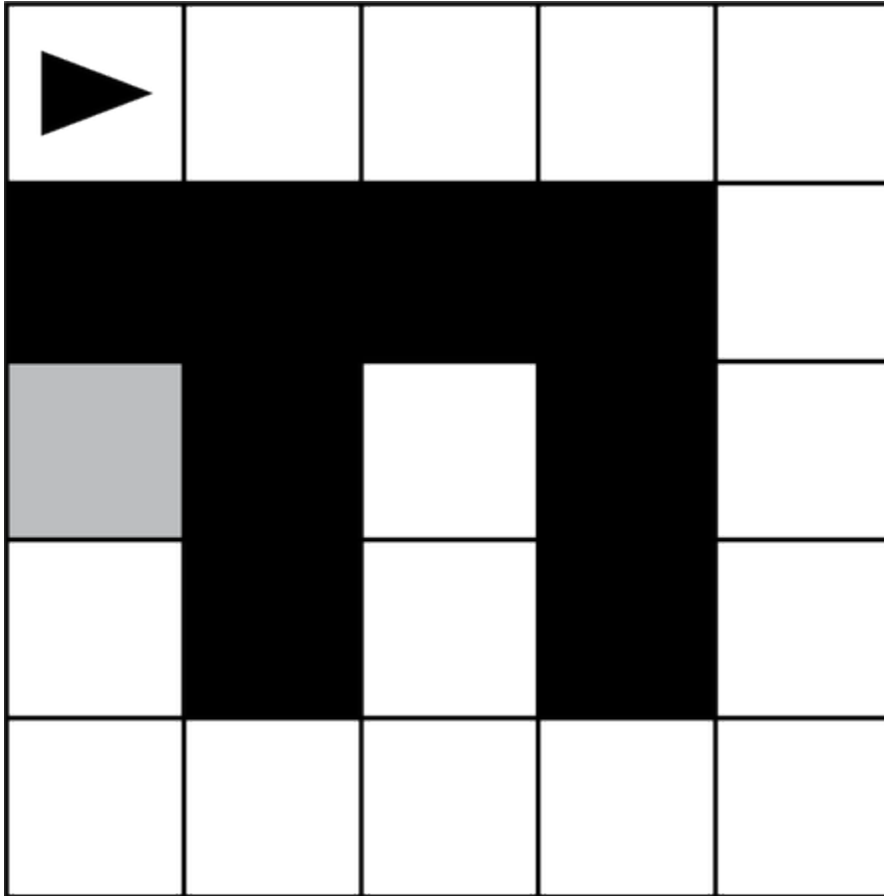


Exam Set 30

1. The grid below contains a robot represented as a triangle, initially facing right. The robot can move into a white or gray square but cannot move into a black region.



The code segment below uses the procedure GoalReached, which evaluates to true if the robot is in the gray square and evaluates to false otherwise.

```
REPEAT UNTIL (GoalReached ())  
{  
    <MISSING CODE>  
}
```

Which of the following replacements for <MISSING CODE> can be used to move the robot to the gray square?

Exam Set 30

```
REPEAT UNTIL (CAN_MOVE (forward) = false)
```

```
{
```

(A) ROTATE_RIGHT ()

```
}
```

```
MOVE_FORWARD ()
```

```
REPEAT UNTIL (CAN_MOVE (forward) = false)
```

```
{
```

(B) MOVE_FORWARD ()

```
}
```

```
ROTATE_RIGHT ()
```

```
REPEAT UNTIL (CAN_MOVE (right))
```

```
{
```

(C) ROTATE_RIGHT ()

```
}
```

```
MOVE_FORWARD ()
```

(D) REPEAT UNTIL (CAN_MOVE (right))

Exam Set 30

```
{  
  
    MOVE_FORWARD ()  
  
}  
  
    ROTATE_RIGHT ()
```

2. The following algorithm is intended to determine the average height, in centimeters, of a group of people in a room. Each person has a card, a pencil, and an eraser. Step 2 of the algorithm is missing.

Step 1: All people stand up.

Step 2: (missing step)

Step 3: Each standing person finds another standing person and they form a pair. If a person cannot find an unpaired standing person, that person remains standing and waits until the next opportunity to form pairs.

Step 4: In each pair, one person hands their card to the other person and sits down.

Step 5: At this point, the standing person in each pair is holding two cards. The standing person in each pair replaces the top number on their card with the sum of the top numbers on the two cards and replaces the bottom number on their card with the sum of the bottom numbers on the two cards. The sitting partner's card is discarded.

Step 6: Repeat steps 3–5 until there is only one person standing.

Step 7: The last person standing divides the top number by the bottom number to determine the average height.

Which of the following can be used as step 2 so that the algorithm works as intended?

- (A) Step 2: Each person writes their height, in centimeters, at the top of the card and writes the number 1 at the bottom of the card.
- (B) Step 2: Each person writes their height, in centimeters, at the top of the card and writes the number 2 at the bottom of the card.
- (C) Step 2: Each person writes the number 1 at the top of the card and writes their height, in centimeters, at the bottom of the card.
- (D) Step 2: Each person writes the number 2 at the top of the card and writes their height, in centimeters, at the bottom of the card.

Exam Set 30

3. A biologist wrote a program to simulate the population of a sample of bacteria. The program uses the following procedures.

Procedure Call	Explanation
InitialPopulation ()	Returns the number of bacteria at the start of the simulation
NextPopulation (currPop)	Based on the current value of currPop, returns the number of bacteria after one hour

Code for the simulation is shown below.

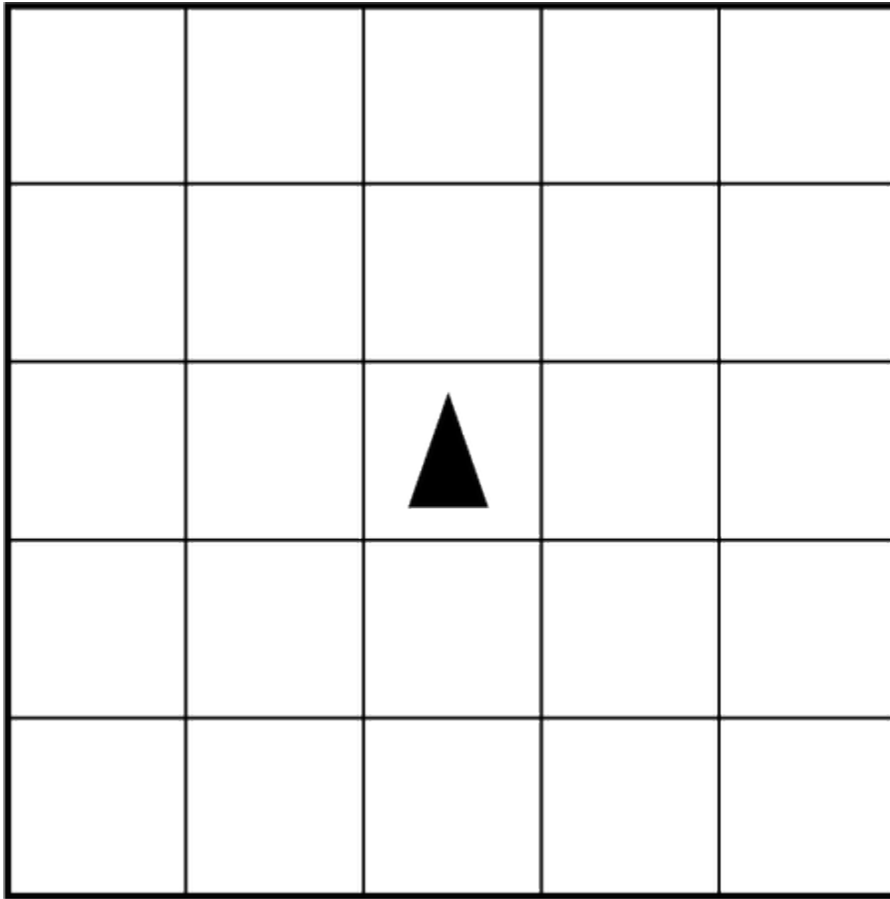
```
hours ← 0
startPop ← InitialPopulation ()
currentPop ← startPop
REPEAT UNTIL ((hours ≥ 24) OR (currentPop ≤ 0))
{
    currentPop ← NextPopulation (currentPop)
    hours ← hours + 1
}
DISPLAY (currentPop - startPop)
```

Which of the following are true statements about the simulation?

1. The simulation continues until either 24 hours pass or the population reaches 0.
 2. The simulation displays the average change in population per hour over the course of the simulation.
 3. The simulation displays the total population at the end of the simulation.
- (A) 1 only
(B) 2 only
(C) 3 only
(D) 1 and 2

Exam Set 30

4. The question below uses a robot in a grid of squares. The robot is represented as a triangle, which is initially in the center square and facing toward the top of the grid.



The following code segment is used to move the robot in the grid.

```
count ← 1
REPEAT 4 TIMES
{
  REPEAT count TIMES
  {
    MOVE_FORWARD()
  }
  ROTATE_LEFT()
  count ← count + 1
}
```

Which of the following code segments will move the robot from the center square along the same path as the code segment above?

Exam Set 30

count \leftarrow 0

REPEAT 4 TIMES

{

count \leftarrow count + 1

REPEAT count TIMES

(A)

{

MOVE_FORWARD()

}

ROTATE_LEFT()

}

count \leftarrow 0

REPEAT 4 TIMES

{

(B)

count \leftarrow count + 1

ROTATE_LEFT()

REPEAT count TIMES

{

Exam Set 30

```
    MOVE_FORWARD()
```

```
  }
```

```
}
```

```
count ← 0
```

```
REPEAT 4 TIMES
```

```
{
```

```
    REPEAT count TIMES
```

```
    {
```

(C)

```
        ROTATE_LEFT()
```

```
    }
```

```
    MOVE_FORWARD()
```

```
    count ← count + 1
```

```
}
```

```
count ← 0
```

```
REPEAT 4 TIMES
```

(D)

```
{
```

```
    ROTATE_LEFT()
```

Exam Set 30

```
REPEAT count TIMES

{

    MOVE_FORWARD()

}

count ← count + 1

}
```

5. **Directions:** The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

The code segment below is intended to display all multiples of 5 between the values `start` and `end`, inclusive. For example, if `start` has the value 35 and `end` has the value 50, the code segment should display the values 35, 40, 45, and 50. Assume that `start` and `end` are multiples of 5 and that `start` is less than `end`.

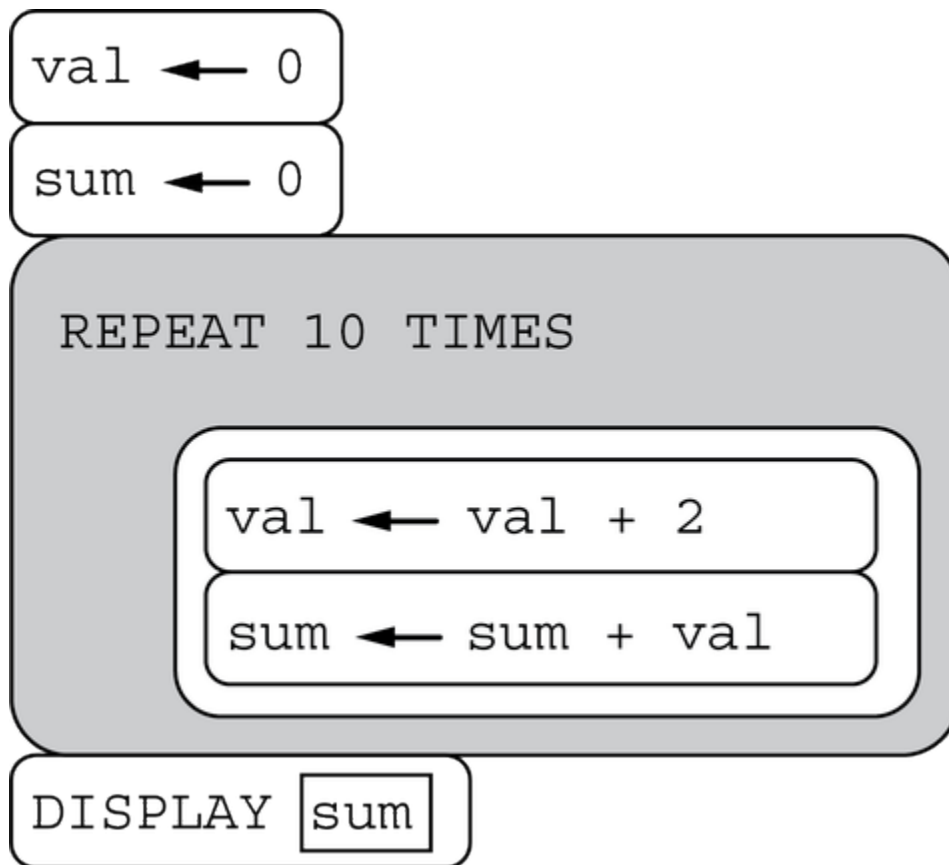
```
Line 1:  i ← start
Line 2:  REPEAT <MISSING EXPRESSION> TIMES
Line 3:  {
Line 4:      DISPLAY (i)
Line 5:      i ← i + 5
Line 6:  }
```

Which of the following could replace `<MISSING EXPRESSION>` in line 2 so that the code segment works as intended?

- (A) `end - start + 1`
- (B) `end - start + 6`
- (C) `((end - start) / 5) + 1`
- (D) `5 * (end - start) + 1`

Exam Set 30

6. Consider the following program.



Which of the following describes the result of executing the program?

- (A) The program displays the sum of the even integers from 2 to 10.
- (B) The program displays the sum of the even integers from 2 to 20.
- (C) The program displays the sum of the odd integers from 1 to 9.
- (D) The program displays the sum of the odd integers from 1 to 19.

Exam Set 30

7. A list of numbers has n elements, indexed from 1 to n . The following algorithm is intended to display true if the value target appears in the list more than once and to display false otherwise. The algorithm uses the variables position and count. Steps 4 and 5 are missing.

Step 1:

Set count to 0 and position to 1.

Step 2:

If the value of the element at index position is equal to target, increase the value of count by 1.

Step 3:

Increase the value of position by 1.

Step 4:

(missing step)

Step 5:

(missing step)

Which of the following could be used to replace steps 4 and 5 so that the algorithm works as intended?

Exam Set 30**Step 4**

Repeat steps 2 and 3 until the value of position is greater than n.

(A)

Step 5

If count is greater than or equal to 2, display true. Otherwise, display false.

Step 4

Repeat steps 2 and 3 until the value of position is greater than n.

(B)

Step 5

If count is greater than or equal to position, display true. Otherwise, display false.

Step 4

Repeat steps 2 and 3 until the value of count is greater than 2.

(C)

Step 5

If position is greater than or equal to n, display true. Otherwise, display false.

Step 4

Repeat steps 2 and 3 until the value of count is greater than n.

(D)

Step 5

If count is greater than or equal to 2, display true. Otherwise, display false.

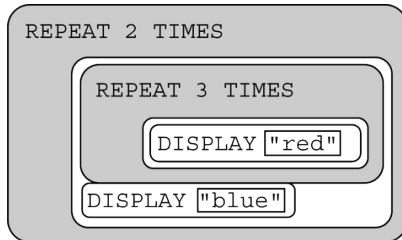
Exam Set 30

8. An algorithm is intended to display the following output.

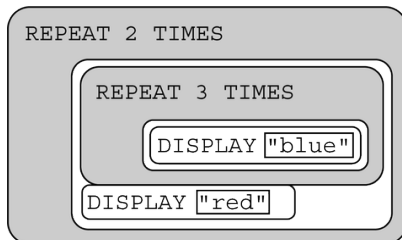
red red blue red red blue red red blue

Which of the following code segments can be used to display the intended output?

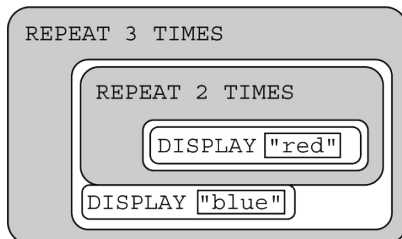
(A)



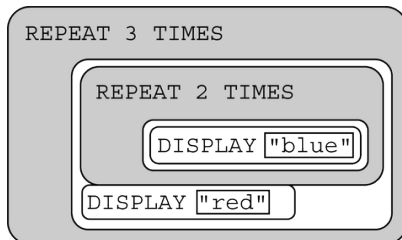
(B)



(C)



(D)

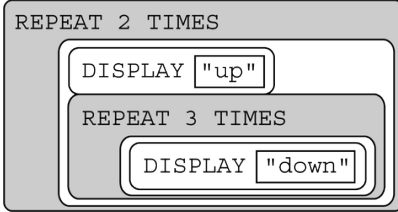
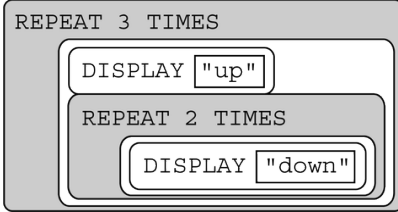
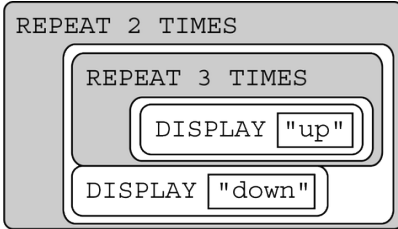
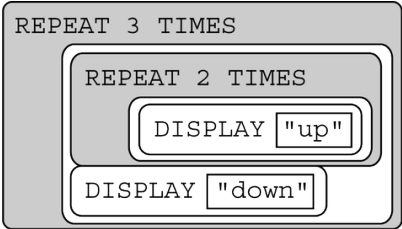


9. A code segment is intended to display the following output.

up down down down up down down down

Which of the following code segments can be used to display the intended output?

Exam Set 30

- (A) 
- (B) 
- (C) 
- (D) 

10. The following code segment is intended to remove all duplicate elements in the list myList. The procedure does not work as intended.

```

j ← LENGTH(myList)
REPEAT UNTIL(j = 1)
{
  IF(myList[j] = myList[j - 1])
  {
    REMOVE(myList, j)
  }
  j ← j - 1
}

```

For which of the following contents of myList will the procedure NOT produce the intended results?

Select 2 answers.

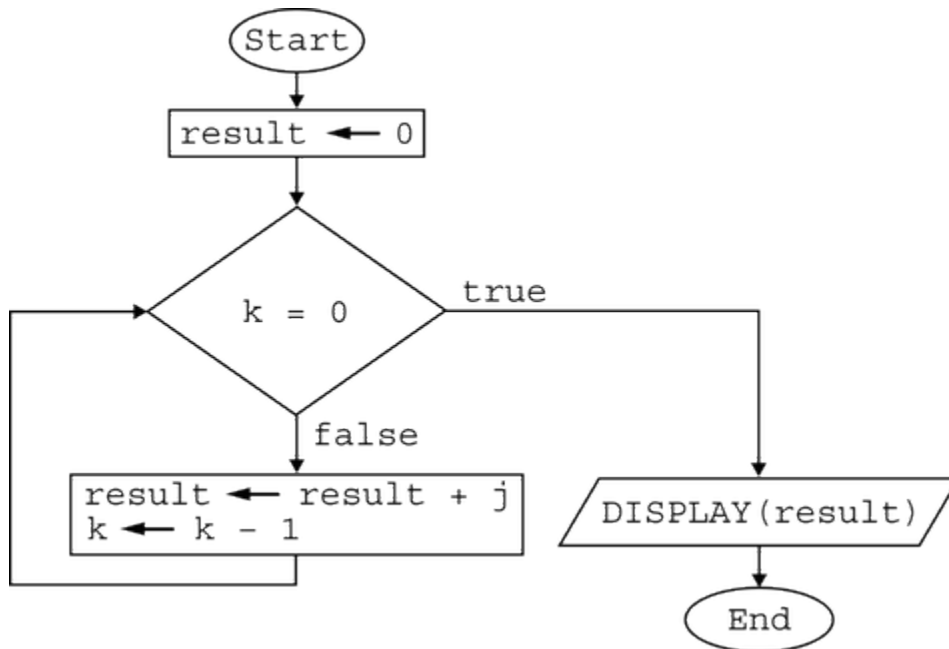
- (A) [10, 10, 20, 20, 10, 10]
 (B) [30, 30, 30, 10, 20, 20]
 (C) [30, 50, 40, 10, 20, 40]
 (D) [50, 50, 50, 50, 50, 50]

Exam Set 30

11. A flowchart provides a way to visually represent an algorithm and uses the following building blocks.

Block	Explanation
Oval	The start or end of the algorithm
Rectangle	One or more processing steps, such as a statement that assigns a value to a variable
Diamond	A conditional or decision step, where execution proceeds to the side labeled true if the condition is true and to the side labeled false otherwise
Parallelogram	Displays a message

In the flowchart below, assume that j and k are assigned integer values.

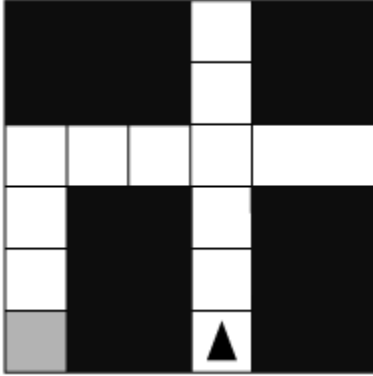


Which of the following initial values of j and k will cause the algorithm represented in the flowchart to result in an infinite loop?

- (A) $j = -5, k = 5$
- (B) $j = 0, k = 5$
- (C) $j = 5, k = 0$
- (D) $j = 5, k = -5$

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12. The grid below contains a robot represented as a triangle, initially facing toward the top of the grid. The robot can move into a white or gray square but cannot move into a black region.



The code segment below uses the procedure `goalReached`, which evaluates to true if the robot is in the gray square and evaluates to false otherwise.

```
REPEAT UNTIL(goalReached())  
{  
<MISSING CODE>  
}
```

Which of the following replacements for `<MISSING CODE>` can be used to move the robot to the gray square?

Exam Set 30

```
IF(CAN_MOVE(left))
```

```
{
```

(A) ROTATE_LEFT()

```
    MOVE_FORWARD()
```

```
}
```

```
IF(CAN_MOVE(forward))
```

```
{
```

(B) MOVE_FORWARD()

```
    ROTATE_LEFT()
```

```
}
```

```
IF(CAN_MOVE(left))
```

```
{
```

(C) ROTATE_LEFT()

```
}
```

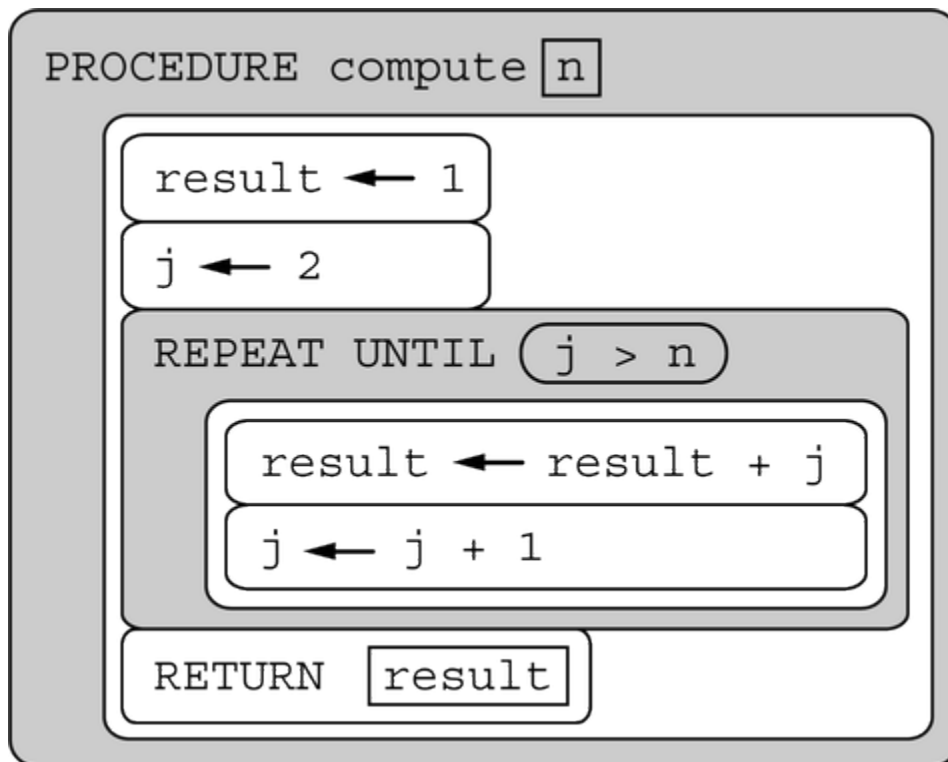
```
    MOVE_FORWARD()
```

(D) IF(CAN_MOVE(forward))

Exam Set 30

```
{  
    MOVE_FORWARD()  
}  
  
ELSE  
  
{  
    ROTATE_LEFT()  
}
```

13. In the following procedure, the parameter n is an integer greater than 2.



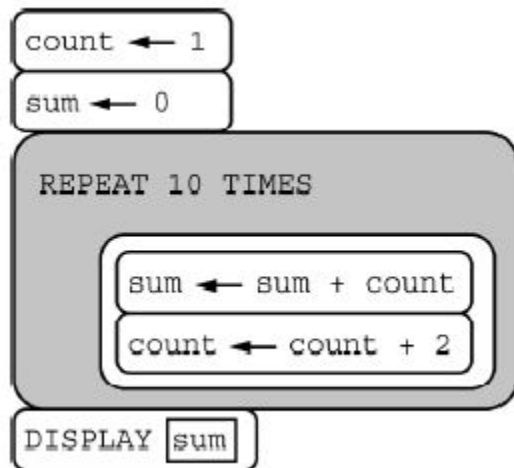
Which of the following best describes the value returned by the procedure?

Exam Set 30

- (A) The procedure returns nothing because it will not terminate.
- (B) The procedure returns the value of $2 * n$.
- (C) The procedure returns the value of $n * n$.
- (D) The procedure returns the sum of the integers from 1 to n .

14. Directions: The question or incomplete statement below is followed by four suggested answers or completions. Select the one that is best in each case.

Consider the following program.



Which of the following describes the result of executing the program?

- (A) The program displays the sum of the even integers from 0 to 10.
- (B) The program displays the sum of the even integers from 0 to 20.
- (C) The program displays the sum of the odd integers from 1 to 9.
- (D) The program displays the sum of the odd integers from 1 to 19.

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15. A game is played by moving a game piece left or right along a horizontal game board. The board consists of spaces of various colors, as shown. The circle represents the initial location of the game piece.

Yellow	Black	Green	Green	Red	Yellow	Black	Black	Yellow	Black
									●

The following algorithm indicates how the game is played. The game continues until the game is either won by landing on the red space or lost when the piece moves off either end of the board.

Step 1 Place a game piece on a space that is not red and set a counter to 0.

Step 2 If the game piece is on a yellow space, move the game piece 3 positions to the left and go to step 3.

Otherwise, if the game piece is on a black space, move the game piece 1 position to the left and go to step 3. Otherwise, if the game piece is on a green space, move the game piece 2 positions to the right and go to step 3.

Step 3 Increase the value of the counter by 1.

Step 4 If game piece is on the red space or moved off the end of the game board, the game is complete.

Otherwise, go back to step 2.

If a game is begun by placing the game piece on the rightmost black space for step 1, what will be the value of the counter at the end of the game?

- (A) 2
- (B) 3
- (C) 4
- (D) 5