Algorithm design and problem-solving – 2021/20 O Level 2210

1. Nov/2021/Paper2/Paper_22/No.1a,b,d

All variables, constants and other identifiers must have meaningful names.

(a)	(i)	Identify one variable you could have used for Task 2 and state its use.
		Variable
		Use
		[2]
	(ii)	Describe the arrays you could have used in Task 1 . Include the name, data type, use and sample data for each array.
		[5]

(b)	Describe how you coustages of the journey is	data entry	for the input o	f the codes for	the different
					[3]

Explain how your program could be changed to count and store the number of booking made by each passenger. Then, after ten bookings have been made by a passenger, app an additional 10% discount to every future booking. Any programming statements used your answer must be fully explained.

2. Nov/2021/Paper2/Paper_22/No.2

Tick (✓) one box in each row to identify if the statement is about validation, verification or neither.

Statement	Validation (✓)	Verification (✓)	Neither (✓)
a check where data is re-entered to make sure no errors have been introduced during data entry			
an automatic check to make sure the data entered has the correct number of characters			
a check to make sure the data entered is sensible			
a check to make sure the data entered is correct			

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3. Nov/2021/Paper2/Paper_22/No.3

A program checks that the data entered is between 1 and 100 inclusive.

Identify **one** piece of normal, extreme and erroneous test data for this program, and give a reason for each.

Normal test data
Reason
Extreme test data
Reason
Erroneous test data
Reason

[6]

4. Nov/2021/Paper2/Paper 22/No.4a

The pseudocode algorithm should work as a calculator and output the result.

```
Continue \leftarrow 1
1
2
   WHILE Continue = 0
3
     OUTPUT "Enter 1 for +, 2 for -, 3 for * or 4 for /"
4
     INPUT Operator
     OUTPUT "Enter the first value"
5
6
     INPUT Value1
7
     OUTPUT "Enter the second value"
     OUTPUT Value2
9
     IF Operator
10
       1: Answer ← Value1 + Value2
       2: Answer ← Value1 - Value2
11
12
       3: Answer ← Value1 * Value2
13
       4: Answer ← Value1 / Value2
14
     ENDCASE
     OUTPUT "The answer is ", Value1
15
16
     OUTPUT "Do you wish to enter more values (Yes or No)?"
17
     INPUT MoreValues
     IF MoreValues = "No"
18
19
       THEN
20
         Continue \leftarrow 1
21
     ENDIF
22 UNTIL Continue = 0
```

(a)	Find the five errors in the pseudocode and suggest a correction for each error.
	Error 1
	Correction
	Error 2
	Correction
	Error 3
	Correction
	Error 4
	Correction
	Error 5
	Correction
	[5]

5. Nov/2021/Paper2/Paper_22/No.5

The flowchart represents an algorithm.

The algorithm will terminate if -1 is entered at the <code>List</code> input.

Complete the trace table for the algorithm using this input data:

2, 77, 2, 16, 1, 35, 2, -7, 5, 18, 1, 11, 1, 12, 2, 20, -1, 18

List	Value	List1	List2	OUTPUT

6. June/2021/Paper2/Paper_21/No.1.a.b.d

[5]

(a) All variables, constants and other identifiers must have meaningful names.

(i)	Identify one constant you could have used for Task 1 , give the value that would assigned to it and its use.	be
	Constant	
	Value	
	Use	
		[3]

	(ii)	Identify one variable and one array you could have used for Task 1 . Explain the use of each one.	
		Variable	
		Use	
		Array	
		Use	
			 [4]
(h)	Evn		
(6)		lain how you should change your program in Task 1 to allow a tutor to enter up to eig didates for the election.	ht
(13)			
(6)	can	didates for the election.	
(15)	can	didates for the election.	
(15)	can	didates for the election.	
(6)	can	didates for the election.	
(6)	can	didates for the election.	
(6)	can	didates for the election.	

- (d) Explain how your program completes these parts of Task 3:
 - Calculate the percentage of the votes that each candidate received from the number of votes cast, excluding abstentions.
 - Display the name of each candidate, the number of votes and the percentage of votes they received from the number of votes cast, excluding abstentions.
 - Display the total number of votes cast in the election and the number of abstentions.

Any programming statements used in your answer must be fully explained.
IN

7. June/2021/Paper2/Paper_21/No.2

Tick (\checkmark) one box in each row to identify if the statement is about validation, verification or both.

Statement	Validation (✓)	Verification (✓)	Both (✓)
Entering the data twice to check if both entries are the same.			
Automatically checking that only numeric data has been entered.			
Checking data entered into a computer system before it is stored or processed.			
Visually checking that no errors have been introduced during data entry.			

[3]

3.	June/2021/Paper2/Paper_21/No.3 Name and describe the most appropriate programming data type for each of the examples of data given. Each data type must be different.
	Data: 37
	Data type name
	Data type description
	Data: Cambridge2021
	Data type name
	Data type description

Data type name

Data type description

[6]

Data: 47.86

9. June/2021/Paper2/Paper_21/No.4a,c

The pseudocode algorithm shown has been written by a teacher to enter marks for the students in her class and then to apply some simple processing.

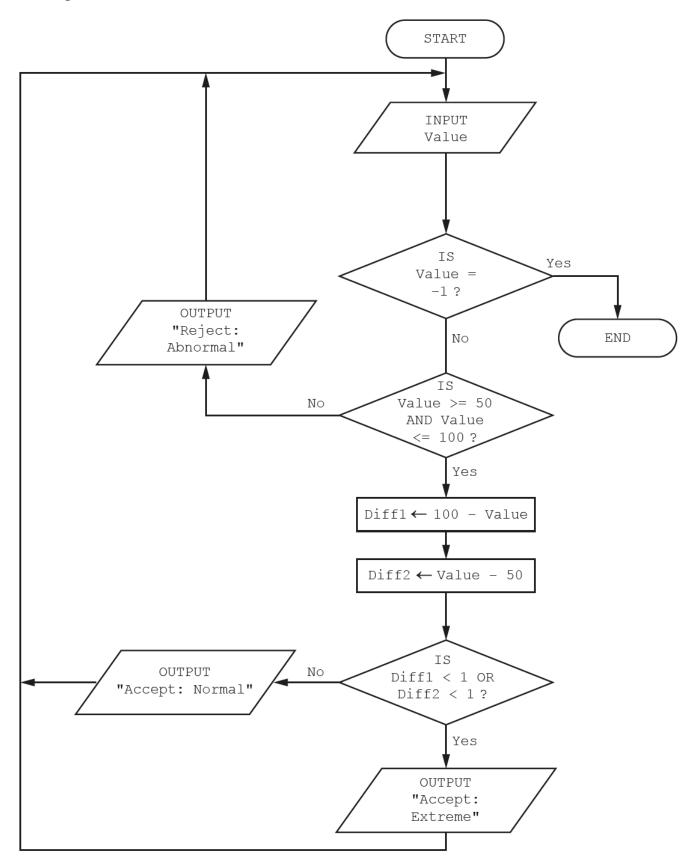
```
Count \leftarrow 0
REPEAT
  INPUT Score[Count]
  IF Score[Count] >= 70
    THEN
      Grade[Count] ← "A"
    ELSE
      IF Score[Count] >= 60
         THEN
           Grade[Count] ← "B"
         ELSE
           IF Score[Count] >= 50
             THEN
               Grade[Count] \leftarrow "C"
             ELSE
               IF Score[Count] >= 40
                  THEN
                    Grade[Count] ← "D"
                 ELSE
                    IF Score[Count] >= 30
                      THEN
                        Grade[Count] ← "E"
                      ELSE
                        Grade[Count] \leftarrow "F"
                    ENDIF
               ENDIF
           ENDIF
      ENDIF
  ENDIF
  Count \leftarrow Count + 1
UNTIL Count = 30
```

uj	Describe what happens in this algorithm.
	[3]
(c)	Describe how you could change the algorithm to allow teachers to use it with any size or class.
(c)	
(c)	class.

10. June/2021/Paper2/Paper_21/No.5

The flowchart represents an algorithm.

The algorithm will terminate if -1 is entered.



(a) Complete the trace table for the input data:

50, 75, 99, 28, 82, 150, -1, 672, 80

Value	Diff1	Diff2	OUTPUT

Γ	1	1
L	7	1

b)	Describe the purpose of the algorithm.
	[2]

11. June/2021/Paper2/Paper_22/No.1a,b,d

All ۱	variables, constants and other identifiers must have meaningful names.
(a)	Identify and give the data type and use of one array that you could have used for Task 1 .
	Array
	Data type
	Use[3]
(b)	Describe two validation checks that could be used when inputting the number of tickets to buy for Task 2 . For each validation check give one example of normal data and one example of erroneous data.
	Validation check 1
	Normal data
	Erroneous data
	Validation check 2
	Normal data

Erroneous data

[6]

(d)	Explain how your program completed Task 3 . Include any programming statements that you have used and fully explain the purpose of each statement.
	re-

- 12. June/2021/Paper2/Paper_22/No.3
 - (a) Draw the most appropriate flowchart symbol for each pseudocode statement.

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Flowchart symbol

IF Number = 20	
PRINT Number	
Number ← Number + 1	

[3]

(b) State the type of each pseudocode statement. For example, $X \leftarrow X + Y$ is totalling.

Number ← Number + 1
PRINT Number
IF Number = 20

[3]

13. June/2021/Paper2/Paper_22/No.4

This algorithm checks passwords.

- Each password must be 8 or more characters in length; the predefined function Length returns the number of characters.
- Each password is entered twice, and the two entries must match.
- Either Accept or Reject is output.
- An input of 999 stops the process.

```
REPEAT
  OUTPUT "Please enter password"
  INPUT Password
  IF Length(Password) >= 8
    THEN
      INPUT PasswordRepeat
      IF Password <> PasswordRepeat
        THEN
          OUTPUT "Reject"
        ELSE
          OUTPUT "Accept"
      ENDIF
    ELSE
      OUTPUT "Reject"
  ENDIF
UNTIL Password = 999
```

(a) Complete the trace table for the algorithm using this input data: Secret, Secret, VerySecret, VerySecret, Pa55word, Pa55word, 999, 888

Password	PasswordRepeat	OUTPUT

(b)	Explain how the algorithm could be extended to allow three attempts at inputting the match password. Any pseudocode statements used in your answer must be fully explained.	ning
		[N]

[3]

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A one-dimensional array dataArray[1:20] needs each element set to zero.

Write a pseudocode routine that sets each element to zero. Use the most suitable loop structure.
[3
 Explain why you chose this loop structure.
[1

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All variables, constants and other identifiers must have meaningful names.

(a)	(1)	Identify one array you could have used for Task 1 and state its purpose.	
		Array	
		Purpose	
			 [2]
	(ii)	Identify one variable you could have used for Task 2 and state its purpose.	
		Variable	
		Purpose	
			 [2]
	(iii)	Identify one constant you could have used for Task 3 and state its purpose.	
		Constant	
		Purpose	
			[2]
(b)	Ехр	lain the benefits of storing Price as a real data type.	
			[2]

(c)	Write an algorithm to show how you completed Task 1 , using either pseudocode, programming statements or a flowchart. It is not necessary to show initialisation or setting up of arrays in your answer.

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d)	Explain how your program completes Task 3 . Any programming statements used in your answer must be fully explained.
	5.43

9)	Describe how you could after your program to allow more than one computer to be boug	
		[2]

16. Nov/2020/Paper2/Paper_22/No.2

Tick (\checkmark) one box in each row to identify if the statement about subroutines is **true** or **false**.

Statement	true (✔)	false (✓)
A subroutine is called from within a program.		
A subroutine is not a complete program.		
A subroutine is a self-contained piece of code.		
A subroutine must return a value to the code from which it was called.		

[2]

17. Nov/2020/Paper2/Paper_22/No.3

This pseudocode algorithm is used as a validation check.

```
PRINT "Input a number from 1 to 5000"
REPEAT
  INPUT Number
  IF Number < 1 OR Number > 5000
      PRINT "Invalid number, please try again"
  ENDIF
UNTIL Number >= 1 AND Number <= 5000
PRINT Number, " is within the correct range"
```

Identify three different types of test data. For each type, give an example of the test data you would use to test this algorithm and state a reason for your choice of test.

Type of test data 1	 	 	
Test data	 	 	
Reason	 	 	
Type of test data 2	 	 	
Test data	 	 	
Reason	 	 	
Type of test data 3	 	 	
Test data	 	 	
Reason	 	 	
			[6]

18. Nov/2020/Paper2/Paper_22/No.5

This pseudocode represents an algorithm.

```
REPEAT
   Flag ← 0
FOR Count ← 0 to 3
    IF Num[Count] < Num[Count + 1]
        THEN
        Store ← Num[Count]
        Num[Count] ← Num[Count + 1]
        Num[Count + 1] ← Store
        Flag ← 1
        ENDIF
        NEXT Count
UNTIL Flag = 0</pre>
```

(a) The contents of the array at the start of the algorithm are:

Num[0]	Num[1]	Num[2]	Num[3]	Num[4]
45	56	30	12	15

Complete the trace table for the algorithm using the data given in the array.

Flag	Count	Num[0]	Num[1]	Num[2]	Num[3]	Num[4]	Store
		45	56	30	12	15	
							[5

(b)	Describe the purpose of the algorithm.	
		[2]

19. Nov/2020/Paper2/Paper_22/No.6

Draw a flowchart symbol to represent each of the following:

Input/Output	Decision

[2]

20. June/2020/Paper2/Paper_21/No.2

Tick (\checkmark) one box in each row to identify if the statement about structure diagrams is true or false.

Statement	True (√)	False (√)
A structure diagram is a piece of code that is available throughout the structure of a program.		
A structure diagram shows the hierarchy of a system.		
A structure diagram is another name for an array.		
A structure diagram shows the relationship between different components of a system.		

[2]

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Programs can perform validation and verification checks when data is entered.

(a)	Give the names of two different validation checks and state the purpose of each one.
	Check 1
	Purpose
	Check 2
	Purpose
	[4]
<i>a</i> \	
(b)	Give the name of one verification check.
	[1]
(c)	Describe the difference between validation and verification.
	[2]

22 . Jur	ne/2020	/Paper2	/Paper	21	/No.4
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The pseudocode algorithm shown should allow numbers to be entered and should allow 50 numbers to be stored in an array.

Count ← 0	
REPEAT	
INPUT Values[Count	[]
Count ← Count + 1	l
UNTIL Count = 0	

(a)	Explain why the algorithm will never end.	
		•••
		•••
		•••
		[2]
(b)	Re-write the original pseudocode so that it terminates correctly and also prevents number below 100 from being stored in the array $Values[\]$	rs
		•••
		•••
		[4]

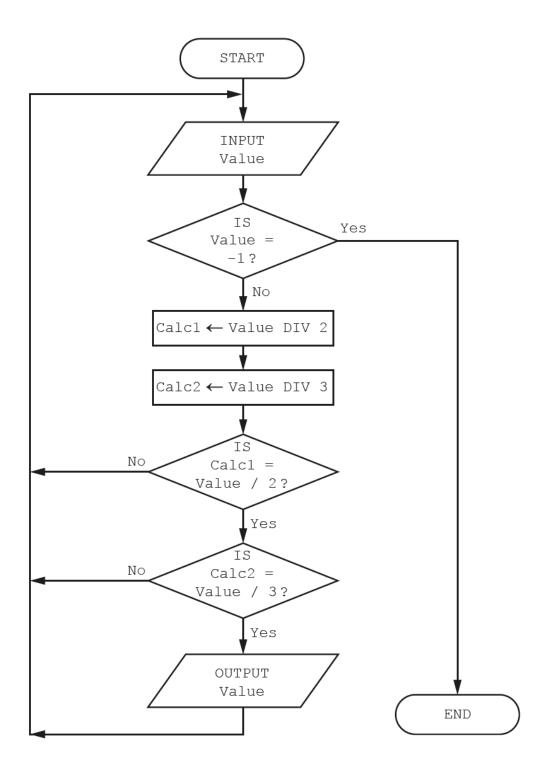
(c)	Describe how you could change your pseudocode in part (b) so that it prevents numbers below 100 and above 200 from being stored in the array Values []				
		^1			

23. June/2020/Paper2/Paper_21/No.5

The flowchart represents an algorithm.

The predefined function DIV gives the value of the result of integer division, for example, $y \leftarrow 9$ DIV 4 gives y a value of 2

An input value of -1 ends the algorithm.



(a) Complete the trace table for the input data:

50, 33, 18, 15, 30, -1, 45, 12, 90, 6

Value	Calc1	Calc2	OUTPUT

		[4]
b)	Describe the purpose of the algorithm.	
		[2]

24. June/2020/Paper2/Paper_22/No.2

Most programming languages include basic data types. Ahmad is describing the basic data types he has used.

State the data type that Ahmad is describing in each sentence.

Choose the data type from this list of programming terms.

Array	Boolean	Char	Constant	Functio	on Integer
Ite	ration I	Procedure	Real	String	Variable
		•			ed in calculations
Data type					
A whole numbe	r that can be p	positive, negative	e or zero an	d used in calc	ulations
Data type					
A single numbe	r, symbol or le	etter			
Data type					
A sequence of	characters				
Data type					
A data type with	n two values, ⁻	True or False			
Data type					[5]

25. June/2020/Paper2/Paper 22/No.3

(a) An algorithm has been written in pseudocode to input the names and marks of 35 students. The algorithm stores the names and marks in two arrays Name[] and Mark[]. The highest mark awarded is found and the number of students with that mark is counted. Both of these values are output.

```
01
    HighestMark ← 100
02
    HighestMarkStudents \leftarrow 0
03
    FOR Count \leftarrow 1 TO 35
04
        OUTPUT "Please enter student name"
05
        INPUT Name[Count]
06
        OUTPUT "Please enter student mark"
07
        INPUT Mark[Counter]
8 0
        IF Mark[Count] = HighestMark
09
           THEN
10
             HighestMarkStudents \leftarrow HighestMarkStudents - 1
11
        ENDIF
12
        IF Mark[Count] > HighestMark
13
           THEN
14
             Mark[Count] ← HighestMark
15
             HighestMarkStudents \leftarrow 1
16
        ENDIF
17
    NEXT Count
18
    OUTPUT "There are ", HighestMarkStudents," with the highest mark of ",
      HighestMark
```

correction for each error.

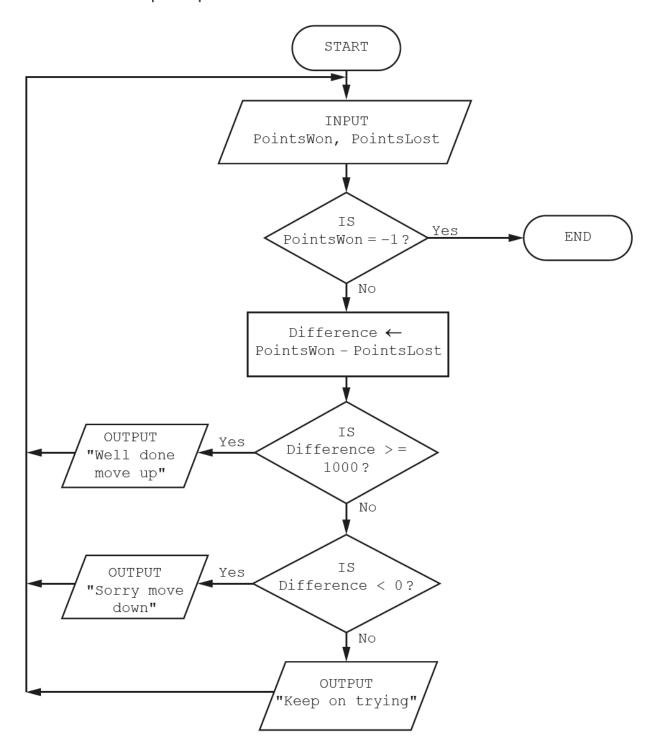
Give line numbers where the four errors are to be found in the pseudocode. Suggest a

Error 1 line number
Correction
Error 2 line number
Correction
Error 3 line number
Correction
Error 4 line number
Correction
[4]

1	Explain how you could extend the algorithm to also find the lowest mark awarded, count the number of students with that mark, and output both these values.
	le:

26. June/2020/Paper2/Paper_22/No.4

This flowchart inputs the points won and the points lost when playing a game. The difference between the points won and lost is calculated and depending on the result the player can: move up to the next level, stay at the same level, or move down to the previous level. The flowchart finishes when the input for points won is -1.



(a) Complete a trace table for this set of input data: 5000, 4474, 6055, 2000, 7900, 9800, 3000, 2150, -1, 6700, 7615

PointsWon	PointsLost	Difference	OUTPUT

[3]

b)	The flowchart needs to be changed. When the difference is more than 5000 the output message is 'Fantastic leap up two levels'.
	Describe the changes that will need to be made to the flowchart.