

PARTICIPANT GUIDE

Robot Algorithms

Hook

1. [Computer Science Basics - Algorithms](#)

Watch this video and answer the question: What is an **algorithm**?

2. What does the AP® Exam robot look like? Watch [this video](#) and explain how the robot looks and how it works.

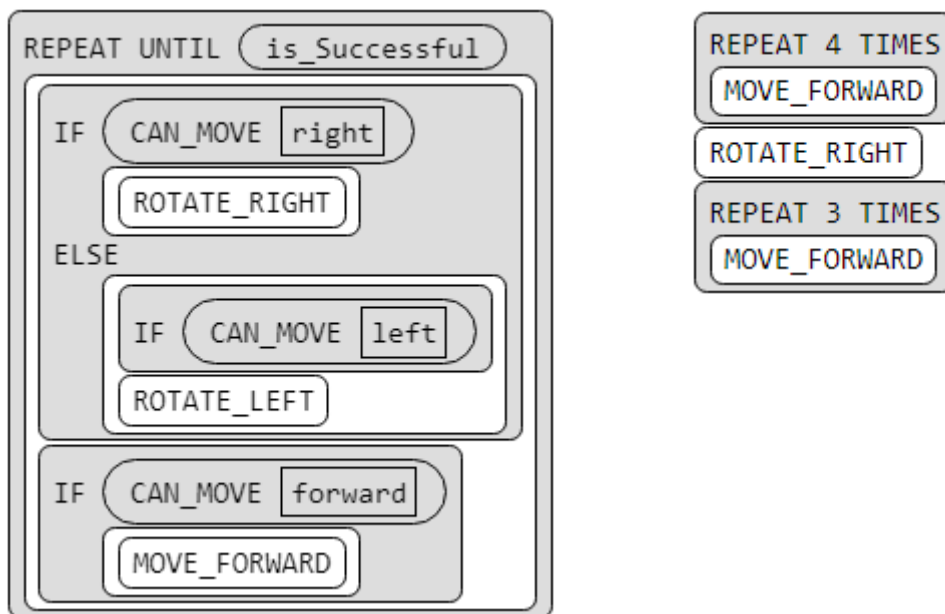
Mini Lesson 1: What can the robot do?

MOVE_FORWARD()	move forward 1 space
ROTATE_LEFT()	always 90 degrees, rotates in place, does not move
ROTATE_RIGHT()	always 90 degrees, rotates in place, does not move
CAN_MOVE(direction)	direction: right, left, forward, backward Evaluates to true if there is an open square one square in the direction relative to where the robot is facing; otherwise evaluates to false.

Mini Lesson 2

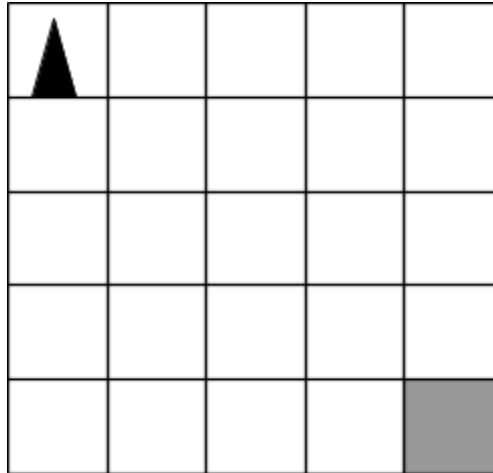
There is always more than one way to get to the goal. The AP® Exam gives one set of code, then asks if there is another way to get to the goal.

Study the following maze. The gray box is the goal. The robot cannot move into a black region.



Both sets of code take the robot to the goal.

Guided Problem-Solving Activities

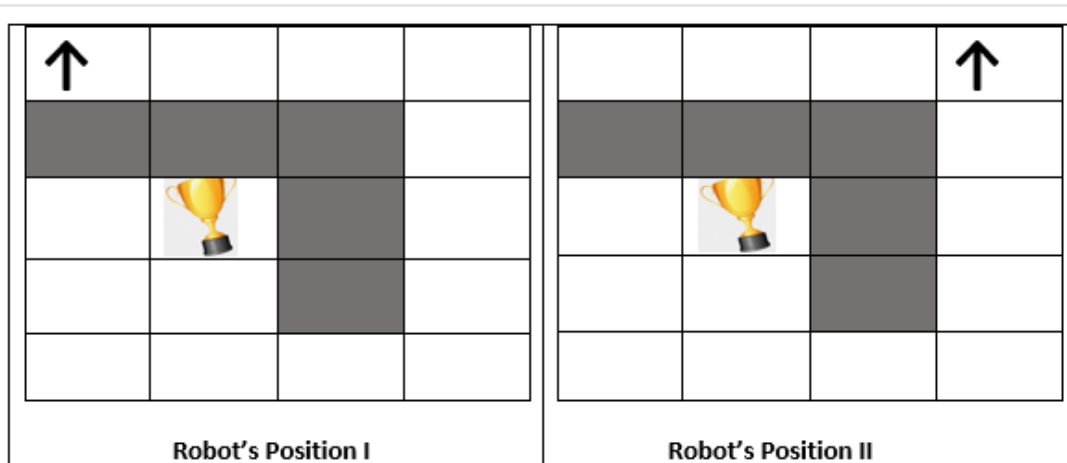


1. If you want the robot to end up in the bottom right square facing up, write steps, using pseudocode to complete this task.

Use the space below to write your response:

Consider the following program:

```
REPEAT UNTIL (foundGold())
{
  IF (CAN_MOVE(forward))
  {
    REPEAT UNTIL (NOT(CAN_MOVE(forward)))
    {
      MOVE_FORWARD()
    }
  }
  ELSE IF (CAN_MOVE(right))
  {
    ROTATE_RIGHT()
    REPEAT UNTIL (NOT(CAN_MOVE(forward)))
    {
      MOVE_FORWARD()
    }
  }
  ELSE
  {
    ROTATE_LEFT()
    REPEAT UNTIL (NOT(CAN_MOVE(forward)))
    {
      MOVE_FORWARD()
    }
  }
}
```

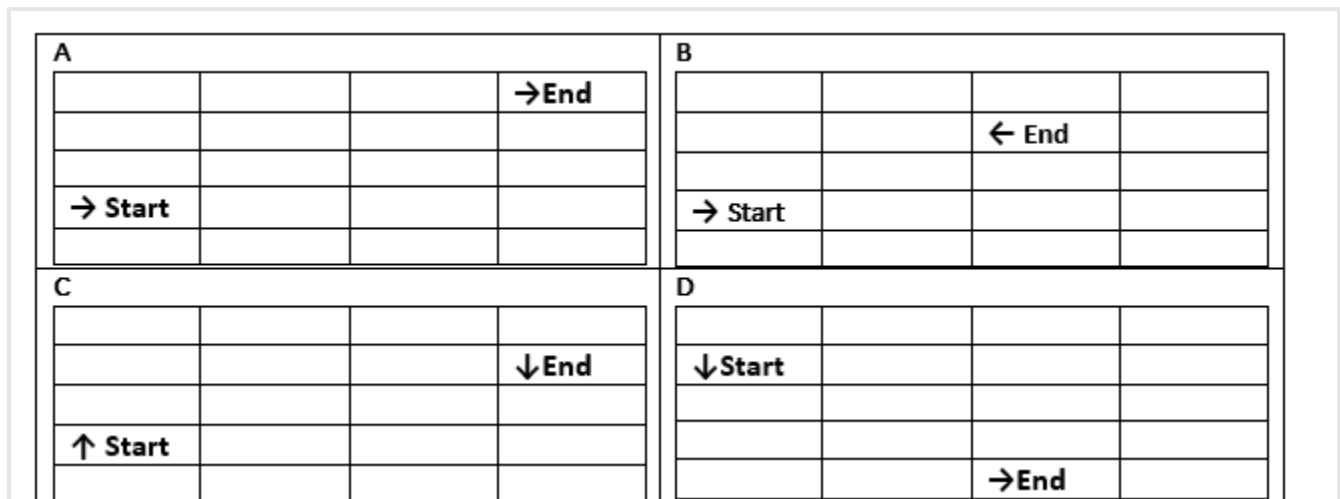


2. In which of the following starting positions could the robot be to capture the gold?
 - a. Either Position I or Position II
 - b. Neither Position I nor Position II

- c. Position I only
- d. Position II only

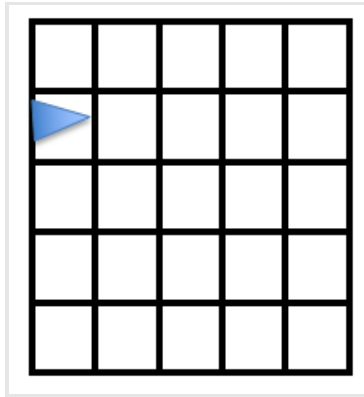
Consider the following code:

```
MOVE_FORWARD()
MOVE_FORWARD()
ROTATE_LEFT()
MOVE_FORWARD()
MOVE_FORWARD()
ROTATE_RIGHT()
MOVE_FORWARD()
ROTATE_LEFT()
```



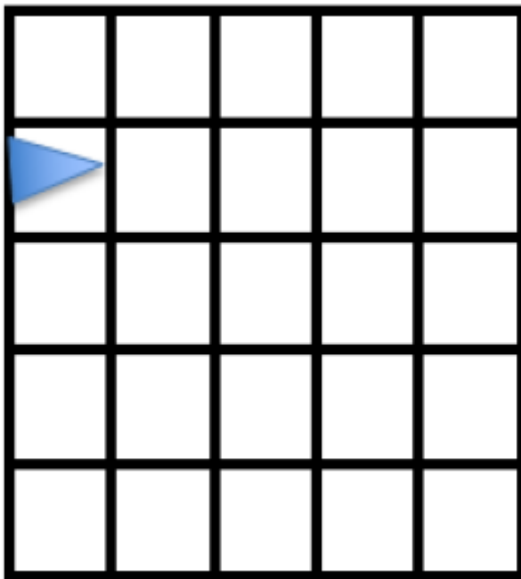
3. Which of the diagrams below match the code above?
- a. A
 - b. B
 - c. C
 - d. D

4. Trace the code given and indicate where the robot will end on the grid. Indicate the final location on the grid with a star. Also indicate the direction the robot is facing with an arrow.

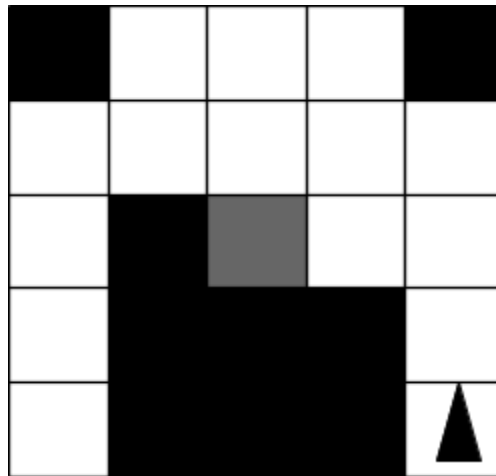


```
ROTATE_LEFT()  
MOVE_FORWARD()  
ROTATE_RIGHT()  
MOVE_FORWARD()  
ROTATE_RIGHT()  
MOVE_FORWARD()  
ROTATE_LEFT()  
MOVE_FORWARD()
```

Draw your answer below:

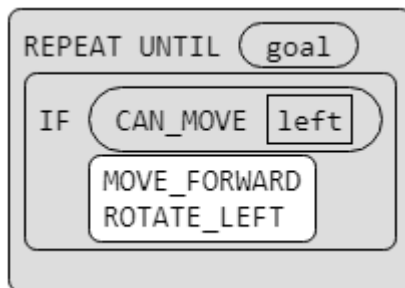


The robot cannot move into black boxes. The robot's goal is to reach the gray box. The code segment uses the procedure `goal()` which evaluates to `true` if the robot gets inside the gray box.

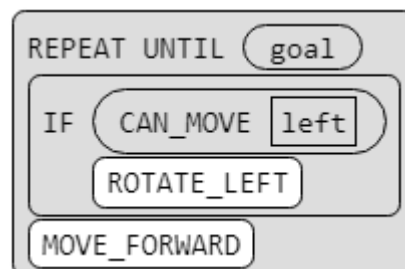


5. Which of the following code can be used to return `true`?

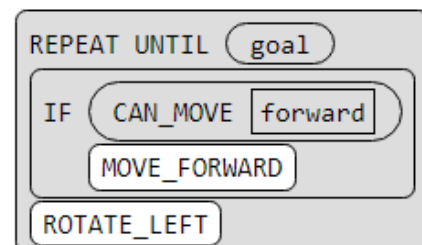
a.

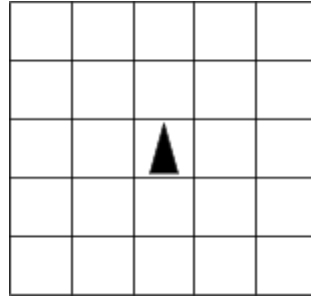


b.



c.

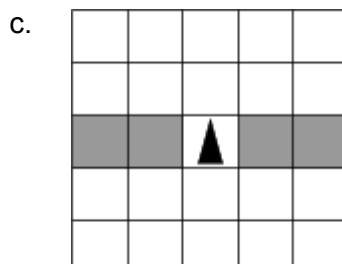
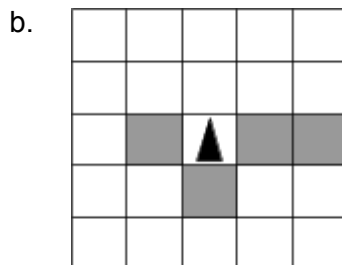
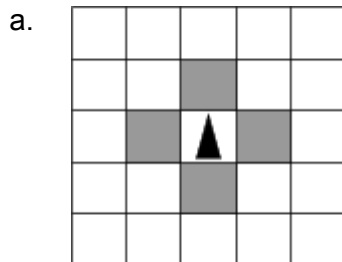




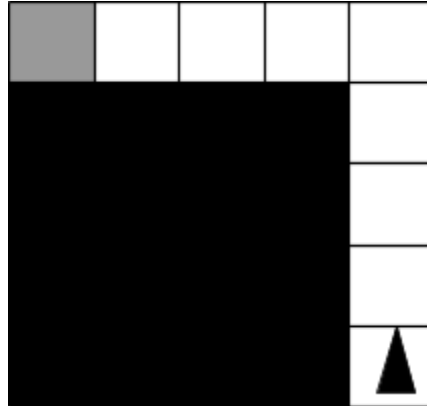
The following code segment is used to move the robot within the grid.

```
x ← RANDOM (1, 4)
REPEAT X TIMES
{
  ROTATE_RIGHT ( )
}
MOVE_FORWARD ( )
```

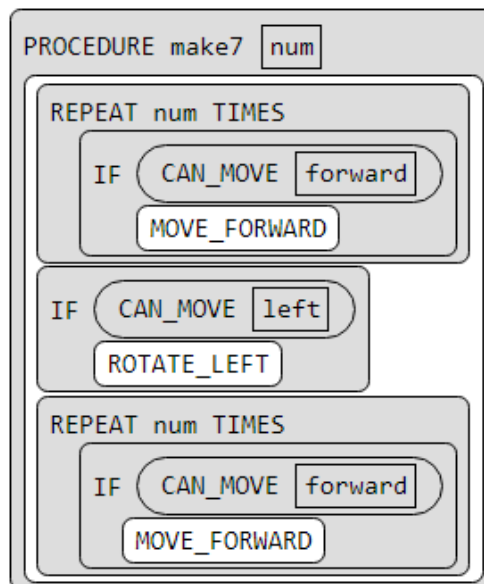
6. A gray box represents the final location of the robot after the code is executed. Which of the following represents all possible final locations?



The following question uses a robot in a grid of squares. The robot cannot move out of the grid or move into black squares. The gray box is where the robot wants to arrive. The robot can face any direction as long as it arrives at the gray square.



Read the procedure below.



7. Which of the following code segments will move the robot to the gray square?

- a. `make7 2`
- b. `make7 4`
- c. `make7 5`

Additional Resources

I want to know more about where algorithms are useful. Where can I go from here?

- On the AP® Exam there will be questions about how to direct a robot to move through a maze. This video will help you visualize the code you will see in your practice problems. [The left-hand algorithm](#) is a common, useful way to find the end of a maze.
- How AI dots can learn to solve a maze: [Genetic Algorithms](#)
- Further notes on sequences, selection and repetition: [Computer Science Basics: Sequences, Selections, and Loops](#)
- Using algorithms to solve crimes: [Algorithm Helping Police Predict Crime](#)
- Using algorithms in medicine: [A.I. Algorithms In Healthcare - The Medical Futurist](#)

Reflections

Now that we have reviewed this content **you** (the student that will take the exam) should ask yourself how well you understand this aspect of computer science. Based on your level of understanding you should determine **your** next steps.

Take about 60 seconds to reflect on this content.

1. Give yourself a ranking of 1 to 5 stars in terms of how well you understand what we just reviewed, 1 star being “I’m so lost” and 5 stars being “I could teach this to my parents.”

1	2	3	4	5

2. Identify three next steps that you will take to improve your knowledge of this content before the exam.

3. We will either “sound off” and verbally share our reflections or post them in the chat (your facilitator will decide).

Note that NMSI has made available a Topic Two Asynchronous Module that further reviews this topic. The module includes practice problems, instructional videos and other review material. Please ask your facilitator for more information about this resource.