

1. Nov/2021//Paper_31/No.10

(a) State **three** essential features of **recursion**.

1

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2

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3

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[3]

(b) Explain the reasons why a stack is a suitable Abstract Data Type (ADT) to implement recursion.

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[3]

(c) Identify **two** ADTs **other** than a stack.

1

2

[2]

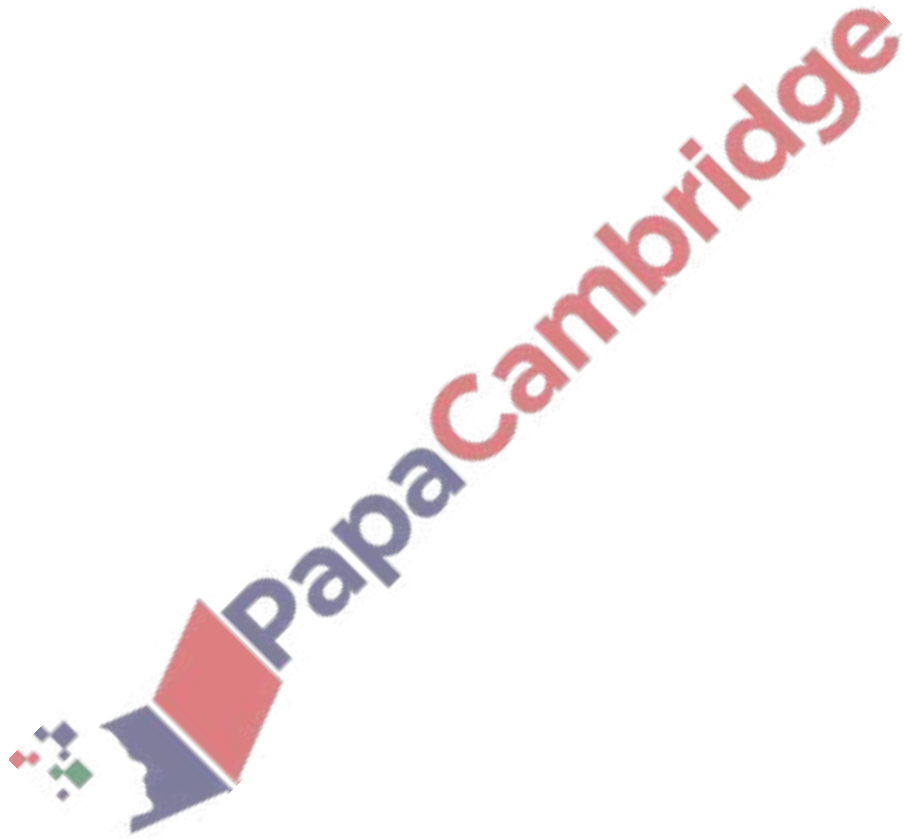
(a) State **two** factors that may affect the performance of a sorting algorithm.

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.....

.....

..... [2]



- (b) The given algorithm is a simple bubble sort that arranges a set of scores stored in a one-dimensional array into **descending** order, and orders the corresponding students' names stored into a two-dimensional array in the same order as the scores. All the arrays are indexed from 1.

The contents of both arrays after sorting are shown.

	Score
1	98
2	97
...	
248	5
249	3

	Name	
	1	2
1	Smithfield	Tom
2	Johnson	Jane
...		
248	Peters	Jade
249	Allen	John

```

YearSize ← 249
Flag ← TRUE
WHILE Flag = TRUE
    Flag ← FALSE
    FOR Student ← 1 TO YearSize - 1
        IF Score[Student] < Score[Student + 1] THEN
            Temp1 ← Score[Student]
            Temp2 ← Name[Student,1]
            Temp3 ← Name[Student,2]
            Score[Student] ← Score[Student + 1]
            Name[Student,1] ← Name[Student + 1,1]
            Name[Student,2] ← Name[Student + 1,2]
            Score[Student + 1] ← Temp1
            Name[Student + 1,1] ← Temp2
            Name[Student + 1,2] ← Temp3
            Flag ← TRUE
        ENDIF
    NEXT Student
ENDWHILE

```


(d) The function `StackFull()` checks whether a stack is full.

The function uses the variable `TopOfStack` to represent the pointer to the most recent position used on the stack, and the variable `Max` to represent the maximum size of the stack. Assume `TopOfStack` and `Max` are global variables.

```
FUNCTION StackFull() RETURNS BOOLEAN
    IF TopOfStack = Max THEN
        RETURN TRUE
    ELSE
        RETURN FALSE
    ENDIF
ENDFUNCTION
```


An algorithm `AddInteger` is required to add a new integer data element to a stack.

The stack is implemented as an array `ArrayStack`.

The function `AddInteger()` calls `StackFull()` and returns an appropriate message.

Complete the pseudocode for the function `AddInteger()`.

FUNCTION AddInteger(NewInteger: INTEGER) RETURNS STRING



ENDFUNCTION