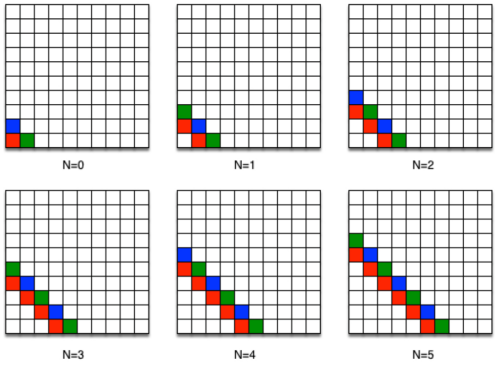
Algorithms

TOTAL POINTS 4

1. The following two questions refer to this figure: 1 point



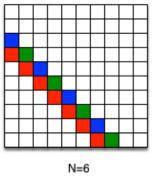
The diagrams shown above are the result of executing an algorithm with one parameter N, a non-negative integer, that colors boxes on a 10 by 10 grid. The patterns for values of N from 0 to 5 are given above.

Determine the algorithm that was used to draw these patterns and

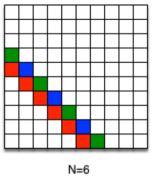
1. Write it down.
2. Execute it for N = 6, and write down your result.

Which of the following diagrams is the result?

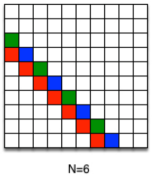
- (●) Pattern:



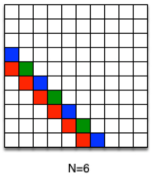
- ( ) Pattern:



- ( ) Pattern:



- ( ) Pattern:



2. Consider an algorithm for the pattern of squares. 1 point

```
Given a non-negative integer N:
  Start at the square (N,0), and color it red,
  Count from 0 to N (exclusive), and for each
  number that you count:
    Move 1 square left and 1 square up,
    Color the square red.
  Start again at the square (N+1,0), and color it
  green,
```

[omitted line]

```
    Move 1 square left and 1 square up,
    If i is even:
      Color the square blue,
    Otherwise:
      Color the square green.
```

Which one of the following lines would make the algorithm correct?

- ○ Count from 1 to N+1 (inclusive), and for each number that you count (call it "i"):
- ◉ Count from 0 to N+1 (exclusive), and for each number that you count (call it "i"):
- ○ Count from 1 to N+2 (exclusive), and for each number that you count (call it "i"):
- ○ Count from 0 to N (exclusive), and for each number that you count (call it "i"):

3. The numbers in the table below are the result of executing an algorithm that has one parameter N, a non-negative integer, and produces sequences of integers as outputs. For values of N from 0 to 5, the algorithm produces the following sequences of numbers as outputs: 1 point

N	output
0	
1	-1 0 3
2	-4 -3 0 5 12 21
3	-9 -8 -5 0 7 16 27 40 55
4	-16 -15 -12 -7 0 9 20 33 48 65 84 105
5	-25 -24 -21 -16 -9 0 11 24 39 56 75 96 119 144 171

Determine the algorithm that was used to generate the numbers in this table, and

1. Write it down.
2. Execute it for N = 6, and write down your result.

What is the sequence of numbers for N = 6?

(Give your answer as integers separated by single spaces.)

-36 -35 -32 -27 -20 -11 0 13 28 45 64 85 108 133 160 189 220 253

4. Which one of the following is a correct algorithm for the above numerical sequence? 1 point

- ◉ Algorithm:

```
1  Given a non-negative integer N:
2  Make a variable called x, and set it to -N*N.
3  Count from 1 to 3N + 1 (exclusive), and for each number that you count (call it
   'i'):
4      Write down the value of x.
5      Update x to be (x + 2i - 1).
```

- ○ Algorithm:

```
1  Given a non-negative integer N:
2  Make a variable called x, and set it to -N*N.
3  Count from 1 to 3N + 1 (exclusive), and for each number that you count (call it
   'i'):
4      Write down the value of x.
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- ○ Algorithm:

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   'i'):
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- ○ Algorithm:

```
1  Given a non-negative integer N:  Make a variable called x, and set it to -N*N.
   Count from 0 to 3N + 1 (exclusive), and for each number that you count (call it
   'i'):    Write down the value of x.    Update x to be (x + 2i).
```