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AS - Computer Science 9618
Sir Aaqib Khan
Paper - 2

Topic: Trace Table of Pseudocode

Worksheet

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Class: As - Level

Question No. 1 By: Sir Aaqib Khan

6 The following pseudocode algorithm attempts to check whether a string is a valid email address.

```
FUNCTION IsValid(InString : STRING) RETURNS BOOLEAN
   DECLARE Index, Dots, Ats, Others : INTEGER
   DECLARE NextChar : CHAR
   DECLARE Valid : BOOLEAN

   Index ← 1
   Dots ← 0
   Ats ← 0
   Others ← 0
   Valid ← TRUE

   REPEAT
      NextChar ← MID(InString, Index, 1)
      CASE OF NextChar
         '.' : Dots ← Dots + 1
         '@' : Ats ← Ats + 1
               IF Ats > 1 THEN
                  Valid ← FALSE
               ENDIF
         OTHERWISE : Others ← Others + 1
      ENDCASE

      IF Dots > 1 AND Ats = 0 THEN
         Valid ← FALSE
      ELSE
         Index ← Index + 1
      ENDIF

   UNTIL Index > LENGTH(InString) OR Valid = FALSE

   IF NOT (Dots >= 1 AND Ats = 1 AND Others > 8) THEN
      Valid ← FALSE
   ENDIF

   RETURN Valid

ENDFUNCTION
```

counting variable

seperate each character

Stop Valid = FALSE OR Index > 12

(a) Part of the validation is implemented by the line:

```
IF NOT (Dots >= 1 AND Ats = 1 AND Others > 8) THEN
```

State the values that would result in the condition evaluating to `TRUE`.

Bracket content evalutes to FALSE if Dots < 1 OR Ats ≠ 1 OR OTHER < 9

Example :- Dots = 0 OR Ats = 2 OR OTHER = 7 [1]

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(b) (i) Complete the trace table by dry running the function when it is called as follows:

```
Result ← IsValid("Liz.123@big@net")
```

Index	NextChar	Dots	Ats	Others	Valid
		0	0	0	TRUE
1	L			1	
2	i			2	
3	z			3	
4	.	1			
5	1			4	
6	2			5	
7	3			6	
8	@		1		
9	b			7	
10	i			8	
11	g			9	
12	@		2		FALSE

[5]

(ii) State the value returned when `IsValid()` is called using the expression shown in **part (b)(i)**.

TRUE ..... [1]

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Question No. 2 By: Sir Aaqib Khan

5 Study the following pseudocode. Line numbers are for reference only.

```
10 PROCEDURE Encode()
11   DECLARE CountA, CountB, ThisNum : INTEGER
12   DECLARE ThisChar : CHAR
13   DECLARE Flag : BOOLEAN
14   CountA ← 0
15   CountB ← 10
16   Flag ← TRUE
17   INPUT ThisNum
18   WHILE ThisNum <> 0
19      ThisChar ← LEFT(NUM_TO_STR(ThisNum), 1)
20      IF Flag = TRUE THEN
21         CASE OF ThisChar
22            '1' : CountA ← CountA + 1
23            '2' : IF CountB < 10 THEN
24                     CountA ← CountA + 1
25                  ENDIF
26            '3' : CountB ← CountB - 1
27            '4' : CountB ← CountB - 1
28                  Flag ← FALSE
29            OTHERWISE : OUTPUT "Ignored"
30         ENDCASE
31      ELSE
32         IF CountA > 2 THEN
33            Flag ← NOT Flag
34            OUTPUT "Flip"
35         ELSE
36            CountA ← 4
37         ENDIF
38      ENDIF
39      INPUT ThisNum
40   ENDWHILE
41   OUTPUT CountA
42 ENDPROCEDURE
```

Loop Run UNTIL Num ≠ 0

Seperate each left integer

Flag = TRUE

COUNT A > 2

Flag = FALSE

COUNT A < 2

(a) Procedure `Encode()` contains a loop structure.

Identify the type of loop **and** state the condition that ends the loop.

Do **not** include pseudocode statements in your answer.

Type Pre conditional loop

Condition when the value of This Num is zero then loop stops.

[2]

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(b) Complete the trace table below by dry running the procedure `Encode()` when the following values are input:

`12, 24, 57, 43, 56, 22, 31, 32, 47, 99, 0`

The first row is already complete.

ThisNum	ThisChar	CountA	CountB	Flag	OUTPUT
		0	10	TRUE	
12	'1'	1			
24	'2'				
57	'5'				ignored
43	'4'		9	FALSE	
56	'5'	4			
22	'2'			TRUE	FLIP
31	'33'		8		
32	'33'		7		
47	'4'		6	FALSE	
99	'9'			TRUE	Flip
0					4

[6]

(c) Procedure `Encode()` is part of a modular program. Integration testing is to be carried out on the program.

Describe **integration testing**. → chp 12

Checking that all the modules are working correctly or not.

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[2]

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Question No. 3 By: Sir Aaqib Khan

5 A global 1D array of strings contains three elements which are assigned values as shown:

```
Data[1] ← "aaaaaa"
Data[2] ← "bbbbbb"
Data[3] ← "cccccc"
```

Procedure `Process()` manipulates the values in the array.

The procedure is written in pseudocode as follows:

```
PROCEDURE Process(Format : STRING)
    DECLARE Count, Index, L : INTEGER
    DECLARE Result : STRING
    DECLARE C : CHAR

    Result ← "****"

    FOR Count ← 1 TO LENGTH(Format) STEP 2
        C ← MID(Format, Count, 1)
        L ← STR_TO_NUM(MID(Format, Count + 1, 1))

        Index ← (Count + 1) DIV 2

        CASE OF C
            'X' : Result ← TO_UPPER(Data[Index])
            'Y' : Result ← TO_LOWER(Data[Index])
            'Z' : Result ← "**" & Data[Index]
        ENDCASE

        Data[Index] ← LEFT(Result, L)
    NEXT Count

ENDPROCEDURE
```

6

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(a) Complete the trace table by dry running the procedure when it is called as follows:

```
CALL Process("X3Y2W4")
```

Count	C	L	Index	Result	Data[1]	Data[2]	Data[3]
				"******"	"aaaaaa"	"bbbbbb"	"cccccc"
1	X	3	1	AAAAAA	"AAA"		
3	Y	2	2	"bbbbbb"		"bb"	
5	W	Y	3				"bbb"

[6]

(b) The procedure is to be modified. If variable `C` is assigned a value other than `'X'`, `'Y'` or `'Z'`, then procedure `Error()` is called and passed the value of variable `C` as a parameter.

This modification can be implemented by adding a **single line** of pseudocode.

(i) Write the single line of pseudocode.

Otherwise CALL Error(C) ..... [1]

(ii) State where this new line should be placed.

Before End Case ..... [1]

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Question No. 4 By: Sir Aaqib Khan

5 A global 1D array of integers contains four elements, which are assigned values as shown:

```
Mix[1] ⟵ 1
Mix[2] ⟵ 3
Mix[3] ⟵ 4
Mix[4] ⟵ 2
```

A procedure `Process()` manipulates the values in the array.

The procedure is written in pseudocode:

```
PROCEDURE Process(Start : INTEGER)
   DECLARE Value, Index, Count : INTEGER

   Index ⟵ Start
   Count ⟵ 0

   REPEAT
      Value ⟵ Mix[Index]
      Mix[Index] ⟵ Mix[Index] - 1
      Index ⟵ Value
      Count ⟵ Count + 1
   UNTIL Count = 5

   Mix[4] ⟵ Count * Index

ENDPROCEDURE
```

Complete the trace table on the opposite page by dry running the procedure when it is called as follows:

```
CALL Process(3)
```

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Index	Value	Count	Mix[1]	Mix[2]	Mix[3]	Mix[4]
			1	2	3	4
3		0				
4	4	1			3	
2	2	2				1
3	3	3		2		
3	3	4			2	
2	2	5			1	
						10

[6]

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Question No. 5 By: Sir Aaqib Khan

5 A global 1D array of integers contains four elements, which are assigned values as shown:

```
Mix[1] ← 4
Mix[2] ← 2
Mix[3] ← 3
Mix[4] ← 5
```

A procedure `Process()` manipulates the values in the array.

The procedure is written in pseudocode as follows:

```
PROCEDURE Process(Start : INTEGER)
   DECLARE Value, Index, Total : INTEGER

   Index ← Start
   Total ← 0

   WHILE Total < 20
      Value ← Mix[Index]
      Total ← Total + Value

      IF Index < 4 THEN
         Mix[Index] ← Mix[Index] + Mix[Index+1]
      ELSE
         Mix[Index] ← Mix[Index] + Mix[1]
      ENDIF
      Index ← (Value MOD 4) + 1

   ENDWHILE

   Mix[1] ← Total * Index

ENDPROCEDURE
```

Complete the trace table on the opposite page by dry running the procedure when it is called as follows:

```
CALL Process(2)
```

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Index	Value	Total	Mix[1]	Mix[2]	Mix[3]	Mix[4]
2		0	4	2	3	5
	2	2				
				5		
3						
	3	5				
					8	
4						
	5	10				
						9
2	5	15		13		
2	13					
		28				
				21		
2						
			56			

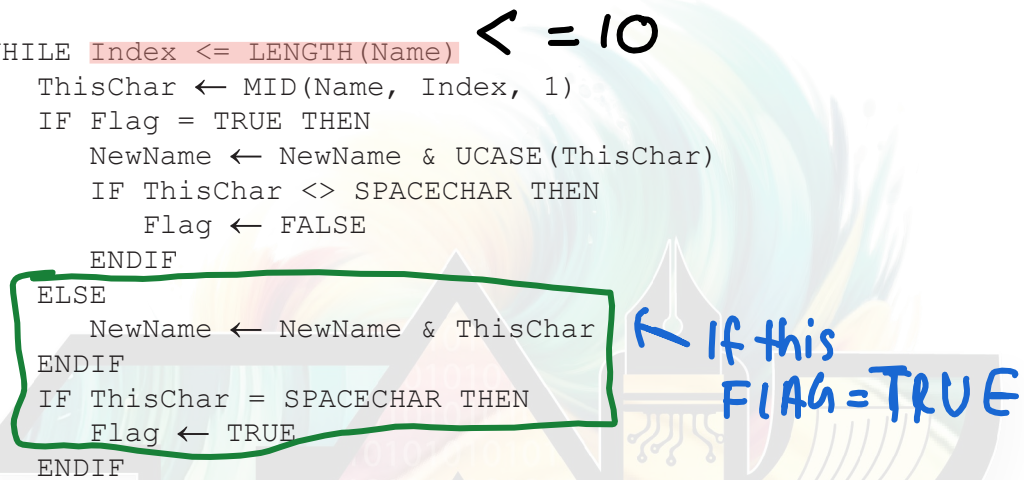
[6]

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Question No. 6 By: Sir Aaqib Khan

4 Study the following pseudocode. Line numbers are for reference only.

```
10 FUNCTION Convert(Name : STRING) RETURNS STRING
11
12   DECLARE Flag: BOOLEAN
13   DECLARE Index : INTEGER
14   DECLARE ThisChar : CHAR
15   DECLARE NewName : STRING
16
17   CONSTANT SPACECHAR = ' '
18
19   Flag ← TRUE
20   Index ← 1
21   NewName ← ""       // formatted name string
22
23   WHILE Index <= LENGTH(Name)
24      ThisChar ← MID(Name, Index, 1)
25      IF Flag = TRUE THEN
26         NewName ← NewName & UCASE(ThisChar)
27         IF ThisChar <> SPACECHAR THEN
28            Flag ← FALSE
29         ENDIF
30      ELSE
31         NewName ← NewName & ThisChar
32      ENDIF
33      IF ThisChar = SPACECHAR THEN
34         Flag ← TRUE
35      ENDIF
36      Index ← Index + 1
37   ENDWHILE
38
39   RETURN NewName
40
41 ENDFUNCTION
```



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(a) Complete the trace table below by dry running the function when it is called as follows:

```
Result ← Convert("∇in∇a∇∇Cup")
```

Note: The symbol '∇' has been used to represent a space character. Use this symbol for any space characters in the trace table.

The first row has been completed for you.

Name	Flag	Index	NewName	ThisChar
"∇in∇a∇∇Cup"	TRUE	1	""	∇
			∇	
	TRUE	2	"∇I"	'j'
	FALSE			
		3	"∇In"	'n'
		4		
	TRUE		"∇In∇"	'∇'
		5		'a'
	FALSE		"∇In∇A"	
		6		'∇'
	TRUE		"∇In∇A∇"	
		7		
			"∇In∇A∇∇"	
		8		
	FALSE		∇In∇A∇∇	
		9		'u'
		10		'p'
	FALSE	11	"∇In∇A∇Cup"	'p'

[5]

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(b) The pseudocode for `Convert()` contains a conditional loop.

State a more appropriate loop structure.

Justify your answer.

Loop structure ..... Count-controlled loop .....

.....

Justification ..... The number of iterations is known. .....

.....

.....

[2]

(c) Two changes need to be made to the algorithm.

Change 1: Convert to lower case any character that is not the first character after a space.
Change 2: Replace multiple spaces with a single space.

(i) Change 1 may be implemented by modifying one line of the pseudocode.

Write the modified line.

..... 24 ThisChar ← LCASE(MID Name, Index, 1) .....

.....[1]

(ii) Change 2 may be implemented by moving one line of the pseudocode.

Write the number of the line to be moved and state its new position.

Line number ..... 26 .....

New position ..... move to line 28. .....

.....

[2]

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