

Practice post Unit 3

1. A cable television company stores information about movie purchases made by subscribers. Each day, the following information is summarized and stored in a publicly available database.

-

The day and date each movie was purchased

-

The title of each movie purchased

-

The cities where subscribers purchased each movie

-

The number of times each movie was purchased by subscribers in a given city

A sample portion of the database is shown below. The database is sorted by date and movie title.

Day and Date	Movie Title	City	Number of Times Purchased
Sat 01 / 05 / 2014	Movie A	Houston, Texas	1
Sat 01 / 05 / 2014	Movie A	Detroit, Michigan	2
Sat 01 / 05 / 2014	Movie B	Houston, Texas	1
Sat 01 / 05 / 2014	Movie C	Anchorage, Alaska	1
Sun 01 / 06 / 2014	Movie A	Wichita, Kansas	3

Which of the following CANNOT be determined using only the information in the database?

- (A) The date when a certain movie was purchased the greatest number of times
- (B) The number of movies purchased by an individual subscriber for a particular month 
- (C) The total number of cities in which a certain movie was purchased
- (D) The total number of movies purchased in a certain city during a particular month
-



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2. A car manufacturer uses simulation software during the design process for a new car. Which of the following are reasons to use simulation software in this context?

1.

Using simulation software can save the company money by helping to compare designs early in the process, before prototype cars are built.

2.

Using simulation software can help to identify safety issues by providing data about how different mechanical components will interact in a wide variety of situations.

3.

The manufacturer can present simulation software to customers to demonstrate different design possibilities.

(A) I and II only

(B) I and III only

(C) II and III only

(D) I, II, and III



3. A certain computer game is played between a human player and a computer-controlled player. Every time the computer-controlled player has a turn, the game runs slowly because the computer evaluates all potential moves and selects the best one. Which of the following best describes the possibility of improving the running speed of the game?

(A) The game's running speed can only be improved if the game is played between two human players instead of with the computer-controlled player.

(B) The game's running speed might be improved by using a process that finds approximate solutions every time the computer-controlled player has a turn.



(C) The game's running speed cannot be improved because computers can only be programmed to find the best possible solution.

(D) The game's running speed cannot be improved because the game is an example of an algorithm that does not run in a reasonable time.



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4. A certain social media Web site allows users to post messages and to comment on other messages that have been posted. When a user posts a message, the message itself is considered data. In addition to the data, the site stores the following metadata.

-

The time the message was posted

-

The name of the user who posted the message

-

The names of any users who comment on the message and the times the comments were made

For which of the following goals would it be more useful to analyze the data instead of the metadata?

- (A) To determine the users who post messages most frequently
- (B) To determine the time of day that the site is most active
- (C) To determine the topics that many users are posting about 
- (D) To determine which posts from a particular user have received the greatest number of comments
-

5. A code segment will be used to swap the values of the variables a and b using the temporary variable $temp$.

Which of the following code segments correctly swaps the values of a and b ?



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(A) `a ← b`
`temp ← a`
`b ← temp`

(B) `temp ← a`
`a ← b`
`b ← temp`



(C) `temp ← a`
`a ← temp`
`a ← b`

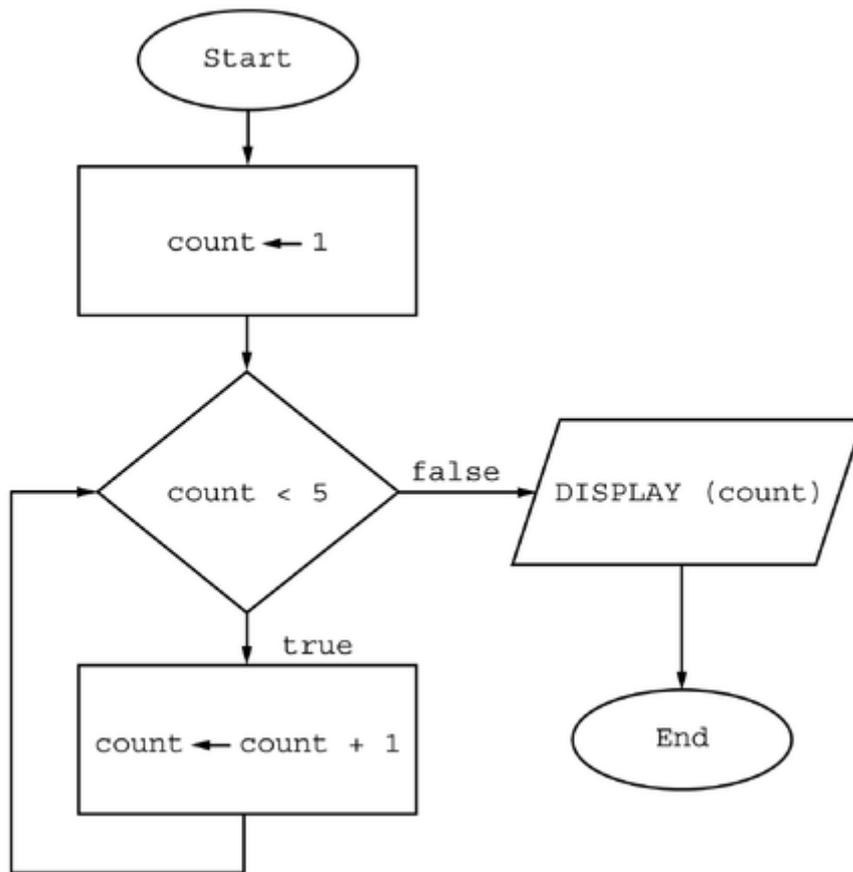
(D) `temp ← a`
`b ← temp`
`a ← b`



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6. A flowchart is a way to visually represent an algorithm. The flowchart below 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 <code>true</code> if the condition is true and to the side labeled <code>false</code> otherwise
Parallelogram ▱	Displays a message



What is displayed as a result of executing the algorithm in the flowchart?



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(A) 5 

(B) 15

(C) 1 2 3 4

(D) 1 2 3 4 5

7. A large data set contains information about all students majoring in computer science in colleges across the United States. The data set contains the following information about each student.

•

The student's gender

•

The state in which the student attends college

•

The student's grade point average on a 4.0 scale

Which of the following questions could be answered by analyzing only information in the data set?

(A) Do students majoring in computer science tend to have higher grade point averages than students majoring in other subjects?

(B) How many states have a higher percentage of female computer science majors than male computer science majors attending college in that state? 

(C) What percent of students attending college in a certain state are majoring in computer science?

(D) Which college has the highest number of students majoring in computer science?



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8. A new bank plans to make customer convenience a priority by minimizing the amount of time a customer waits in line. The bank is considering two options: a single line where the customer at the front waits for the next available teller, or separate lines for each teller. The bank decides to use a computer simulation of these two options to determine the average wait time for customers.

Which of the following is NOT true about the bank's plan?

- A The bank can incorporate other factors, such as the number of tellers, in the simulation.
- B The bank can use the simulation to investigate these two options without causing inconvenience for customers.
- C The bank may consider new alternatives based on the simulation results.
- D The simulation will not produce usable results because actual customer data are not available. ✓
-

9. A programmer completes the user manual for a video game she has developed and realizes she has reversed the roles of goats and sheep throughout the text. Consider the programmer's goal of changing all occurrences of "goats" to "sheep" and all occurrences of "sheep" to "goats." The programmer will use the fact that the word "foxes" does not appear anywhere in the original text. Which of the following algorithms can be used to accomplish the programmer's goal?

- A First, change all occurrences of "goats" to "sheep."
Then, change all occurrences of "sheep" to "goats."
- B First, change all occurrences of "goats" to "sheep."
Then, change all occurrences of "sheep" to "goats."
Last, change all occurrences of "foxes" to "sheep."
- C First, change all occurrences of "goats" to "foxes."
Then, change all occurrences of "sheep" to "goats."
Last, change all occurrences of "foxes" to "sheep." ✓
- D First, change all occurrences of "goats" to "foxes."
Then, change all occurrences of "foxes" to "sheep."
Last, change all occurrences of "sheep" to "goats."
-



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10. A programmer is deciding between using a linear or binary search to find a target value in a sorted list. Which of the following is true?

(A) In all cases, a binary search of a sorted list requires fewer comparisons than a linear search.

(B) Generally, the advantage of using a binary search over a linear search increases as the size of the list increases. ✓

(C) A linear search will generally run faster than a binary search because a linear search requires fewer lines of code to implement.

(D) Using a linear search is preferable to using a binary search if there is a chance that the target may not be found in the list.

11. A programmer is writing a program that is intended to be able to process large amounts of data. Which of the following considerations is LEAST likely to affect the ability of the program to process larger data sets?

(A) How long the program takes to run

(B) How many programming statements the program contains ✓

(C) How much memory the program requires as it runs

(D) How much storage space the program requires as it runs



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12. A programmer wrote the code segment below to display the average of all the elements in a list called numbers. There is always at least one number in the list.

```
Line 1:  count ← 0
Line 2:  sum ← 0
Line 3:  FOR EACH value IN numbers
Line 4:  {
Line 5:      count ← count + 1
Line 6:      sum ← sum + value
Line 7:      average ← sum / count
Line 8:  }
Line 9:  DISPLAY (average)
```

The programmer wants to reduce the number of operations that are performed when the program is run. Which change will result in a correct program with a reduced number of operations performed?

- (A) Interchanging line 1 and line 2
- (B) Interchanging line 5 and line 6
- (C) Interchanging line 6 and line 7
- (D) Interchanging line 7 and line 8



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13. A retailer that sells footwear maintains a single database containing records with the following information about each item for sale in the retailer's store.

- Item identification number
- Footwear type (sneakers, boots, sandals, etc.)
- Selling price (in dollars)
- Size
- Color
- Quantity available

Using only the database, which of the following can be determined?

(A) Which items listed in the database are not currently in the store



(B) Which colors are more popular among men than women

(C) Which type of footwear is most popular among adults

(D) The total number of shoes sold in a particular month

14. A student is recording a song on her computer. When the recording is finished, she saves a copy on her computer. The student notices that the saved copy is of lower sound quality than the original recording. Which of the following could be a possible explanation for the difference in sound quality?



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- (A) The song was saved using fewer bits per second than the original song. 
- (B) The song was saved using more bits per second than the original song.
- (C) The song was saved using a lossless compression technique.
- (D) Some information is lost every time a file is saved from one location on a computer to another location.
-

15. An algorithm has been developed to compute the sum of all the elements in a list of integers. Which of the following programming structures must be added to the existing algorithm so that the new algorithm computes the sum of only the even integers in the list?

- (A) Iteration
- (B) Searching
- (C) Selection 
- (D) Sequencing
-

16. An algorithm will be used to identify the maximum value in a list of one or more integers. Consider the two versions of the algorithm below.

Algorithm I : Set the value of a variable *max* to -1 . Iterate through the list of integer values. If a data value is greater than the value of the variable *max*, set *max* to the data value.

Algorithm II : Set the value of a variable *max* to the first data value. Iterate through the remaining values in the list of integers. If a data value is greater than the value of the variable *max*, set *max* to the data value.

Which of the following statements best describes the behavior of the two algorithms?



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- (A) Both algorithms work correctly on all input values.
- (B) Algorithm I always works correctly, but Algorithm II only works correctly when the maximum value is not the first value in the list.
- (C) Algorithm II always works correctly, but Algorithm I only works correctly when the maximum value is greater than or equal to -1 . ✓
- (D) Neither algorithm will correctly identify the maximum value when the input contains both positive and negative input values.
-

17. An Internet service provider (ISP) is considering an update to its servers that would save copies of the Web pages most frequently visited by each user.

Which of the following is LEAST likely to occur as a result of the update?

- (A) Average response time for user requests might decrease.
- (B) Privacy of users might be negatively affected.
- (C) Storage requirements for the servers might increase.

(D) Web sites that are not visited frequently might no longer be accessible to users. ✓

18. Biologists often attach tracking collars to wild animals. For each animal, the following geolocation data is collected at frequent intervals.

•

The time

•

The date

•

The location of the animal

Which of the following questions about a particular animal could NOT be answered using only the data collected from the tracking collars?



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(A) Approximately how many miles did the animal travel in one week?

(B) Does the animal travel in groups with other tracked animals?

(C) Do the movement patterns of the animal vary according to the weather? 

(D) In what geographic locations does the animal typically travel?

19. Central High School keeps a database of information about each student, including the numeric variables *numberOfAbsences* and *gradePointAverage*. The expression below is used to determine whether a student is eligible to receive an academic award.

$(\text{numberOfAbsences} \leq 5) \text{ AND } (\text{gradePointAverage} > 3.5)$

Which of the following pairs of values indicates that a student is eligible to receive an academic award?

(A) $\text{numberOfAbsences} = 3, \text{gradePointAverage} = 3.5$

(B) $\text{numberOfAbsences} = 5, \text{gradePointAverage} = 3.8$ 

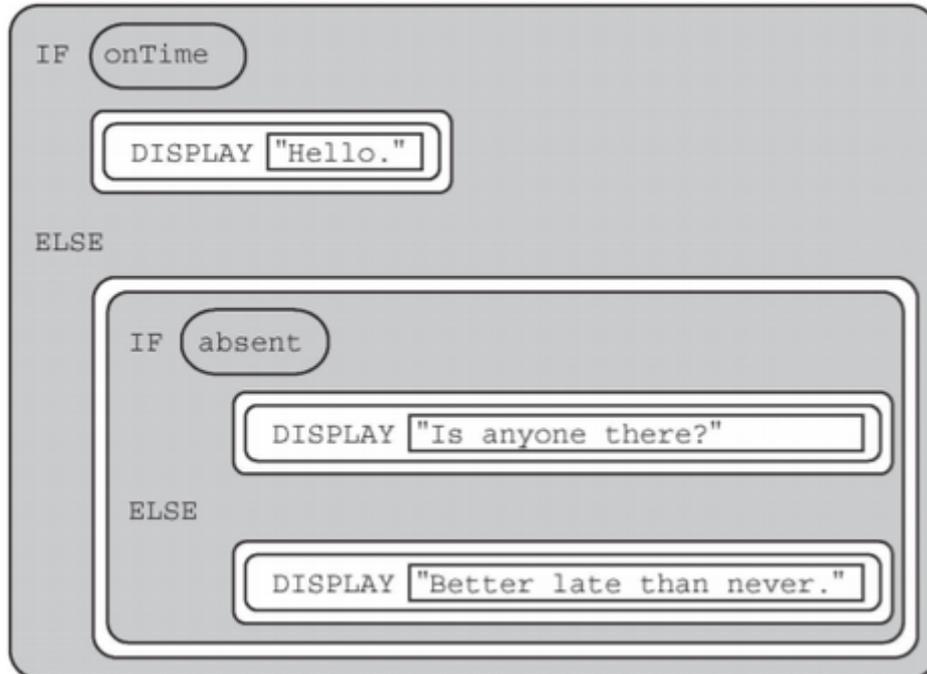
(C) $\text{numberOfAbsences} = 6, \text{gradePointAverage} = 3.4$

(D) $\text{numberOfAbsences} = 6, \text{gradePointAverage} = 3.6$



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20. Consider the code segment below.



If the variables *onTime* and *absent* both have the value *false*, what is displayed as a result of running the code segment?

(A) Is anyone there?

(B) Better late than never. 

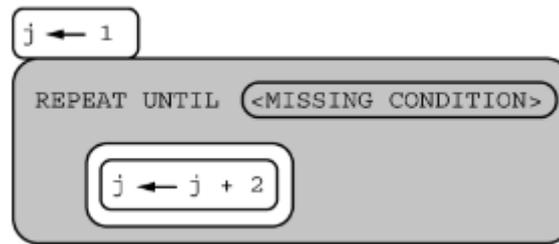
(C) Hello. Is anyone there?

(D) Hello. Better late than never.



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21. Consider the following code segment.



Which of the following replacements for <MISSING CONDITION> will result in an infinite loop?

- (A) $j = 6$ ✓
 - (B) $j \geq 6$
 - (C) $j = 7$
 - (D) $j > 7$
-

22. Digital images are often represented by the red, green, and blue values (an RGB triplet) of each individual pixel in the image. A photographer is manipulating a digital image and overwriting the original image. Which of the following describes a lossless transformation of the digital image?

- (A) Compressing the image in a way that may lose information but will suffer only a small loss of image quality.
 - (B) Creating the gray scale of an image by averaging the amounts of red, green, and blue in each pixel and assigning this new value to the corresponding pixel in the new image. The new value of each pixel represents a shade of gray, ranging from white to black.
 - (C) Creating the negative of an image by creating a new RGB triplet for each pixel in which each value is calculated by subtracting the original value from 255. The negative of an image is reversed from the original; light areas appear dark, and colors are reversed. ✓
 - (D) Modifying part of the image by taking the pixels in one part of the picture and copying them to the pixels in another part of the picture.
-



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23. In the procedure *Mystery* below, the parameter *number* is a positive integer.

```
PROCEDURE Mystery (number)
{
    REPEAT UNTIL (number ≤ 0)
    {
        number ← number - 2
    }
    IF (number = 0)
    {
        RETURN (true)
    }
    ELSE
    {
        RETURN (false)
    }
}
```

Which of the following best describes the result of running the procedure *Mystery*?

- A The procedure returns *true* when the initial value of *number* is 2, and it otherwise returns *false*.
- B The procedure returns *true* when the initial value of *number* is greater than 2, and it otherwise returns *false*.
- C The procedure returns *true* when the initial value of *number* is even, and it otherwise returns *false*. ✓
- D The procedure returns *true* when the initial value of *number* is odd, and it otherwise returns *false*.
-



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24. The algorithm below is used to simulate the results of flipping a coin 4 times. Consider the goal of determining whether the simulation resulted in an equal number of heads and tails.

Step 1: Initialize the variables *heads_counter* and *flip_counter* to 0.

Step 2: A variable *coin_flip* is randomly assigned a value of either 0 or 1. If *coin_flip* has the value 0, the coin flip result is heads, so *heads_counter* is incremented by 1.

Step 3: Increment the value of *flip_counter* by 1.

Step 4: Repeat steps 2 and 3 until *flip_counter* equals 4.

Following execution of the algorithm, which of the following expressions indicates that the simulation resulted in an equal number of heads and tails?

(A) *coin_flip* = 1

(B) *flip_counter* = 1

(C) *flip_counter* = 2

(D) *head_counter* = 2



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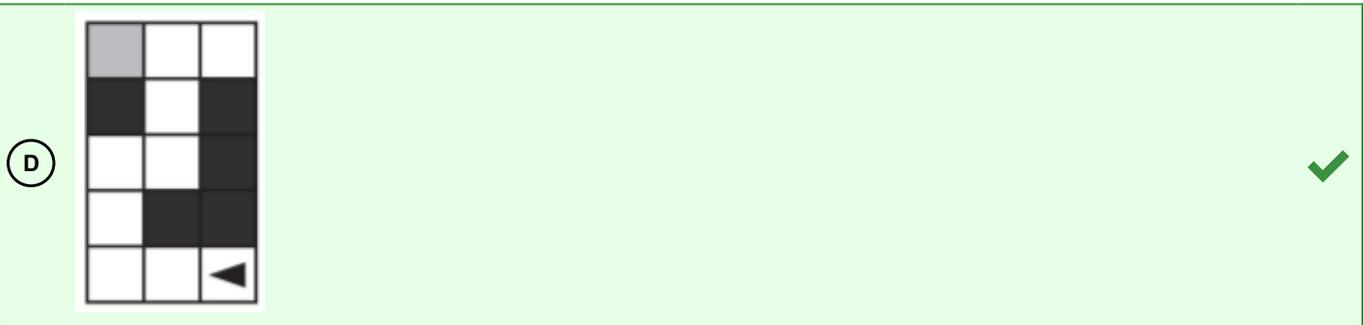
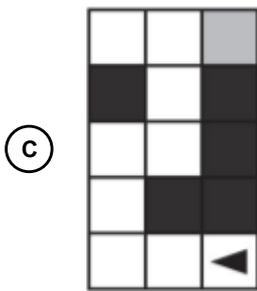
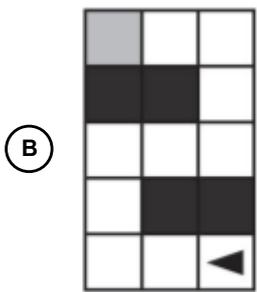
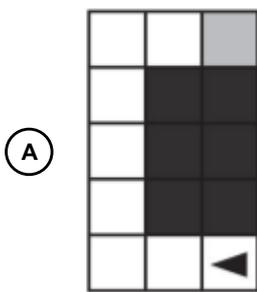
25. The program segment below is intended to move a robot in a grid to a gray square. The program segment uses the procedure *GoalReached*, which evaluates to *true* if the robot is in the gray square and evaluates to *false* otherwise. The robot in each grid is represented as a triangle and is initially facing left. The robot can move into a white or gray square but cannot move into a black region.

```
REPEAT UNTIL (GoalReached ())
{
  IF (CAN_MOVE (forward))
  {
    MOVE_FORWARD ()
  }
  IF (CAN_MOVE (right))
  {
    ROTATE_RIGHT ()
  }
  IF (CAN_MOVE (left))
  {
    ROTATE_LEFT ()
  }
}
```

For which of the following grids does the program NOT correctly move the robot to the gray square?

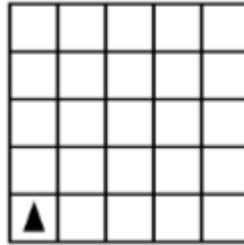


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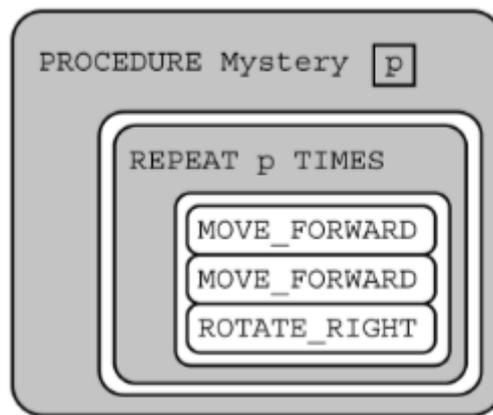


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26. The question below uses a robot in a grid of squares. The robot is represented as a triangle, which is initially in the bottom-left square of the grid and facing toward the top of the grid.



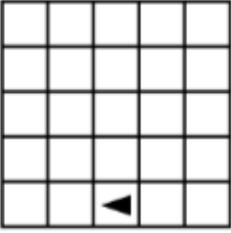
Code for the procedure *Mystery* is shown below. Assume that the parameter p has been assigned a positive integer value (e.g., 1, 2, 3, ...).

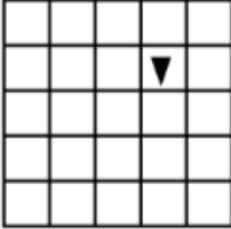


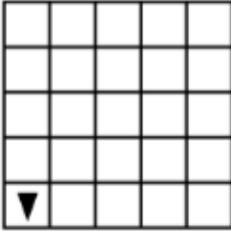
Which of the following shows a possible result of calling the procedure?

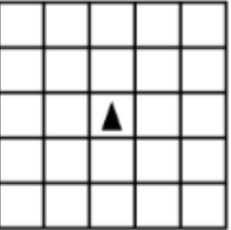


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(A)  

(B) 

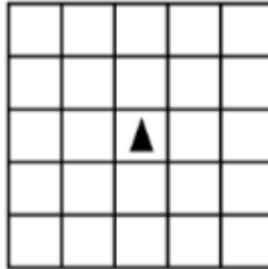
(C) 

(D) 



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27. 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 of the grid and facing toward the top of the grid.



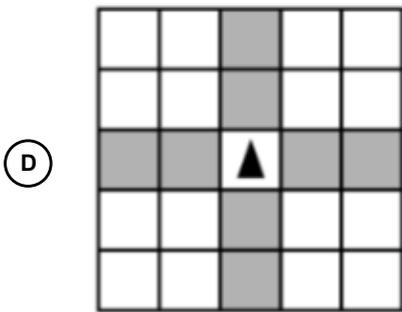
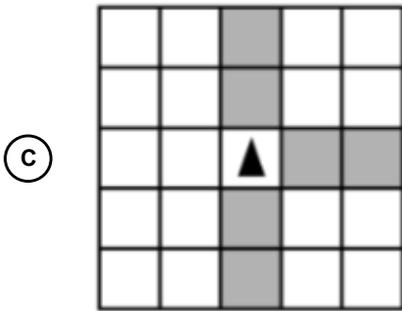
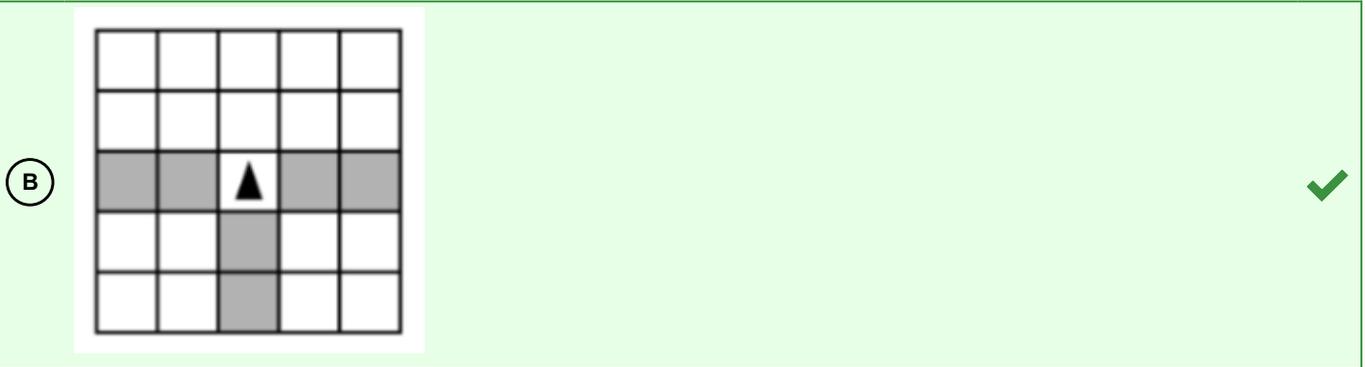
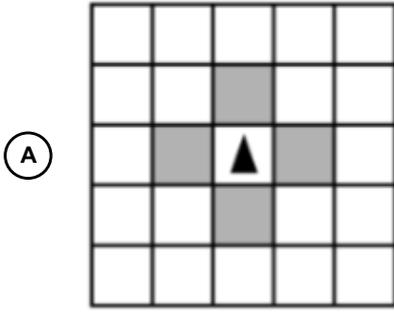
The following code segment is used to move the robot within the grid.

```
x ← RANDOM (1, 3)
REPEAT x TIMES
{
    ROTATE_RIGHT ()
}
y ← RANDOM (1, 2)
REPEAT y TIMES
{
    MOVE_FORWARD ()
}
```

A gray square represents a possible final location of the robot after the code segment is executed. Which of the following represents all possible final locations for the robot?



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28. The table below shows the time a computer system takes to complete a specified task on the customer data of different-sized companies.

Task	Small Company (approximately 100 customers)	Medium Company (approximately 1,000 customers)	Large Company (approximately 10,000 customers)
Backing up data	2 hours	20 hours	200 hours
Deleting entries from data	100 hours	200 hours	300 hours
Searching through data	250 hours	300 hours	350 hours
Sorting data	0.01 hour	1 hour	100 hours

Based on the information in the table, which of the following tasks is likely to take the longest amount of time when scaled up for a very large company of approximately 100,000 customers?

- (A) Backing up data
- (B) Deleting entries from data
- (C) Searching through data
- (D) Sorting data 



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29. There are 32 students standing in a classroom. Two different algorithms are given for finding the average height of the students.

Algorithm A

Step 1: All students stand.

Step 2: A randomly selected student writes his or her height on a card and is seated.

Step 3: A randomly selected standing student adds his or her height to the value on the card, records the new value on the card, and is seated. The previous value on the card is erased.

Step 4: Repeat step 3 until no students remain standing.

Step 5: The sum on the card is divided by 32. The result is given to the teacher.

Algorithm B

Step 1: All students stand.

Step 2: Each student is given a card. Each student writes his or her height on the card.

Step 3: Standing students form random pairs at the same time. Each pair adds the numbers written on their cards and writes the result on one student's card; the other student is seated. The previous value on the card is erased.

Step 4: Repeat step 3 until one student remains standing.

Step 5: The sum on the last student's card is divided by 32. The result is given to the teacher.

Which of the following statements is true?

- A Algorithm A always calculates the correct average, but Algorithm B does not.
- B Algorithm B always calculates the correct average, but Algorithm A does not.
- C Both Algorithm A and Algorithm B always calculate the correct average. ✓
- D Neither Algorithm A nor Algorithm B calculates the correct average.
-



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30. Two lists, *list1* and *list2*, contain the names of books found in two different collections. A librarian wants to create *newList*, which will contain the names of all books found in either list, in alphabetical order, with duplicate entries removed.

For example, if *list1* contains

["Macbeth", "Frankenstein", "Jane Eyre"]

and *list2* contains

["Frankenstein", "Dracula", "Macbeth", "Hamlet"],

then *newList* will contain

["Dracula", "Frankenstein", "Hamlet", "Jane Eyre", "Macbeth"].

The following procedures are available to create *newList*.

Procedure	Explanation
<code>Sort (list)</code>	Sorts <code>list</code> in alphabetical order and returns the resulting list.
<code>Combine (list1, list2)</code>	Creates a new list consisting of the entries from <code>list1</code> followed by the entries from <code>list2</code> . The resulting list is returned.
<code>RemoveDuplicates (list)</code>	Iterates through <code>list</code> . If any two or more entries have the same value, the duplicate entries are removed so that any entry appears at most once. The resulting list is returned.

Which of the following code segments will correctly create *newList* ?

- A** `newList ← Combine (list1, list2)`
`newList ← Sort (newList)`
`newList ← RemoveDuplicates (newList)` ✓
- `list1 ← Sort (list1)`
B `list2 ← Sort (list2)`
`newList ← Combine (list1, list2)`
`newList ← RemoveDuplicates (newList)`
- C** `list1 ← RemoveDuplicates (list1)`
`list2 ← RemoveDuplicates (list2)`
`newList ← Combine (list1, list2)`
`newList ← Sort (newList)`
- `list1 ← RemoveDuplicates (list1)`
`list1 ← Sort (list1)`
D `list2 ← RemoveDuplicates (list2)`
`list2 ← Sort (list2)`
`newList ← Combine (list1, list2)`



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31. Under which of the following conditions is it most beneficial to use a heuristic approach to solve a problem?

- (A) When the problem can be solved in a reasonable time and an approximate solution is acceptable
- (B) When the problem can be solved in a reasonable time and an exact solution is needed
- (C) When the problem cannot be solved in a reasonable time and an approximate solution is acceptable ✓
- (D) When the problem cannot be solved in a reasonable time and an exact solution is needed
-

32. When a cellular telephone user places a call, the carrier transmits the caller's voice as well as the voice of the person who is called. The encoded voices are the data of the call. In addition to transmitting the data, the carrier also stores metadata. The metadata of the call include information such as the time the call is placed and the phone numbers of both participants. For which of the following goals would it be more useful to computationally analyze the metadata instead of the data?

1.
To determine if a caller frequently uses a specific word
 2.
To estimate the number of phone calls that will be placed next Monday between 10:30 A.M. and noon.
 3.
To generate a list of criminal suspects when given the telephone number of a known criminal
- (A) I only
- (B) II only
- (C) II and III only ✓
- (D) I, II, and III
-



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33. Which of the following is a true statement about data compression?

- (A) Data compression is only useful for files being transmitted over the Internet.
- (B) Regardless of the compression technique used, once a data file is compressed, it cannot be restored to its original state.
- (C) Sending a compressed version of a file ensures that the contents of the file cannot be intercepted by an unauthorized user.

(D) There are trade-offs involved in choosing a compression technique for storing and transmitting data. ✓

34. Which of the following programs is most likely to benefit from the use of a heuristic?

- (A) A program that calculates a student's grade based on the student's quiz and homework scores
- (B) A program that encrypts a folder of digital files

(C) A program that finds the shortest driving route between two locations on a map ✓

(D) A program that sorts a list of numbers in order from least to greatest

35. Which of the following statements describes a limitation of using a computer simulation to model a real-world object or system?



Practice post Unit 3

- (A) Computer simulations can only be built after the real-world object or system has been created.
- (B) Computer simulations only run on very powerful computers that are not available to the general public.
- (C) Computer simulations usually make some simplifying assumptions about the real-world object or system being modeled. ✓
- (D) It is difficult to change input parameters or conditions when using computer simulations.
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36. Which of the following statements is true?

- (A) Every problem can be solved with an algorithm for all possible inputs, in a reasonable amount of time, using a modern computer.
- (B) Every problem can be solved with an algorithm for all possible inputs, but some will take more than 100 years, even with the fastest possible computer.
- (C) Every problem can be solved with an algorithm for all possible inputs, but some of these algorithms have not been discovered yet.
- (D) There exist problems that no algorithm will ever be able to solve for all possible inputs. ✓
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