

Cambridge IGCSE[™]

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		



COMPUTER SCIENCE

0478/21

Paper 2 Algorithms, Programming and Logic

May/June 2023

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer all questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do not write on any bar codes.
- Calculators must not be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].
- No marks will be awarded for using brand names of software packages or hardware.

1 (a) Four descriptions of stages in the program development life cycle are shown.

Draw **one** line to link each description to its most appropriate program development life cycle stage.

Not all program development life cycle stages will be used.

Pr	ogran	n developmeı	nt life cycle description	Program development life cycle stage)
		ing structure d	m to solve the problem iagrams, flowcharts or docode	analysis	
				coding	
	dete	ect and fix the	errors in the program	design	
	identi	ify the problen	n and its requirements	evaluation	
	write		ent the instructions to be problem	testing	
	(b)	Identify three	e of the component parts after a	problem has been decomposed.]
		2			
				[3	 3]
2		x (√) one box ne data type.	to show the name of the data s	ructure used to store a collection of data of th	е
	Α	Array			
	В	Constant			
	С	Function			
	D	Variable		[′]

(a)	Describe what is meant by data validation.
	[2
(b)	A validation check is used to make sure that any value that is input is an integer between 30 and 200 inclusive.
	Give one example of each type of test data to check that the validation check is working as intended. Each example of test data must be different.
	Give a reason for each of your choices of test data.
	Normal test data
	Reason
	Abnormal test data
	Reason
	Extreme test data
	Reason
	[6]
Exp	lain the purpose of the library routines DIV and ROUND
DIV	,
ROU	ND
	[4]

5 An algorithm has been written in pseudocode to allow some numbers to be input. All the positive numbers that are input are totalled and this total is output at the end.

An input of 0 stops the algorithm.

```
01 Exit \leftarrow 1
02 WHILE Exit <> 0 DO
03 INPUT Number
      IF Number < 0
05
        THEN
06
           Total \leftarrow Total + Number
07
       ELSE
8 0
          IF Number = 0
09
            THEN
10
              Exit \leftarrow 1
11
          ENDIF
12 ENDIF
13 ENDIF
14 OUTPUT "The total value of your numbers is ", Number
```

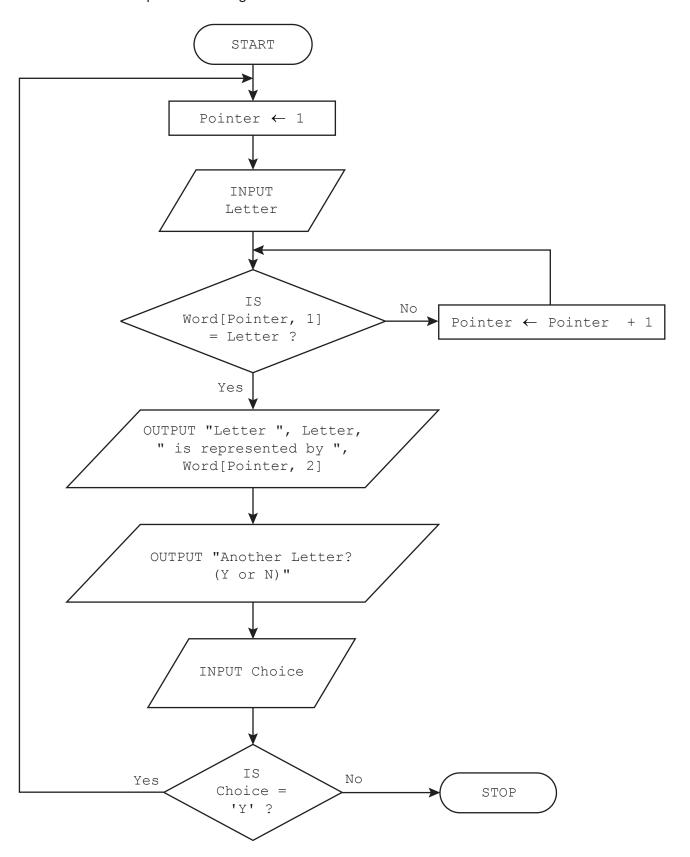
(a) Identify the **four** errors in the pseudocode and suggest a correction for each error.

Error 1
Correction
Error 2
Correction
Error 3
Correction
Error 4
Correction

[4]

	You do not need to rewrite the algorithm.	
Stat		
	te two features that should be included to create a maintainable program.	
Give	te two features that should be included to create a maintainable program.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	
Give	te two features that should be included to create a maintainable program. e a reason why each feature should be used.	

7 The flowchart represents an algorithm.



The table represents the two-dimensional (2D) array Word[] which stores the first half of the phonetic alphabet used for radio transmission. For example, Word[10,1] is 'J'.

Index	1	2
1	А	Alpha
2	В	Bravo
3	С	Charlie
4	D	Delta
5	Е	Echo
6	F	Foxtrot
7	G	Golf
8	Н	Hotel
9	I	India
10	J	Juliet
11	K	Kilo
12	L	Lima
13	М	Mike

(a) Complete the trace table for the algorithm by using the input data: F, Y, D, N

Pointer	Letter	Choice	OUTPUT

(b)	Identify the type of algorithm used.
	[1
(c)	Describe one problem that could occur with this algorithm if an invalid character was input.
	[2

BLANK PAGE

The	function LENGTH (Phrase) calculates the length of a string Phrase
(a)	 Write the pseudocode statements to: store the string "The beginning is the most important part" in Phrase calculate and output the length of the string output the string in upper case.
(b)	Write the output your pseudocode should produce.

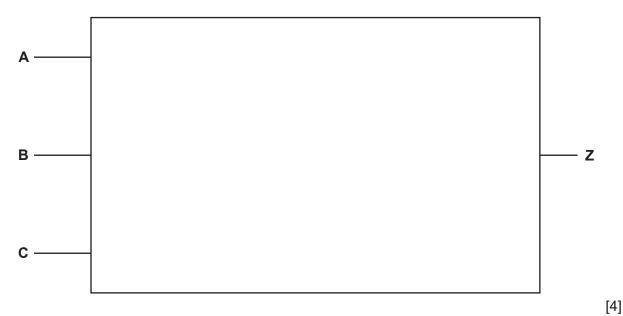
9 Consider this logic expression.

Z = (NOT A OR B) AND (B XOR C)

(a) Draw a logic circuit for this logic expression.

Each logic gate must have a maximum of **two** inputs.

Do not simplify this logic expression.



(b) Complete the truth table from the given logic expression.

Α	В	С	Working space	Z
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

10 A database table called TVRange shows the main features and prices of a range of televisions.

TVCode	ScreenSize	Satellite	SmartTV	SoundBar	Price\$
TV90SaSmSd	90	YES	YES	YES	9750.00
TV75SaSmSd	75	YES	YES	YES	8500.00
TV75SaSd	75	YES	NO	YES	8000.00
TV65SaSmSd	65	YES	YES	YES	6000.00
TV65SmSd	65	NO	YES	YES	5000.00
TV65SaSd	65	YES	NO	YES	5000.00
TV55SaSmSd	55	YES	YES	YES	4000.00
TV55SaSd	55	YES	NO	YES	3500.00
TV55SmSd	55	NO	YES	YES	3500.00
TV50SaSmSd	50	YES	YES	YES	2500.00
TV50Sa	50	YES	NO	NO	1750.00
TV50Sm	50	NO	YES	NO	1750.00
TV40Sa	40	YES	NO	NO	1200.00
TV40	40	NO	NO	NO	950.00
TV32	32	NO	NO	NO	650.00

State the reason for this choice.
Field
Reason

[2]

(a) Give the name of the field that is most suitable to be the primary key.

(b)	The database uses the data types:
. ,	• text
	 character
	 Boolean
	 integer
	• real
	date/time.

Complete the table to show the most appropriate data type for each field. Each data type must be different.

Field	Data type
TVCode	
ScreenSize	
SmartTV	
Price\$	

1	2	
		۰

(c)	Complete the structured query language (SQL) query to return the television (TV) code screen size and price of all Smart TVs in the database table.
	SELECT TVCode,,
	TVRange
	WHERE SmartTV =;

[4]

11	A one-dimensional (1D) array <code>Days[]</code> contains the names of the days of the week. A two-dimensional (2D) array <code>Readings[]</code> is used to store 24 temperature readings, taken once
	an hour, for each of the seven days of the week. A 1D array AverageTemp[] is used to store the average temperature for each day of the week.
	The position of any day's data is the same in all three arrays. For example, if Wednesday is

The position of any day's data is the same in all three arrays. For example, if Wednesday is in index 4 of <code>Days[]</code>, Wednesday's temperature readings are in index 4 of <code>Readings[]</code> and Wednesday's average temperature is in index 4 of <code>AverageTemp[]</code>

The temperature readings are in Celsius to one decimal place. Temperatures can only be from -20.0 °C to +50.0 °C inclusive.

Write a program that meets the following requirements:

- input and validate the hourly temperatures for one week
- calculate and store the average temperature for each day of the week
- calculate the average temperature for the whole week
- convert all the average temperatures from Celsius to Fahrenheit by using the formula Fahrenheit = Celsius * 9/5 + 32
- output the average temperature in Celsius and in Fahrenheit for each day
- output the overall average temperature in Celsius and in Fahrenheit for the whole week.

You must use pseudocode or program code and add comments to explain how your code works.

You do **not** need to declare any arrays, variables or constants; you may assume that this has already been done.

All inputs and outputs must contain suitable messages.

All data output must be rounded to one o	tecimal	place.
--	---------	--------

You will need to initialise and populate the array <code>Days[]</code> at the start of the program.

-

[15

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.