CONTOUREDUCATION

VCE Specialist Mathematics ½
Logic & Algorithms I [2.4]
Test

24.5 Marks. 1 Minute Reading. 20 Minutes Writing.

<u>Results</u>:

Test Questions	_____ / 24.5

Section A: Test Questions (24.5 Marks)

Question 1 (2.5 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. Selections allow us to selectively perform an operation.	✓	
b. For loops can be used when we don't know how many loops it will exactly take to finish.		✗
c. Infinite loop can be created if the variable controlling the loop is updated within the operation of the loop.	✓	
d. Function can be defined to hold an algorithm and can be called within another algorithm.	✓	
e. List can be used to hold multiple values at once.	✓	

Handwritten notes in cell c:
$$x \leftarrow 51$$
$$\text{e.g } while \ x > 50$$
$$x \leftarrow 2x - 1$$

Space for Personal Notes

Question 2 (2 marks)

Turn the following hybrid function into an algorithm:

$$f(n) = \begin{cases} 1 - 2n, & \text{if } n \text{ is even} \\ 4, & \text{if } n = 5 \\ 2n + 1, & \text{otherwise} \end{cases}$$

Step 1: Input n.

Step 2: **If** n is even, **then** $y \leftarrow 1 - 2n$
         else if $n = 5$, **then** $y \leftarrow 4$
         else $y \leftarrow 2n + 1$.

Step 3: Print y.

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Question 3 (2 marks)

Write an algorithm to find the first six terms of the arithmetic sequence with the first term 19 and common difference 3.

Step 1: $T \leftarrow 19$ & $n \leftarrow 1$
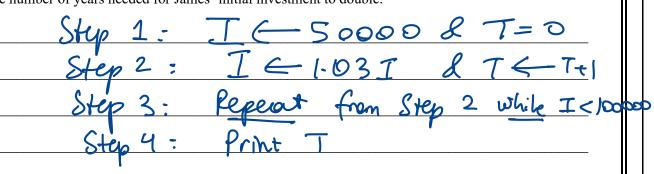
Step 2: Print n & Print T

Step 3: $T \leftarrow T + 3$ & $n \leftarrow n+1$

Step 4: Print n & print T

Step 5: Repeat from Step 3 while $n < 6$

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OR

$T \leftarrow 0$

for i from 1 to 6

$\quad T \leftarrow 19 + (i-1) \times 3$

$\quad$ Print T

end for

Question 4 (2 marks)

James decides to invest $50000 at an interest rate of 3% compounded annually. Construct an algorithm that outputs the number of years needed for James' initial investment to double.

Step 1: $I \leftarrow 50000$ & $T = 0$

Step 2: $I \leftarrow 1.03I$ & $T \leftarrow T+1$

Step 3:   Repeat from Step 2 while $I < 100000$

Step 4:   Print T

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$(1.03)^{23} * 50000 = 98679.3256$

$(1.03)^{24} * 50000 = 101639.705$

```
1  I = 50000
2  t = 0
3  while I < 100000:
4      I = 1.03 * I
5      t = t+1
6
7  print(t)
```

```
24

=== Code Execution Successful ===
```

Question 5 (6 marks)

Consider the sequence $3,5,7,9, ..., 2n + 1$.

Using pseudocode, write an algorithm to calculate:

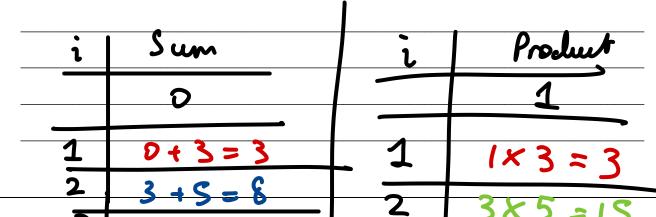**a.** The sum of the terms in this sequence. (2 marks)

```
input  n
sum ← 0
For i from 1 to n
        sum ← sum + (2i + 1)
End for
Print Sum
```

b. The product of the terms in this sequence. (2 marks)

```
input  n
product ← 1
For i from 1 to n
        product ← product × (2i + 1)
End for
Print Product
```

c. Provide a table of values to demonstrate each algorithm when $n = 3$. (2 marks)

i	Sum
	0
1	0 + 3 = 3
2	3 + 5 = 8
3	8 + 7 = 15

i	Product
	1
1	1 × 3 = 3
2	3 × 5 = 15
3	15 × 7 = 105

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Question 6 (3 marks)

Using pseudocodes, construct an algorithm for the following:

An algorithm that outputs the remainder of a division with a given input of number and divisor.

```
input number, divisor
remainder ← number
while remainder ≥ divisor
        remainder ← remainder−divisor
end while
print remainder
```

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Question 7 (4 marks)

Using pseudocodes, construct an algorithm for the following:

An algorithm that reads 3 numbers (a, b, c) and writes them in ascending order.

input a, b, c
    If $a \leq b$ and $a \leq c$, then
       If $b \leq c$, then
          Print (a, b, c) $(a, ,)$
       Else
          Print (a, c, b)
    End if

    Else If $b \leq a$ and $b \leq c$, then
       If $a \leq c$, then
          Print (b, a, c) $(b, ,)$
       Else
          Print (b, c, a)
    End if
    Else
       If $a \leq b$, then
          Print (c, a, b) $(c,)$
       Else
          Print (c, b, a)

Space for Personal Notes

Question 8 (3 marks)

Using pseudocode, write an algorithm to find the positive integer solutions of the equation.

$$43x + 17y + 7z = 200$$

```
1  for x in range(1,5):              (1, 1, 20)
2      for y in range(1,12):         (1, 8, 3)
3          for z in range(1,29):     (2, 3, 9)
4              if 43*x+17*y+7*z == 200:
5                  print((x,y,z))    === Code Execution Successful ===
6
```

_____

_____

_____

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