

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and then enter the appropriate letter in the corresponding space on the answer sheet.

1. Consider the following code segment, which uses the variables `r`, `s`, and `t`.

```
r ← 1
s ← 2
t ← 3
r ← s
s ← t
DISPLAY (r)
DISPLAY (s)
```

What is displayed as a result of running the code segment?

- (A) 1 1
- (B) 1 2
- (C) 2 3
- (D) 3 2

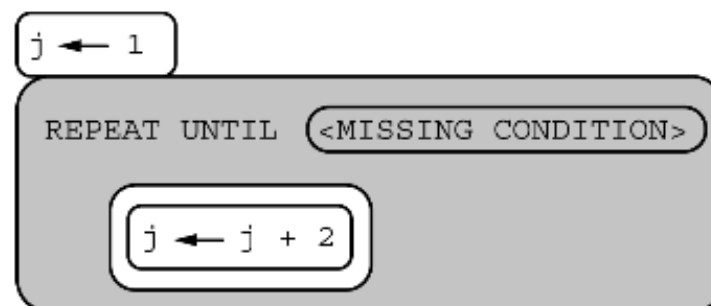
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2. Which of the following is a true statement about program documentation?

- (A) Program documentation should not be changed after it is first written.
- (B) Program documentation is only needed for programs in development; it is not needed after a program is completed.
- (C) Program documentation is useful when programmers collaborate but not when a programmer works individually on a project.
- (D) Program documentation is useful during initial program development and also when modifications are made to existing programs.

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3. Which of the following best explains what happens when a new device is connected to the Internet?
- (A) A device driver is assigned to the device.
 - (B) An Internet Protocol (IP) address is assigned to the device.
 - (C) A packet number is assigned to the device.
 - (D) A Web site is assigned to the device.

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4. 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) $j > 7$

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5. 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) `heads_counter = 2`

-
6. 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

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7. Which of the following activities poses the greatest personal cybersecurity risk?
- (A) Making a purchase at an online store that uses public key encryption to transmit credit card information
 - (B) Paying a bill using a secure electronic payment system
 - (C) Reserving a hotel room by e-mailing a credit card number to a hotel
 - (D) Withdrawing money from a bank account using an automated teller machine (ATM)

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8. The code segment below uses the procedure `IsFound (list, item)`, which returns `true` if `item` appears in `list` and returns `false` otherwise. The list `resultList` is initially empty.

```
FOR EACH item IN inputList1
{
    IF (IsFound (inputList2, item)
    {
        APPEND (resultList, item)
    }
}
```

Which of the following best describes the contents of `resultList` after the code segment is executed?

- (A) All elements in `inputList1` followed by all elements in `inputList2`
- (B) Only elements that appear in both `inputList1` and `inputList2`
- (C) Only elements that appear in either `inputList1` or `inputList2` but not in both lists
- (D) Only elements that appear in `inputList1` but not in `inputList2`

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9. 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

-
10. Which of the following is LEAST likely to indicate a phishing attack?
- (A) An e-mail from your bank asks you to call the number on your card to verify a transaction
 - (B) An e-mail from a merchant asks that you click on a link to reset your password
 - (C) An e-mail from a utility company asks you to enter your date of birth and social security number for verification purposes
 - (D) An e-mail indicates that you have won a large sum of money and asks you to enter your bank account number so that the money can be transferred to you

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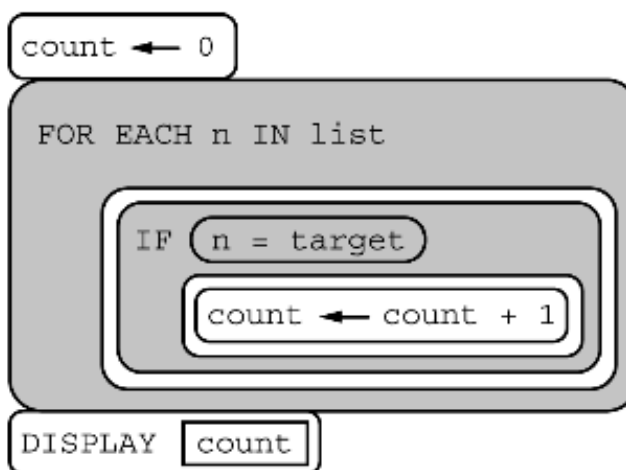
11. Which of the following is considered an unethical use of computer resources?
- (A) Downloading freeware or shareware onto your home computer
 - (B) Purchasing a game from an app store and downloading it directly to a mobile device
 - (C) Purchasing a single-user copy of photo editing software and installing it on all the computers in a computer lab
 - (D) Searching online for an electronic version of a school textbook

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12. Which of the following statements are true about using a high-level programming language instead of a lower-level language?
- I. Programs written in a high-level language are generally easier for people to read than programs written in a low-level language.
 - II. A high-level language provides programmers with more abstractions than a low-level language.
 - III. Programs written in a high-level language are generally easier to debug than programs written in a low-level language.
- (A) I only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II, and III

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13. 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?
- (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.

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14. Consider the following program, which is intended to display the number of times a number `target` appears in a list.



Which of the following best describes the behavior of the program?

- (A) The program correctly displays the number of times `target` appears in the list.
- (B) The program does not work as intended when `target` does not appear in the list.
- (C) The program does not work as intended when `target` appears in the list more than once.
- (D) The program does not work as intended when `target` appears as the last element of the list.

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15. In the program below, the initial value of x is 5 and the initial value of y is 10.

```
IF (x < 0)
{
    DISPLAY ("Foxtrot")
}
ELSE
{
    IF (x > y)
    {
        DISPLAY ("Hotel")
    }
    ELSE
    {
        IF (y > 0)
        {
            DISPLAY ("November")
        }
        ELSE
        {
            DISPLAY ("Yankee")
        }
    }
}
```

What is displayed as a result of running the program?

- (A) Foxtrot
- (B) Hotel
- (C) November
- (D) Yankee

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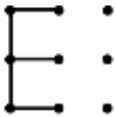
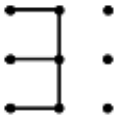
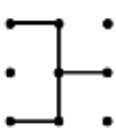
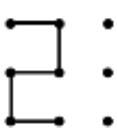
16. The procedure `Draw (length, direction)` is used to draw a line segment `length` units long in a given `direction` (`left`, `right`, `up`, or `down`), starting at the current cursor position. The cursor is then repositioned at the end of the line segment that was drawn. Consider the following program, where the cursor starts in the upper left corner of a grid of dots. The dots are spaced one unit apart.

```

Draw (1, right)
Draw (2, down)
Draw (1, left)
Draw (1, right)
Draw (1, up)
Draw (1, left)

```

Which of the following represents the figure that is drawn by the program?

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

17. 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) `numberOfAbsences = 3`, `gradePointAverage = 3.5`
- (B) `numberOfAbsences = 5`, `gradePointAverage = 3.8`
- (C) `numberOfAbsences = 6`, `gradePointAverage = 3.4`
- (D) `numberOfAbsences = 6`, `gradePointAverage = 3.6`

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18. Computers are often used to search through large sets of data to find useful patterns in the data. Which of the following tasks is NOT an example where searching for patterns is needed to produce useful information?
- (A) A credit card company analyzing credit card purchases to identify potential fraudulent charges
 - (B) A grocery store analyzing customers' past purchases to suggest new products the customer may be interested in
 - (C) A high school analyzing student grades to identify the students with the top ten highest grade point averages
 - (D) An online retailer analyzing customers' viewing habits to suggest other products based on the purchasing history of other customers

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19. The code fragment below is intended to display "odd" if the positive number num is odd.

```
IF <MISSING CONDITION>
    DISPLAY "odd"
```

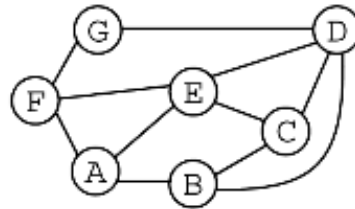
Which of the following can be used to replace <MISSING CONDITION> so that the code fragment will work as intended?

- (A) $(\text{num MOD } 1) = 0$
- (B) $(\text{num MOD } 1) = 1$
- (C) $(\text{num MOD } 2) = 0$
- (D) $(\text{num MOD } 2) = 1$

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Questions 20 - 21 refer to the information below.

The figure below represents a network of physically linked computers labeled A through G. A line between two computers indicates that the computers can communicate directly with each other. Any information sent between two computers that are not directly connected must go through at least one other computer. For example, information can be sent directly between computers A and B, but information sent between computers A and C must go through other computers.



20. What is the minimum number of connections that must be broken or removed in the network before computer E can no longer communicate with computer F?
- (A) 1
(B) 2
(C) 3
(D) 4
-
21. Which of the following statements about security in the network is true?
- I. Computers A and D need to communicate with at least two additional computers in the network in order to communicate with each other.
- II. Computers B and C can communicate with each other without additional computers being aware of the communication.
- (A) I only
(B) II only
(C) I and II
(D) Neither I nor II

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22. ASCII is a character-encoding scheme that uses 7 bits to represent each character. The decimal (base 10) values 65 through 90 represent the capital letters A through Z, as shown in the table below.

Decimal	ASCII Character	Decimal	ASCII Character
65	A	78	N
66	B	79	O
67	C	80	P
68	D	81	Q
69	E	82	R
70	F	83	S
71	G	84	T
72	H	85	U
73	I	86	V
74	J	87	W
75	K	88	X
76	L	89	Y
77	M	90	Z

What ASCII character is represented by the binary (base 2) number 1001010 ?

- (A) H
- (B) I
- (C) J
- (D) K

-
23. A user enters a Web address in a browser, and a request for a file is sent to a Web server. Which of the following best describes how the file is sent to the user?
- (A) The file is broken into packets for transmission. The packets must be reassembled upon receipt.
 - (B) The file is broken into packets for transmission. The user's browser must request each packet in order until all packets are received.
 - (C) The server attempts to connect directly to the user's computer. If the connection is successful, the entire file is sent. If the connection is unsuccessful, an error message is sent to the user.
 - (D) The server repeatedly attempts to connect directly to the user's computer until a connection is made. Once the connection is made, the entire file is sent.

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24. Some programming languages use constants, which are variables that are initialized at the beginning of a program and never changed. Which of the following are good uses for a constant?
- I. To represent the mathematical value π (pi) as 3.14
 - II. To represent the current score in a game
 - III. To represent a known value such as the number of days in a week
- (A) I and II only
(B) I and III only
(C) II and III only
(D) I, II, and III

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25. 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.

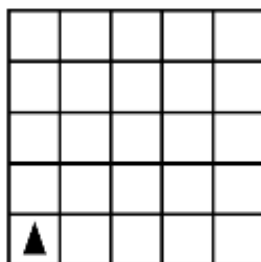
Day and Date	Movie Title	City	Number of Times Purchased
Sat 01 / 05 / 2014	Movie A	Houston, Texas	1
Sat 01 / 05 / 2014	Movie A	Detroit, Michigan	2
Sat 01 / 05 / 2014	Movie B	Houston, Texas	1
Sat 01 / 05 / 2014	Movie C	Anchorage, Alaska	1
Sun 01 / 06 / 2014	Movie A	Wichita, Kansas	3

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

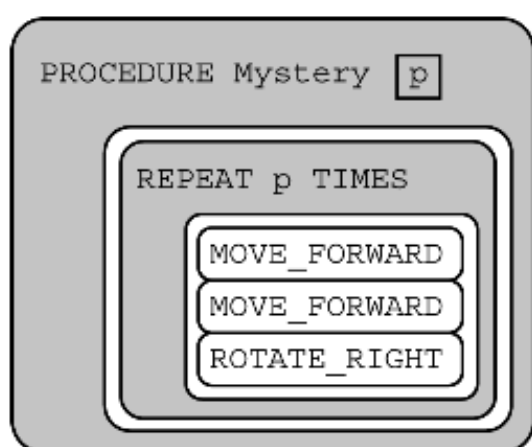
- (A) The date when a certain movie was purchased the greatest number of times
- (B) The number of movies purchased by an individual subscriber for a particular month
- (C) The total number of cities in which a certain movie was purchased
- (D) The total number of movies purchased in a certain city during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

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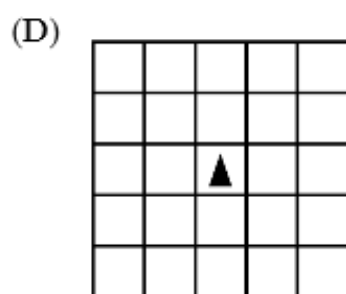
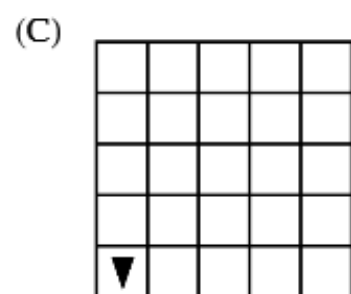
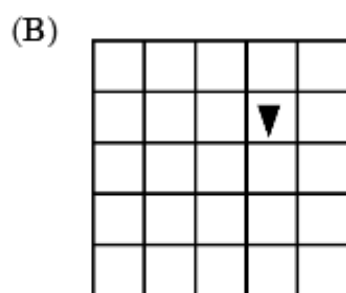
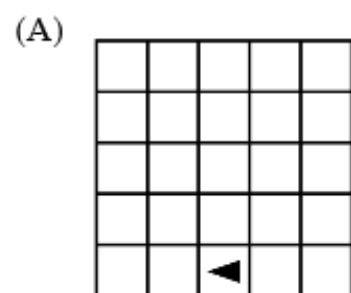
26. The question below uses a robot in a grid of squares. The robot is represented as a triangle, which is initially in the bottom-left square of the grid and facing toward the top of the grid.



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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27. 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.

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28. Consider the code segment below.

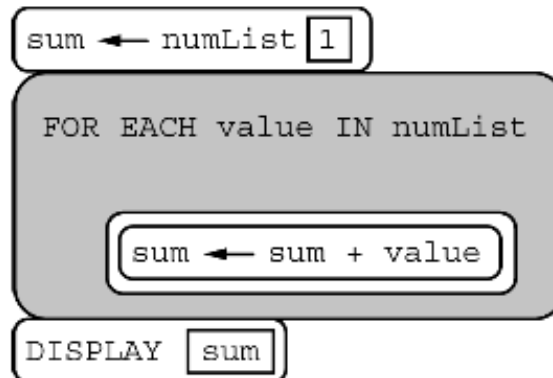
```
Line 1: IF (a = 0)
Line 2: {
Line 3:     b ← a + 10
Line 4: }
Line 5: ELSE
Line 6: {
Line 7:     b ← a + 20
Line 8: }
```

Which of the following changes will NOT affect the results when the code segment is executed?

- (A) Changing line 3 to $b \leftarrow 10$
- (B) Changing line 3 to $a \leftarrow b + 10$
- (C) Changing line 7 to $b \leftarrow 20$
- (D) Changing line 7 to $a \leftarrow b + 20$

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29. A programmer wrote the program below. The program uses a list of numbers called `numList`. The program is intended to display the sum of the numbers in the list.



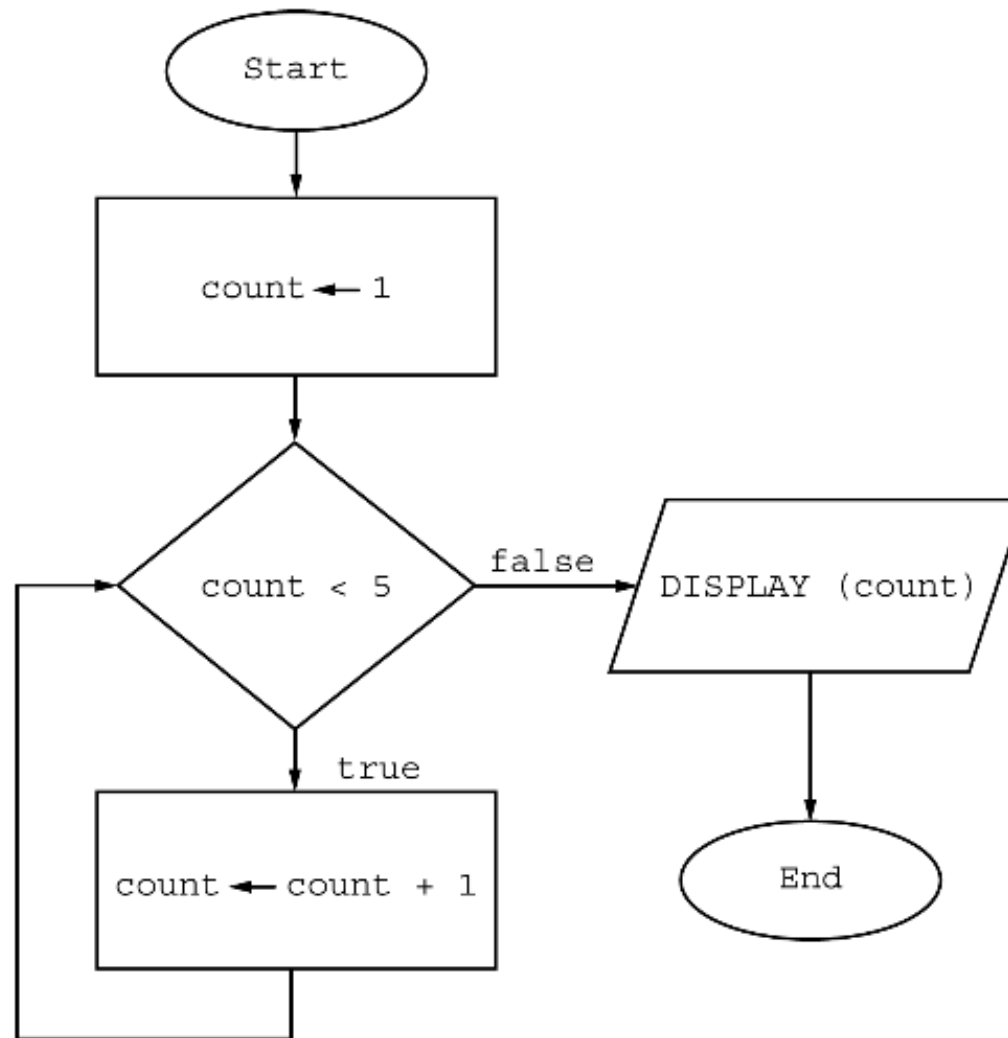
In order to test the program, the programmer initializes `numList` to `[0, 1, 4, 5]`. The program displays `10`, and the programmer concludes that the program works as intended. Which of the following is true?

- (A) The conclusion is correct; the program works as intended.
- (B) The conclusion is incorrect; the program does not display the correct value for the test case `[0, 1, 4, 5]`.
- (C) The conclusion is incorrect; using the test case `[0, 1, 4, 5]` is not sufficient to conclude the program is correct.
- (D) The conclusion is incorrect; using the test case `[0, 1, 4, 5]` only confirms that the program works for lists in increasing order.

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30. 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?

- (A) 5
- (B) 15
- (C) 1 2 3 4
- (D) 1 2 3 4 5

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31. 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)`
- (B) `list1 ← Sort (list1)`
`list2 ← Sort (list2)`
`newList ← Combine (list1, list2)`
`newList ← RemoveDuplicates (newList)`
- (C) `list1 ← RemoveDuplicates (list1)`
`list2 ← RemoveDuplicates (list2)`
`newList ← Combine (list1, list2)`
`newList ← Sort (newList)`
- (D) `list1 ← RemoveDuplicates (list1)`
`list1 ← Sort (list1)`
`list2 ← RemoveDuplicates (list2)`
`list2 ← Sort (list2)`
`newList ← Combine (list1, list2)`

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32. 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.

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33. Which of the following is a characteristic of the fault-tolerant nature of routing on the Internet?
- (A) The ability to use a hierarchical naming system to avoid naming conflicts
 - (B) The ability to provide data transmission even when some connections have failed
 - (C) The ability to resolve errors in domain name system (DNS) lookups
 - (D) The ability to use multiple protocols such as hypertext transfer protocol (HTTP), Internet protocol (IP), and simple mail transfer protocol (SMTP) to transfer data

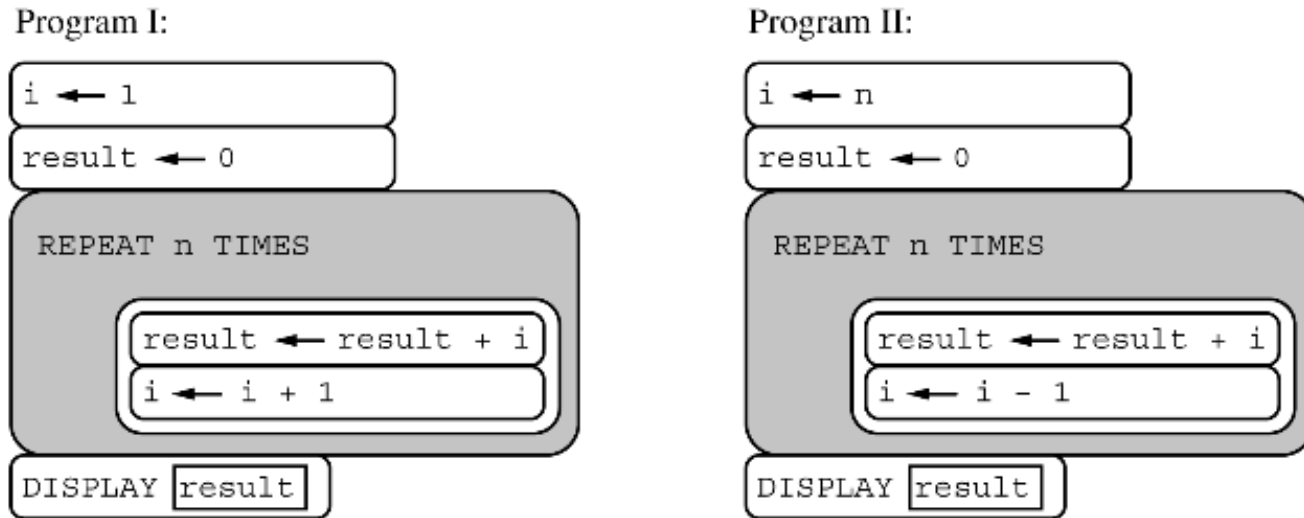
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34. A car manufacturer uses simulation software during the design process for a new car. Which of the following are reasons to use simulation software in this context?
- I. Using simulation software can save the company money by helping to compare designs early in the process, before prototype cars are built.
 - II. 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.
 - III. 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

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35. Two computers are built by different manufacturers. One is running a Web server and the other is running a Web browser. Which of the following best describes the ability of the two computers to communicate with each other across the Internet?
- (A) The computers cannot communicate because different manufacturers use different communication protocols.
 - (B) The computers can communicate, but additional hardware is needed to convert data packets from one computer's protocol to the other computer's protocol.
 - (C) The computers can communicate directly only if the messages consist of text; other formats cannot be interpreted across computers.
 - (D) The computers can communicate directly because Internet communication uses standard protocols.

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36. Programs I and II below are each intended to calculate the sum of the integers from 1 to n . Assume that n is a positive integer (e.g., 1, 2, 3, ...).



Which of the following best describes the behavior of the two programs?

- (A) Program I displays the correct sum, but program II does not.
- (B) Program II displays the correct sum, but program I does not.
- (C) Both program I and program II display the correct sum.
- (D) Neither program I nor program II displays the correct sum.
-
37. 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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