre>		6	<p>½ mark for start. ½ mark for end. 1 mark for correct decision. 1 mark for each correct process. 1 mark for correct output. 1 mark for correct symbols / overall flowchart.</p>
e.	i.	Off-the-Shelf because it is a readymade software common to all users who own an AC.	2	1 mark for off-the-shelf, 1 mark for explanation. Accept relevant answers.
	ii.	Freeware because the user would have already paid for it when purchasing the AC.	2	1 mark for freeware, 1 mark for explanation. Accept relevant answers.
f.	i.	JAVA is a high-level language whilst Assembly is a low-level language. OR Java allows the possibility for software portability whilst Assembly is machine dependent etc.	1	Accept relevant answers.
	ii.	No, because of platform compatibility.	2	Accept relevant answers in terms of both a YES and a NO reply.
g.		IP Camera that can be accessed and interfaced from any digital device that has access to the Internet.	2	Accept relevant answers.
Total: 22 marks				
8.	a.	General-purpose OS is used in devices that can perform several unrelated tasks. Embedded OS is used in embedded systems that can perform only one task or several related tasks.	1	Accept relevant answers.
	b.	No because the computer needs to have an OS that can handle several hardware resources and the running of several applications which perform different tasks.	2	Accept relevant answers.
	c.	NUI is appropriate because of the smartphone's portable nature which makes it usable also in situations where hands free mode is required.	1	Accept relevant answers.
	d.	Open Source lets the user use and modify the code for free, while shareware allows the user to use the software for a limited time only.	1	

e.	i.	Quad Core means that the CPU has 4 independent internal CPU units. 1Ghz is the speed measurement of each internal CPU.	2	Accept relevant answers.
	ii.	ALU performs arithmetic and logical operations when the Control Unit requires it to execute instructions. CU controls the fetching and the executing of instructions.	2	
	iii.	Word length because the larger it is, the more bits of instructions the CPU can handle per cycle.	2	Accept relevant answers.
	iv.	No, because it can directly access 2^8 (256) byte addressable locations whilst Android 9 PI requires 512MB of RAM.	2	1 mark for answering no, 1 mark for proper explanation.
	v.	Formatting is done by a specialised software utility that creates the storage file structure that is compatible with the OS. The Filing Structure is where the OS stores the files and their properties.	2	Accept relevant answers.
	vi.	SSD has a faster file access rate than a Hard Disk Drive.	1	
f.	The OS gives time slices to each app and uses a technique, such as Round Robin or Priority-scheduling.	1	Accept relevant answers.	
g.	Virtual memory is used as an extension of RAM when the CPU requires more memory space than is available.	1	Accept relevant answers.	
Total: 18 marks				

Specimen Assessments: Private Candidates Paper Level 1-2-3

L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
PRIVATE CANDIDATES SAMPLE PAPER**

SUBJECT: Computing
PAPER: Level 1 - 2 - 3
DATE:
TIME: 2 Hours

Directions to Candidates

Answer **all** questions in the space provided.

You are **not** allowed to use any 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.

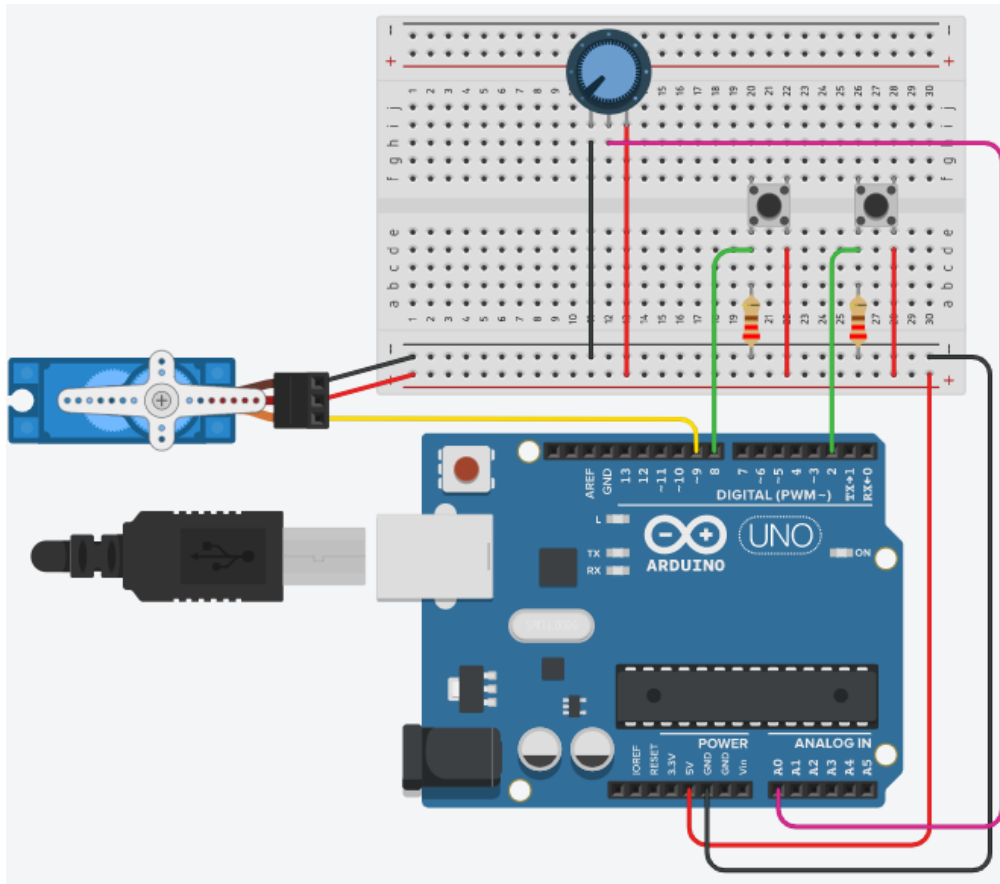
Section A

Side car mirrors are nowadays electronically controlled. The below Arduino project simulates the horizontal movement of a side car mirror. The potentiometer switches the system on and off, whilst the switches rotate the servo (mirror) left and right.

Analyse the circuit and the program below and answer the following questions.



<https://bit.ly/2T45BrX>



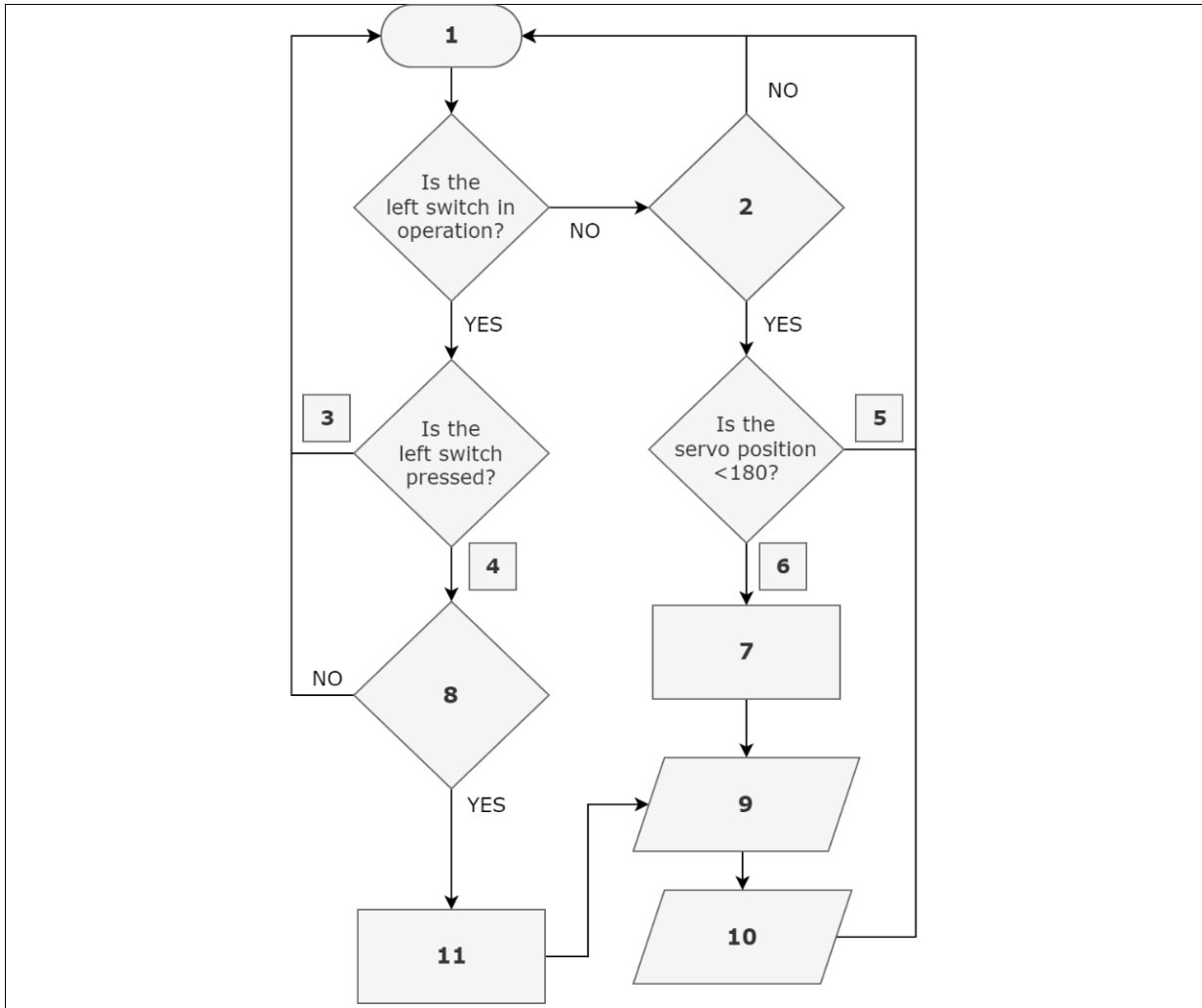
```

1:
2:  #include <Servo.h>
3:
4:  int leftSwitch = ____;
5:  int rightSwitch = ____;
6:  int pot = A0;
7:
8:  Servo mirror;
9:
10: int pos = 90;
11:
12: //establishing pinmodes for any input and output component
13: //opening communication channel if needed and
14: //initialise servo position
15: void setup(){
16:     pinMode(leftSwitch, INPUT);
17:     _____;
18:     mirror.attach(9);
19:     _____;
20:     mirror.write(pos);
21: }
22:
23: void loop(){
24:     if (toggle_mode() == true){
25:         if(digitalRead(leftSwitch) == HIGH && (pos > 0)){
26:             pos--;
27:             mirror.write(pos);
28:             Serial.print(pos);
29:             Serial.println("deg");
30:         }
31:
32:         if(digitalRead(rightSwitch) == HIGH && (pos < 180)){
33:             pos++;
34:             mirror.write(pos);
35:             Serial.print(pos);
36:             Serial.println("deg");
37:         }
38:     }
39: }
40:
41: _____
42: boolean toggle_mode (){
43:     int potValue = analogRead(pot);
44:     potValue = map(potValue, 0, 1023, 0, 1);
45:     if (potValue == 1)
46:         return true;
47:     else
48:         return false;
49: }
50:

```


- a. Mention **ONE** construct used in the above program snippet which is related to:
- i. arithmetic process: _____ (1)
 - ii. condition: _____ (1)
 - iii. decision: _____ (1)
 - iv. input: _____ (1)
 - v. library import: _____ (1)
 - vi. output: _____ (1)
 - vii. user-defined function: _____ (1)
 - viii. variable initialisation: _____ (1)
- b. Refer to the circuit diagram and complete the following lines:
- i. line 4: _____ (1)
 - ii. line 5: _____ (1)
- c. Write the missing statement in line 17. Explain. _____ (2)
- d. Write the missing statement in line 19. Explain. _____ (2)
- e. Justify the reason why the potentiometer is connected to pin A0 and not to pin 11. _____ (1)
- f. Explain what is happening in line 8. _____ (1)
- g. What is the initial position of the Servo? _____ (1)
- h. Which line number is moving the Servo to its initial position when the program runs? _____ (1)

i. Complete the flowchart below that represents the function loop().



- 1: _____ (1)
- 2: _____ (1)
- 3: _____ (1)
- 4: _____ (1)
- 5: _____ (1)
- 6: _____ (1)
- 7: _____ (1)
- 8: _____ (1)
- 9: _____ (1)
- 10: _____ (1)
- 11: _____ (1)

j. Ideally programming practises are adhered to when developing a code, such as the use of comments to briefly explain a routine or part-routine of a code.

i. Name **TWO** other good programming practises.

_____ (2)

ii. Write a missing comment in line 41.

_____ (1)

k. Which data type is function `toggle_mode()` declared?

_____ (1)

l. Outline the purpose of the function `toggle_mode()` in relation to how the circuit works.

_____ (1)

m. It is observed that the `map` function in line 44 may not be required. Why is this so?

_____ (1)

n. What changes are required in line 45, if line 44 is removed?

_____ (1)

o. Draw the flowchart that represents function `toggle_mode()`.

Flowchart here

_____ (8)

- p. It was observed that the statements in lines 27, 28 and 29 are repeated in lines 34, 35 and 36.
- i. Create a user-defined function, called `move_mirror`, that performs the action of these three lines.

(3)

- ii. Complete line 9 of the program snippet below:

```

1: void loop(){
2:     if (toggle_mode() == true){
3:         if(digitalRead(leftSwitch) == HIGH && (pos > 0)){
4:             pos--;
5:         }
6:         if(digitalRead(rightSwitch) == HIGH && (pos < 180)){
7:             pos++;
8:         }
9:         _____
10:    }
11: }

```

(1)

(Total: 48 marks)

Section B

A lottery is a game in which players pay for a ticket, select a group of numbers and win prizes based on how they match the drawn results.



- a. Write a program that simulates a lottery system according to the rules below. Marks are awarded for code efficiency throughout.
- i. The program should start by displaying an adequate message on the screen to show the user that the lottery prize is €500,000. (1)
 - ii. The lottery prize should be stored in a variable. (1)
 - iii. Five lottery numbers are randomly drawn and are not visible to the user. The numbers should be between 1 and 45. (5)
 - iv. Lottery numbers drawn should not contain duplicate numbers. *The random.sample() function should not be used.* (2)
 - v. The user is asked to purchase ONE lottery ticket, by inputting five numbers. (6)
 - vi. Lottery ticket inputted should not contain duplicate numbers. (3)
 - vii. Calculate the amount of numbers guessed. (3)
 - viii. According to the numbers guessed, a prize is won: (10)
 - With three numbers guessed, the user wins 10% of the lottery prize.
 - With four numbers guessed, the user wins 25% of the lottery prize.
 - With five numbers guessed, the user wins lottery prize in full.
 - With less than three numbers guessed, the use does not win a prize.
 - ix. At the end, the program should display the numbers drawn, the amount of numbers guessed, and the prize won (if applicable). (4)
 - x. The user-interface should be neatly presented. (2)
- b. Proper use of data-structures. (4)
- c. Code Modularity (the use of user-defined functions). (3)
- d. Use proper inline comments. (2)
- e. Use proper code indentation. (2)

- f. Use proper and meaningful variable names. (2)
- g. The program can compile and run. (1)
- h. Save your work in a folder called q3_2020_indexnumber. For example: q3_2020_0012. (1)

(Total: 52 marks)

END OF PAPER

Specimen Assessments: Private Candidates Paper Level 1 – 2 – 3 Marking Scheme



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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
MARKING SCHEME FOR PRIVATE CANDIDATES SAMPLE PAPER**

SUBJECT: Computing
PAPER: Level 1 – 2 – 3
DATE:
TIME: 2 Hours

Section A				
Question	Suggested Answer	Marks	Comments	
a.	i.	pos-- or pos++ or map() function	1	
	ii.	toggle_mode == true	1	Accept relevant answers such as digitalRead(leftSwitch) == HIGH or pos < 180, etc.
	iii.	If – Else	1	
	iv.	digitalRead() or analogRead()	1	
	v.	#include	1	
	vi.	.write() or Serial.println()	1	
	vii.	toggle_mode()	1	
	viii.	int pos= 90;	1	
b.	i.	int leftSwitch = 8;	1	Accept int leftSwitch = 2 as well if the answer in part b. (ii) is int leftSwitch = 8.
	ii.	int rightSwitch = 2;	1	Accept int leftSwitch = 8 as well if the answer in part b. (ii) is int leftSwitch = 2.
c.	pinMode(rightSwitch, INPUT); Here the user is declaring that pin 2 is going to be used for inputting data.	2	1 mark for correct line of code and 1 mark for correct explanation. Accept relevant answers.	
d.	Serial.begin(9600); Here the user is opening the serial communication channel between the Arduino and the device it is connected to.	2	1 mark for correct line of code and 1 mark for correct explanation. Accept relevant answers.	
e.	Potentiometer is an analogue component.	1	Accept relevant answers such as A0 is dedicated for the inputting of data from analogue components or that pin 11 is digital and hence not compatible.	

f.	An instance called mirror of library Servo is created.	1	Accept also answers related to accessing the library Servo.
g.	90 degrees.	1	
h.	Line 20.	1	
i.	1: Start 2: Is the right switch pressed? 3: No 4: Yes 5: No 6: Yes 7: Decrease servo position by 1 8: Is the servo position >0? 9: Turn the servo to the current position 10: Display the servo position 11: Increase servo position by 1	11	1 mark for each correct statement. Accept other relevant answers.
j.	i. Text indentation Meaningful variable / data structure / function names	2	1 mark for each mentioned good practice.
	ii. //The below function implements the use of the potentiometer as a toggle switch.	1	Accept relevant answers and make sure that the statement is a comment (the use of //).
k.	Boolean.	1	
l.	The function toggle determines whether the left or the right will be used.	1	Accept relevant answers.
m.	Potentiometer value 1023 can be used instead of value 1.	1	Accept relevant answers.
n.	if (potValue ==1023)	1	
o.	<pre> graph TD Start([START]) --> Read[/Read Potentiometer Value/] Read --> Convert[Convert Potentiometer values to a range 0-1] Convert --> Decision{Is converted value 1?} Decision -- YES --> ReturnTrue[Return TRUE] Decision -- NO --> ReturnFalse[Return FALSE] ReturnTrue --> End([END]) ReturnFalse --> End </pre>	8	1 mark for START. 1 mark for END. 1 mark for Input. 3 marks - 1 mark for each correct process. <i>Also accept responses similar to: "toggle to left switch" or "toggle to right switch" instead of "Return True" and "Return False".</i> 1 mark for Decision <i>Also accept value = 1023.</i> 1 mark for YES/NO indicators.
p.	i. <pre>void move_mirror() { mirror.write(pos); Serial.print(pos); Serial.println("deg"); }</pre>	3	1 mark for correct function name. 1 mark for a void function. 1 mark for correct instructions inside the function.
	ii. <pre>move_mirror();</pre>	1	
Total: 48 marks			

Section B			
Question	Marks	Comments	
a.	i.	1	
	ii.	1	
	iii.	5	2 marks for randomizing numbers. 1 mark for range 1 to 45. 2 marks for using a loop.
	iv.	2	1 mark for checking for non-duplicate numbers. 1 mark for using a loop.
	v.	6	1 mark for inputting numbers. 1 mark for range 1 to 45. 2 marks for using a loop. 1 mark for displaying adequate prompts. 1 mark for looping until a valid number is input.
	vi.	3	1 mark for checking for non-duplicate numbers. 2 marks for using a loop.
	vii.	3	1 mark for displaying numbers generated. 1 mark for displaying ticket numbers. 1 mark for displaying lottery status (prize or no prize).
	viii.	10	1 mark for each correct conditional statement. <i>This applies to each of the four possibilities listed in the question.</i> 1 mark for using nested if statements (rather than separate if statements). 2 marks for using a loop. 1 mark for appropriate use of a counter. 2 marks for calculating the percentage of the lottery price.
	ix.	4	1 mark for displaying the numbers drawn. 1 mark for displaying the amount of numbers guessed. 1 mark for displaying the appropriate message when no prize is won. 1 mark for displaying the appropriate message when prize is won.
	x.	2	1 mark if the interface includes carriage returns or borders or any other features to help the user distinguish at least some of the sections of the program. OR 2 marks if the interface includes carriage returns or borders or any other features to help the user distinguish all the sections of the program.
b.	4	2 marks if a data structure is used to store lottery numbers. 2 marks if a data structure is used to store ticket numbers.	
c.	3	2 marks for using user-defined function/s. 1 mark for appropriately calling the user-defined function/s.	
d.	2	1 mark if a few comments are used and not necessarily to help code readability and understanding. OR 2 marks if comments are intentionally done to help understanding of code.	
e.	2	1 mark if parts of code are property indented. OR 2 marks if all code is property indented.	

f.		2	1 mark if some of the variable names are given a meaningful name. OR 2 marks if all variable names are given a meaningful name.
g.		1	1 mark if program runs.
h.		1	1 mark for saving with filename as indicated.

Sample Solution:

```

from random import randint

#declare global vars and data structures
generated_nums = []
user_ticket = []
guessed = 0

#define function/s
def calculate_prize():
    prize = 0

    if guessed == 3:
        prize = 500000 * 0.1
    elif guessed == 4:
        prize = 500000 * 0.25
    elif guessed == 5:
        prize = 500000

    return int(prize) #type cast to prize to int

#start program
#generate 5 unique lottery numbers and store in list generated_nums
while len(generated_nums) < 5:
    number = randint(1, 45)
    if number not in generated_nums:
        generated_nums.append(number)

#show title
print("\n-----")
print("-- SUPER 5 LOTTERY --")
print("-----\n")
print("    Purchase Ticket\n")

#user enters five numbers
while len(user_ticket) < 5:
    user_input = int(input("Number " + str(len(user_ticket)+1) + ": "))
    if user_input in range(1,46): #if valid number
        if user_input not in user_ticket: #if number is not already chosen
            user_ticket.append(user_input) #add number to ticket
            #check if number guessed correctly

```

```
        if user_input in generated_nums:
            guessed +=1
        else:
            print(">> Number already chosen <<")
    else:
        print(">> INVALID NUMBER <<")

#display result screen
print("\n----- RESULT SCREEN ----- \n")

print("Numbers drawn: ", end = "")
for i in range(0, 5):
    print(generated_nums[i], " ", end = "")

print("\nNumbers gussed:", guessed)

if calculate_prize() != 0:
    print("Prize won: €", calculate_prize())
else:
    print("No Prize is won ... Better Luck Next Time!")
```

Total: 52 marks