COMPUTER SCIENCE PRINCIPLES

SECTION I

Time—2 hours

Number of Questions—70

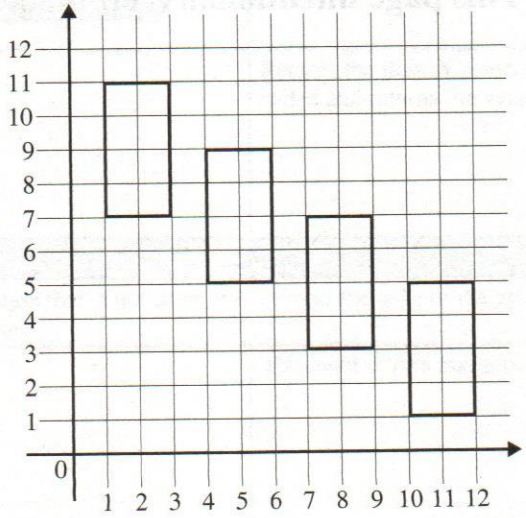
Percent of total exam grade—70%

Directions: Choose one best answer for each questions. Some questions at the end of the test will have more than one correct answer; for these, you will be instructed to choose two answer choices.

1. Consider the following procedure.

Procedure Call	Explanation
`drawRectangle(x1, y1, x2, y2)`	Draws a rectangle with the top left coordinate (x1,y1), and the bottom right coordinate (x2,y2)

The `drawRectangle` method will be used to draw the following on a coordinate grid.



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Which of the following code segments can be used to draw the rectangles?

(A)
```
x ← 1
y ← 11
REPEAT 4 TIMES
{
    drawRectangle(1, 11, 3, 7)
    x ← x + 3
    y ← y + 2
}
```

(B)
```
x ← 1
y ← 11
REPEAT 4 TIMES
{
    drawRectangle(x, y, x+3, y+7)
    x ← x + 3
    y ← y + 2
}
```

(C)
```
x ← 10
y ← 5
REPEAT 4 TIMES
{
    drawRectangle(x, y, x+2, y-4)
    x ← x - 3
    y ← y + 2
}
```

(D)
```
x ← 10
y ← 5
REPEAT 4 TIMES
{
    drawRectangle(x, y, x+2, y+4)
    x ← x - 3
    y ← y + 2
}
```

2. What would be stored at x upon completion of the following code segment?

```
x ← 10
y ← 20
IF (x < 15)
{
    IF (y < 20)
        x ← x - 10
    ELSE
        x ← x + 10
}
IF (x > 15)
    x ← x + 5
```

(A) 10
(B) 20
(C) 25
(D) 30

3. A concert is selling tickets online only for an upcoming show. The management is trying to use metadata from each sale to attempt to figure out what they should charge in the future for similar concerts. Here is the metadata taken from each sale.

- The time and the seat location of each ticket purchased
- The name and age of the purchaser
- The geolocation of the purchaser

Using the metadata given to us, which of the following CANNOT be analyzed to help determine future ticket prices?

(A) The seat locations of tickets that sold the fastest
(B) The financial status of each purchaser
(C) The amount of people who are most likely coming from out of town to see the concert
(D) The amount of time it took for the tickets to sell out

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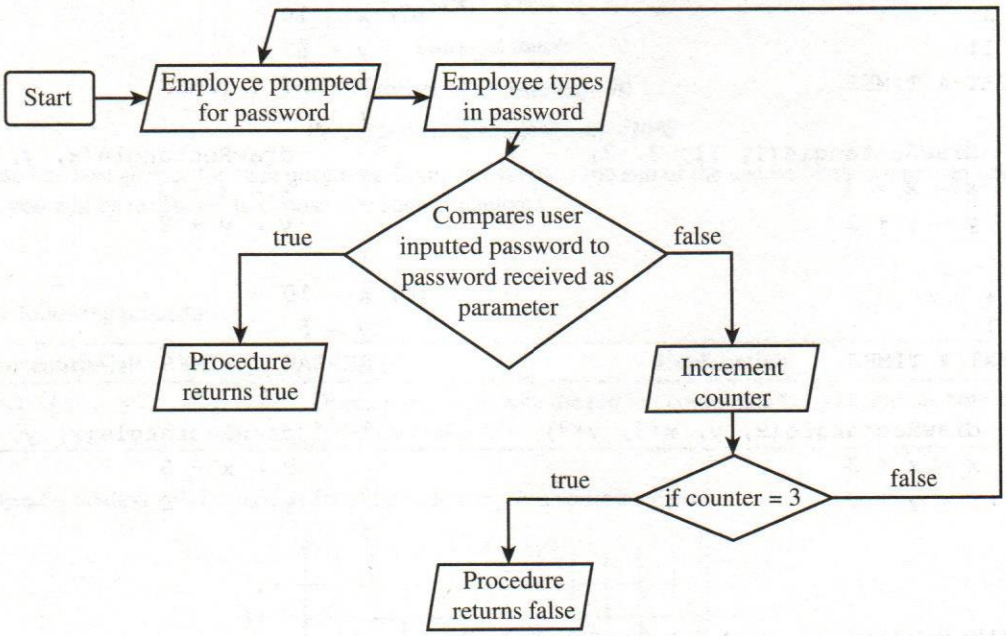
4. The following storyboard is used to create a password system.



Which of the following code segments works correctly for this storyboard?

(A)

```
PROCEDURE correctPassword(password)
{
    counter ← 0
    REPEAT UNTIL (counter = 3)
    {
        DISPLAY("Enter the password:")
        pw ← INPUT
        IF (password = pw)
            RETURN(true)
    }
}
```

(B)

```
PROCEDURE correctPassword(password)
{
    correct = false
    REPEAT 3 TIMES
    {
        DISPLAY("Enter the password:")
        pw ← INPUT
        IF (password = pw)
            correct = true
        ELSE
            correct = false
    }
    RETURN(correct)
}
```

(C)

```
PROCEDURE correctPassword(password)
{
    counter ← 0
    REPEAT UNTIL (counter = 3)
    {
        DISPLAY("Enter the password:")
        pw ← INPUT
        IF (password = pw)
            RETURN(true)
        ELSE
            counter ← counter + 1
    }
    RETURN(false)
}
```

(D)

```
PROCEDURE correctPassword(password)
{
    REPEAT 3 TIMES
    {
        DISPLAY("Enter the password:")
        pw ← INPUT
        IF (password = pw)
            RETURN(true)
        ELSE
            RETURN(false)
    }
}
```

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5. What is an appropriate way to prove that a problem is undecidable?

   (A) Create an algorithm that will solve one of the possible solutions, but will not solve all of the possible solutions.
   (B) Prove that there exists a solution to the problem that has no possible algorithm to solve it.
   (C) Create an algorithm that will solve the problem in a reasonable amount of time.
   (D) Prove that there exists an algorithm to solve the problem, but it cannot solve the problem in a reasonable amount of time.

6. Using a binary system with only 4 bits, if the decimal numbers 8 and 10 were added together, the sum would be 0010. What would be the reason for the incorrect answer?

   (A) A truncating error
   (B) A rounding error
   (C) An overflow error
   (D) An addition error

7. Consider the following procedure.

```
PROCEDURE someMath(num1, num2)
{
    IF (num1 > num2)
      RETURN(num1 - num2)
    ELSE
      RETURN(num2 * num1)
}
```

What would be output after the following calls to the procedure?

```
x ← someMath(10, 6)
y ← someMath(2, x)
z ← someMath(x, y)
DISPLAY(z)
```

(A) 2
(B) 4
(C) 24
(D) 32

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8. Which of the following help explain the purpose of using comments in code?

   I. Using comments helps keep the documentation current when changes are made to the code.
   II. When using previous code segments, such as procedures, a coder can read the comments and know what to do without even looking at the code.
   III. When someone in the future needs to make changes to the code, they can look through the comments to find what changes need to be made instead of dissecting the entire code.

   (A) I only
   (B) I and II only
   (C) II and III only
   (D) I, II, and III

9. There is a disclaimer on a website that the information provided could be used for crowdsourcing. What would be an example of crowdsourcing using data that has been obtained by a website that collects health information and how a person feels daily?

   (A) Using the daily information to figure out if people with certain medical information feel ill more often than others
   (B) Creating an online fundraiser for people that are in need of financial assistance due to their medical situations
   (C) Not allowing any of the people's information to be used by any other institutions due to privacy concerns
   (D) Using the data to determine what people are losing their jobs and how to better reach these people

10. What would be the next three binary numbers after 10001101?

    (A) 10001111, 10010000, 10010001
    (B) 10001101, 10010011, 10010100
    (C) 10001110, 10001111, 10011111
    (D) 10001110, 10001111, 10010000

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11. While at a library, a person logs into the public Wi-Fi network labeled "Library" with their private device. The person then uses their device to make a deposit into their bank account. That deposit never reaches the user's bank account, but is instead rerouted to another account. It turns out that the public Wi-Fi network was not from the library, but instead a cybercriminal installed an access point on the library's Wi-Fi without the library's permission and used that access point to reroute the money into the cybercriminal's account.

    What type of attack would this be considered?

    (A) Malware
    (B) Keylogging
    (C) Phishing
    (D) Rogue Access Point

12. The following list `myList` contains all integers.

```
PROCEDURE changeList(myList)
    counter ← 1
    REPEAT UNTIL (counter > LENGTH(myList))
        IF (myList[counter] < 0)
            myList[counter] = 0
        counter ← counter + 1
    RETURN(myList)
```

    Which of the following best describes how this code segment works?

    (A) The code segment will replace all negative indexes in myList with 0 and return mylist.
    (B) The code segment will have an error since it will go out of bounds on myList.
    (C) The code segment will find all values in myList that are 0 and remove them, and then return myList.
    (D) The code segment will count how many values in myList are negative, and return that value.

13. What would be the output from the following code segment?

```
a ← 28
b ← 5
c ← a MOD b
DISPLAY (c)
```

    (A) 2
    (B) 3
    (C) 5
    (D) 5.6

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14. A large spreadsheet contains the following data about a company. Here is a small sample of what the data could look like. The top row is the header.

Name	Number of Years	Job Title	Revenue	Expenses
"Stanford"	25	"Manager"	1000	500
"Kathy"	22	"Manager"	1500	250
"Mike"	8	"Sales"	2000	1500
"Beth"	5	"Sales"	500	1750
"Brian"	3	"Sales"	1000	1200
"Jacob"	4	"Sales"	700	500

The company has to figure out which employees with the job title "Sales" need to be promoted to "Manager." In order to be promoted, an employee must fit the following criteria.

- Be an employee of 5 or more years
- Have a job title of "Sales"
- Have their revenue exceed their expenses

Which of the following would be the most efficient way to find all the employees that should be promoted?

(A) Filter out all employees with the Job Title "Manager"
Sort by Revenue
Sort by Number of Years

(B) Sort by Job Title
Sort by Number of Years
Create another column with the formula (Revenue – Expenses)
Filter out all employees with a value 0 or lower in the new column

(C) Manually remove all employees with the Job Title "Manager"
Manually remove all employees with Number of Years less than 5
Create another column with the formula (Revenue – Expenses)
Manually remove all numbers 0 or less from the new column

(D) Filter out all employees with the Job Title "Manager"
Filter out all employees with Number of Years less than 5
Create another column with the formula (Revenue – Expenses)
Sort the new column, and delete all that are less than or equal to 0

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15. Computer A uses sequential computing, and has one processor. Computer B uses parallel computing, and has two identical processors that run in parallel. Each of these processors can only run one process at a time. No process can be split into two different processors.

    There are three processes that need to be run, and they can be run in any order. One of the processes takes 10 minutes, one of the processes takes 15 minutes, and the final process takes 22 minutes. How much longer will it take Computer A to run the three processes than it will take Computer B?

    (A) Same amount of time
    (B) 3 minutes
    (C) 22 minutes
    (D) 25 minutes

16. There are currently twenty employees at a store. The store is planning on opening up four new locations, each of which will have twenty employees. This means that the company will now have 100 employees.

    Currently each employee has an ID number that is only five bits long, and contains only 0s and 1s. How many more bits must the company add to its current five-bit employee ID system so it can have all 100 employees have a unique ID number of 0s and 1s, without wasting any extra bits?

    (A) 0
    (B) 1
    (C) 2
    (D) 3

17. A company will begin to use software through a third party that will allow them to log on to their servers more securely. Each employee will log on every day, and that login will give them access to their email and workspace. Which of the following would be an example of a phishing attack that could occur against the company?

    (A) An employee receives an email to change their password, but is instead sent to a fake website. This leads to them giving away their password, which the cybercriminal uses to steal important company information.
    (B) A hacker tries over and over to guess someone's password, using certain information about the person, such as birthday, address, child's name, etc., and then pretends to be that person.
    (C) A cybercriminal gets software downloaded onto an employee's computer with the attempt to damage or slow down the new login system.
    (D) An employee unintentionally downloads software to the system, and that software allows the cybercriminal to take over the computer to launch more attacks on the system.

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18. Which of the code segments would produce the following output?

```
0 0
0 1
0 2
1 1
1 2
2 2
```

(A)

```
x ← 0
REPEAT UNTIL (x = 3)
{
    y ← x
    REPEAT UNTIL (y = 3)
    {
        DISPLAY (x + " " + y)
        y ← y + 1
    }
    x ← x + 1
}
```

(B)

```
x ← 0
REPEAT UNTIL (x = 3)
{
    y ← x
    REPEAT UNTIL (y = 3)
    {
        y ← y + 1
        DISPLAY (x + " " + y)
    }
    x ← x + 1
}
```

(C)

```
x ← 0
y ← 0
REPEAT UNTIL (x = 3)
{
    REPEAT UNTIL (y = 3)
    {
        y ← y + 1
        DISPLAY (x + " " + y)
    }
    x ← x + 1
}
```

(D)

```
x ← 0
REPEAT UNTIL (x = 3)
{
    y ← x
    REPEAT UNTIL (y = 3)
    {
        DISPLAY (x + " " + y)
        y ← y + 1
        x ← x + 1
    }
}
```

```
x ← 0
REPEAT UNTIL (x = 3)
{
    y ← x
    REPEAT UNTIL (y = 3)
    {
        DISPLAY (x + " " + y)
        y ← y + 1
    }
    x ← x + 1
}
```

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19. The results of an online survey are automatically put into a spreadsheet. The survey is being used to find out the respondents' favorite candy by age group and state they live in. Here are the questions that are asked.

    Name (Open Field)
    Age (Dropdown menu)
    State (Dropdown menu)
    Favorite Candy (Open Field)

    Which of the following data pieces will most likely need to be cleaned the most?

    (A) Name
    (B) Age
    (C) State
    (D) Favorite Candy

20. Which of the following are NOT common protocols used on the Internet or the World Wide Web?

    (A) TCP
    (B) HTTP
    (C) UDP
    (D) IETF

21. Which of the following is an example of data mining being used to discriminate against a group of individuals?

    (A) Supermarkets use data mining from purchase history to determine what products they should group together at the store.
    (B) Medical professionals want to analyze large data sets of patient information to determine which patients would be the best candidates for different treatments.
    (C) Credit card companies use predictive analytics to determine what demographic of people will most likely have worse credit scores and need to be charged higher interest rates.
    (D) Social media sites use search history to help predict what websites someone will want to see.

22. A board game developer wants to see each player's chances of winning a game since the player who goes first might have an advantage. In order to do this, the developer must run over one thousand simulations.

    The game deals with a spinner that has 6 numbers on it, and all players will spin and move around the board. The players will not make any decisions, just move around the board the entire game. Which of the possible simulations will be the MOST efficient and cost-effective way to test out each player's chances of winning the game?

    (A) Have a person play the game by hand one thousand times, keeping track of which player wins each game.
    (B) Use a random number generator to have a person manually play the game, keeping track of which player wins each game.
    (C) Create an online simulator that runs through the game over a thousand times using random spins, keeping track of which player wins each game.
    (D) Hire 10 testers to play the game 100 times each, and track which player wins each game.

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23. A group of students is allowing a researcher to track the amount of time they spend on their smartphones throughout the day. The goal is to prove that smartphone use does not correlate with student success. The following data sets have been received by the researcher about each student:

- Amount of time spent on their phones each day
- Current GPA
- Social media sites used

Which of the following information should also be requested by the researcher in order to attempt to disprove a causal relationship between smartphone use and student success?

(A) The student's geolocations throughout the day
(B) If the student is using their smartphone for academic purposes
(C) How much time during the weekends the student uses their phones
(D) The financial and scholarship records from each student

24. The following procedure is intended to return true if all the values in `myList` increase the entire time. For example, if `myList` contains [0, 1, 2, 3], the values are increasing. If `myList` contains [0, 4, 4, 6], they are not increasing the entire time.

```
PROCEDURE isIncreasing(myList)
{
    increasing ← false
    prev ← 0
    FOR EACH item IN myList
    {
        IF(prev < item)
            increasing = true
        ELSE
            increasing = false
        prev = item
    }
    RETURN(increasing)
}
```

Which of the following values for `myList` can be used to show that this code segment does not work as intended?

(A) [1, 2, 4, 6]
(B) [1, 4, 2, 6]
(C) [1, 2, 6, 4]
(D) [1, 2, 4, 4]

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25. Every character has a corresponding ASCII key code. For example, the letter "K" has the corresponding ASCII key code of 75. Each letter is broken down into their ASCII key code in decimal (base 10) and then converted to binary (base 2). Here is a table of ASCII key codes:

Decimal	ASCII	Decimal	ASCII
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

Which of the following would be the binary representation of "HEY"?

(A) 01001000 01000101 01011001
(B) 01101000 01100101 01111001
(C) 00010010 10100010 10011010
(D) 01001001 01000110 01011010

26. What is the relationship between the World Wide Web and the Internet?

(A) The Internet connects servers to devices, and the World Wide Web uses the Internet to transmit and receive HTML to those devices.
(B) The Internet creates web pages, while the World Wide Web sends those pages to and from devices.
(C) The Internet can log off and log on, while the World Wide Web is always on and connected.
(D) The World Wide Web was created first for data sharing, while the Internet came after to assist in sharing information.

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27. Bradley wants to have a program that will determine what days he is supposed to work out and what days he is taking a day off. Bradley only wants to work out on odd numbered days of the month, and he takes weekends (Saturday and Sunday) off.

There are two variables. One is an integer called day that stores the day of the month. The other variable is a string called week that stores the day of the week (e.g., "Friday," "Saturday").

Which of the following code segments would NOT correctly output if Bradley should be working out or taking the day off?

(A)
```
var dayOdd = day MOD 2
IF (dayOdd = 0)
      DISPLAY("Day Off")
ELSE IF (week = "Saturday" OR week
  = "Sunday")
      DISPLAY ("Day Off")
ELSE
      DISPLAY ("Workout")
```

(B)
```
var dayOdd = day MOD 2
IF (dayOdd = 0 AND week =
  "Saturday" AND week = "Sunday")
      DISPLAY ("Day Off")
ELSE
      DISPLAY ("Workout")
```

(C)
```
var dayOdd = day MOD 2
IF (dayODD = 0 OR week = "Saturday"
  OR week = "Sunday)
      DISPLAY ("Day Off")
ELSE
      DISPLAY ("Workout")
```

(D)
```
var dayOdd = day MOD 2
IF (dayODD = 1 AND (week ≠
  "Saturday" AND week ≠ "Sunday"))
      DISPLAY ("Workout")
ELSE
      DISPLAY ("Day Off")
```

28. A bank needs to create a program to allow its customers to make deposits and withdrawals and print out a bank statement for each such transaction. Which of the following would be a good use of abstraction to manage the complexity of the program?

(A) Subtracting a fee from the customer's account every time they withdraw money
(B) Creating a loop that will continue until the customer is done depositing and withdrawing money
(C) Creating a procedure that will print out the customers bank statement that can be used multiple times throughout the program
(D) Checking to make sure the customers have enough money whenever they withdraw money, and then subtracting the amount withdrawn from their account

29. In order for drivers' education students to practice driving safely, a company created a driving simulation program. While the simulator does not have all of the typical controls of a car or move the driver physically around, it still simulates a driving situation around real streets. Which of the following would be the LEAST likely advantage to using this software?

(A) A driving simulator can let the user know how it physically feels to get into an accident.
(B) A driving simulator can help the user learn how to drive in traffic.
(C) A driving simulator can show the user when to use turn signals.
(D) A driving simulator can help the user learn how to follow all appropriate road signs.

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30. Which of the following is NOT a benefit of parallel computing as opposed to using sequential computing?

(A) Parallel computing will solve larger problems that can be broken into smaller problems that do not need to be solved in a specific order significantly quicker than sequential computing.
(B) With problems that fluctuate between being small or large, parallel computing makes it much easier to scale no matter the size of the problem.
(C) If a problem can be broken into smaller problems, but those smaller problems have to be solved in order, you can still use parallel computing because it can solve the problem more quickly.
(D) Some problems may require algorithms that cannot be solved in a reasonable amount of time using parallel computing, but may be solved in a reasonable amount of time using parallel computing.

31. Which of the following would not be a harmful effect on society, culture, or economy caused by using solar panels that harness energy on a large scale?

(A) The amount of land being used by a large number of solar panels could degrade the environment and possibly the habitat of plants or animals living there.
(B) The renewable energy will create less of a need for energy from other sources that cause major environmental issues.
(C) A tremendous amount of water is needed to produce solar panels, so their manufacturers could drain local water resources.
(D) Solar panel production requires manufacturers and their workers to handle toxic chemicals.

32. Which of the following would do the LEAST to lessen the digital divide in a school?

(A) A school purchasing devices for all the students to use in and out of school
(B) Training all parents on how to use their child's devices to monitor their academic success
(C) Not assigning homework that would require an Internet connection at home
(D) Allowing students to bring in their own personal devices for their online schoolwork

33. A manager of a shop is trying to disseminate information about wait times for their customers. Each time a customer shows up, they sign in, get added to a queue, and wait to be helped. What would be the greatest advantage of using a list to store each customer's time they signed in and the time they were helped, as opposed to just using several variables?

(A) The ability to print out each user's sign in time and the time they were helped at the end of the day
(B) The ability to find the average wait time
(C) The ability to find the longest and shortest wait times
(D) The ability to print out the total number of customers that day

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34. The following code segment is intended to store the maximum temperature of three days into the variable max. All three variables are integers. The code segment does not work for all cases.

```
max ← 0
IF (day1 > max)
      max = day1
IF (day2 > max)
      max = day2
IF (day3 > max)
      max = day3
```

Which of the following values for `day1`, `day2`, and `day3` would this code segment not work correctly?

(A) day1 = 50, day2 = 70, day3 = 30
(B) day1 = 30, day2 = 30, day3 = 30
(C) day1 = –40, day2 = –20, day3 = –30
(D) day1 = 0, day2 = 20, day3 = 40

35. Which of the following lines of code should be turned into a procedure in order to reuse duplicated code to help manage the complexity of the program?

```
Line 1:   IF (CAN_MOVE(forward))
Line 2:   {
Line 3:             MOVE_FORWARD()
Line 4:             ROTATE_LEFT()
Line 5:             ROTATE_LEFT()
Line 6:   }
Line 7:   ELSE
Line 8:   {
Line 9:             ROTATE_LEFT()
Line 10:            ROTATE_LEFT()
Line 11:            MOVE_FORWARD()
Line 12:            MOVE_FORWARD()
Line 13:  }
Line 14:  ROTATE_LEFT()
```

(A) Create a procedure called `turnLeftTwice()`, and use it to replace lines 4 and 5, and to replace lines 9 and 10.
(B) Create a procedure called `moving()`, and use it to replace lines 3–5, and lines 9–12.
(C) Create a procedure called `cantMove()`, and use it to replace lines 9–12.
(D) Create a procedure called `moveForwardTwice()` and use it to replace lines 11 and 12.

36. Which of the following are some advantages of using a lossy compression algorithm?

I. Using a lossy compression algorithm can greatly reduce the size of a file.
II. Using a lossy compression algorithm can ensure that the quality will not be reduced.
III. Using a lossy compression algorithm makes it quicker to send and store files.

(A) I only
(B) III only
(C) I and III only
(D) II and III only

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37. The code segment is supposed to take the list `fullList` and add all the values that are larger than `largeNum` to the list `newList`. The numbers do not need to be removed from `fullList`. All we want is `newList` to contain all the numbers larger than `largeNum`.

For example, if `fullList` contains [10, 20, 5, 25, 30, 15], and `largeNum` = 13, then `newList` should contain [20, 25, 30, 15] after running the code.

```
1 ← index
FOR EACH item IN fullList
{
    <missing code>
}
```

Which of the following code segments would make the code work as wanted?

(A)
```
IF (item < largeNum)
{
    INSERT(newList,index,item)
    index ← index + 1
}
```

(B)
```
IF (item > largeNum)
{
    INSERT(newList,index,item)
    index ← index + 1
}
```

(C)
```
IF (item > largeNum)
{
    INSERT(newList,index,item)
}
```

(D)
```
IF (item > largeNum)
{
    index ← index + 1
    INSERT(newList,index,item)
}
```

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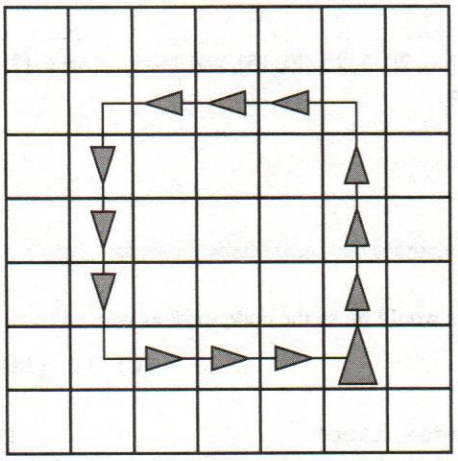
38. The following grid contains a robot represented as a triangle. The robot is initially facing up, and the robot ends in the same location facing up.



This example works for a robot that is moving three squares in each direction. We want to make it so the procedure takes one argument that will determine the number of squares in each direction the robot will go to make the square.

Which of the following code segments can be used to move the robot so it starts and finishes in the same location, facing the same direction, making a square the correct size?

(A)

```
PROCEDURE makeSquare(sideLength)
{
    REPEAT sideLength TIMES
    {
        REPEAT sideLength TIMES
        {
            MOVE_FORWARD()
        }
        ROTATE_LEFT()
    }
}
```

(B)

```
PROCEDURE makeSquare(sideLength)
{
    REPEAT 4 TIMES
    {
        MOVE_FORWARD()
        MOVE_FORWARD()
        MOVE_FORWARD()
        ROTATE_LEFT()
    }
}
```

(C)

```
PROCEDURE makeSquare(sideLength)
{
    REPEAT 4 TIMES
    {
        REPEAT sideLength TIMES
        {
            MOVE_FORWARD()
            ROTATE_LEFT()
        }
    }
}
```

(D)

```
PROCEDURE makeSquare(sideLength)
{
    REPEAT 4 TIMES
    {
        REPEAT sideLength TIMES
        {
            MOVE_FORWARD()
        }
        ROTATE_LEFT()
    }
}
```

GO ON TO THE NEXT PAGE.

Questions 39–40 refer to the information below.

Beth is creating a program that will create work groups in a class that she teaches. She wants establish groups to work with an assignment about the digital divide. The students are going to write a paper on how the digital divide creates unfair disadvantages for different students. She wants each group to have students who can contribute their own personal experiences with the digital divide.

Once Beth enters every students' information into the program, it will create groups with even numbers of students.

39. Which of the following data input(s) are going to be necessary to complete this program?

I. Each student's list of friends in the class
II. Each student's socioeconomic status
III. Every student's access to the Internet at home

(A) II only
(B) I and II only
(C) II and III
(D) I, II and III

40. Which of the following strategies would LEAST assist in creating a collaborative group environment for them to write a research paper on the digital divide?

(A) Have each student independently write a research paper, then combine their papers into one larger document.
(B) Have the students discuss their own experiences with the digital divide, and use that as a starting point to their research.
(C) Have each student research articles, then have everyone read the articles together and discuss.
(D) Have the group come up with an outline of the project together in a shared document.

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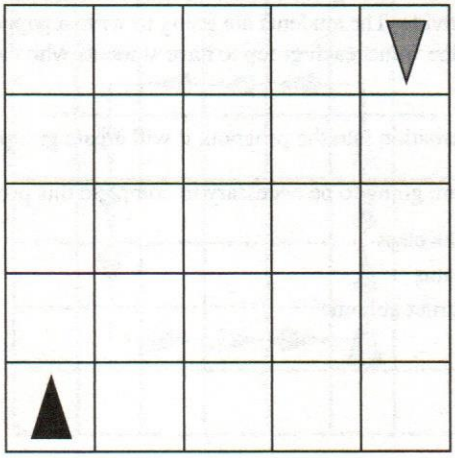
41. The following grid contains a robot represented as a triangle. The robot is initially the black triangle in the bottom left corner facing up. The robot needs to end up as the other triangle in the top right corner facing down.



Which of the following changes needs to be made to fix the following code?

```
Line 1:   REPEAT 2 TIMES
Line 2:   {
Line 3:         REPEAT 4 TIMES
Line 4:         {
Line 5:               MOVE_FORWARD()
Line 6:               TURN_RIGHT()
Line 7:         }
Line 8:   }
```

(A) Change Line 1 to `REPEAT 4 TIMES`
(B) Move Line 6 after Line 7
(C) Switch Line 5 and Line 6
(D) Move Line 6 after Line 8

42. A group of high school students from the same school all have similar demographics. This group is asked to fill out a survey that has different types of poll questions. The group administering the survey is not sure of the number of students who will participate, so the data analyzation must be scalable for all sizes. The school cannot require the students to take the survey, so as few as five students may take the survey, or as many as 2,000 students may take the survey.

The survey consists of the following types of questions.

- Ten questions that have two options
- Ten questions that have four options
- Five questions where the students will write in answers to the poll questions

Which of the following is LEAST likely to cause an issue when trying to fairly analyze the data without bias or having to spend too much time cleaning the data.

(A) The data set from the questions with two and four options will be too large to analyze.
(B) The data will need to be cleaned too much, especially write-in answers.
(C) The data will have bias since everyone is from similar demographics.
(D) The data will be incomplete if there are too few students answering the poll.

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43. Which of the following would be an example of a lossless compression?

(A) A picture is compressed to a much smaller size, but when it is restored it does not have the same picture quality as the original file before it was compressed.
(B) A file is compressed so it may be transmitted quicker, with no guarantees of being able to restore all the information.
(C) A music file is compressed and loses some quality, but not any quality that makes a difference to the human ear.
(D) A video is compressed since it was too large to be transmitted, but when it was restored back to its original size, it didn't lose anything.

44. A high school is holding an election for class president. There are two candidates running for office. Candidate A excels in all his classes and is in several clubs. Candidate B excels in athletics and music but struggles in academics. The entire school votes, and every student's vote is tracked in a data file.

The school has a second data file that contains every student's GPA, attendance record, and demographics. In addition to that, the second data file also contains which clubs, athletics, and music programs each student is involved in.

The stats class wants to combine both data sets and try to find as many correlations as they can between who the students voted for and information about the students. Using what we know about the two candidates, what filter would be LEAST important to use when trying to find a correlation?

(A) Create a filter to compare the votes and each student's GPA to look for a correlation.
(B) Create a filter to compare the students who are in the same clubs as candidate A and what percent of them voted for candidate A.
(C) Create a filter to compare the students who are in the same athletics as candidate B and what percent of them voted for candidate B.
(D) Create a filter that compares the attendance records of each student and who they voted for.

45. The following code segment is intended to store all the prime numbers that are between the numbers 1 and 20, inclusively, in the list `primeList`. The program currently has a procedure called `prime(number)`, which will receive a single parameter, and return true if that number is prime, false otherwise.

Procedure Call	Explanation
`prime(number)`	Returns true if the parameter (number) is a prime number, false otherwise

```
i ← 1
REPEAT 20 TIMES
{
    <missing code>
}
```

Which of the following can be used to replace `<missing code>` so that the code segment works as intended?

(A)
```
IF (prime(i))
    APPEND(primeList, i)
```

(B)
```
IF (prime(i))
{
    APPEND(primeList, i)
    i ← i + 1
}
```

(C)
```
IF (prime(i))
{
    i ← i + 1
    APPEND(primeList, i)
}
```

(D)
```
IF (prime(i))
{
    APPEND(primeList, i)
}
i ← i + 1
```

GO ON TO THE NEXT PAGE.

46. Upon completion of the following code segment, what would be printed out?

```
a ← 10
b ← 15
c ← a
a ← 20
c ← b

DISPLAY (a)
DISPLAY (c)
```

(A) 10 10
(B) 10 15
(C) 20 10
(D) 20 15

47. During an upcoming election, a social media site is accused of presenting bias toward one of the candidates. What adjustments can be made to the site that will be MOST effective for eliminating bias in their algorithms?

(A) Only show users news articles that may be favorable to whomever they are interested in voting for.
(B) Censor all information that might be questionable without checking the information, just to be sure that nothing gets posted that is untrue.
(C) Ensure that the search algorithms do not favor one candidate over another and show an equal amount of information about both candidates.
(D) Create an algorithm that will use the previously searched information to guide a user towards a candidate.

48. Which of the following will swap the values of `larger` and `smaller` only if `larger` is less than `smaller`?

For example, if `larger = 10` and `smaller = 20`, then the program should swap the two values since `smaller` is greater than `larger`. Therefore, `larger = 20` and `smaller = 10` at the end of the code segment.

(A)
```
IF larger > smaller
    larger = smaller
```

(B)
```
IF larger < smaller
    var temp = larger
    larger = smaller
    smaller = temp
```

(C)
```
IF larger < smaller
    larger = smaller
    smaller = larger
```

(D)
```
IF larger < smaller
    var temp = larger
    smaller = larger
    smaller = temp
```

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49. AN RGB triplet is a combination of three values that form a color, in the order of (red, green, blue). The decimal value of golden brown as an RGB triplet is (153, 101, 21). What would be the correct RGB value using binary?

(A) (10011001, 01100101, 00010101)
(B) (11011001, 11000101, 00001101)
(C) (11011001, 01100101, 00001101)
(D) (10011001, 11000101, 00010101)

50. The following procedure is supposed to return the number of items in `myList` that are between min and max, inclusively.

```
1   PROCEDURE countBetween(myList, min, max)
2   {
3    counter ← 0
4    FOR EACH item IN myList
5    {
6     IF(item ≥ min OR item ≤ max)
7        counter ← counter + 1
8    }
9    RETURN(counter)
10  }
```

The procedure does not work as intended. What change needs to be made so the procedures will work as intended?

(A) Switch Line 3 so it is inside the loop, right after line 5
(B) Switch Line 9 into the loop, right after Line 7
(C) Change Line 6 to `IF(item = min OR item = max)`
(D) Change the `OR` in Line 6 to `AND`

51. Which of the following is NOT a legal way to use materials you have found on the Internet?

(A) The material does not have the © for copyright anywhere on it, so it is freely available for anyone to use.
(B) When using only a smaller part of an online text, you do not have to ask permission, even if that small part is the most important part.
(C) Any work on the Internet is automatically public domain and can be used in any way.
(D) Anyone can use open source materials for which the rights for reproduction have been waived by the owner.

52. What is the LEAST concerning issue with putting your personally identifiable information online?

(A) Your geolocation can be used by someone to find you at any time.
(B) Your browsing history can be used for targeted marking.
(C) Your social security number online can be used to steal your identity.
(D) Your geolocation can be used to commit a crime against someone if their location is always known.

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53. Which of the following would properly perform a binary search, and what would be the maximum amount of searches needed to find an element on the list using a binary search?

(A) Searching for a name through a list of 50 names and ID numbers that are stored alphabetically. Using a binary search to find a name in this list would take a maximum of 6 searches.
(B) Searching for an ID number through a list of 50 names and ID numbers that are stored alphabetically. Using a binary search, this would take a maximum of 6 searches.
(C) Searching for an account number through a list of 100 account numbers that are stored from least to greatest. Using a binary search, this would take a maximum of 10 searches.
(D) Searching for an account number through an unsorted list of 100 account numbers. Using a binary search, this would take a maximum of 7 searches.

54. A list of names has n elements, indexed from 1 to n. A program needs to go through the entire list and find all the occurrences of the name "Jenny." The program would start by creating a variable called counter, and setting it to 0. Then it would create a variable called position, and set it to 1.

Which of the following algorithms would properly count all the occurrences of "Jenny" in the list, and print out the number of times it appears after the program is done counting?

(A) Step 1: If the value of index position in list equals "Jenny", increment counter by 1.
Step 2: Repeat Step 1
Step 3: Display counter
(B) Step 1: If the value of index position in list equals "Jenny", increment position by 1.
Step 2: Increment position by 1.
Step 3: Repeat Step 2
Step 4: Display position
(C) Step 1: If the value of index position in list equals "Jenny", increment counter by 1.
Step 2: Increment position by 1.
Step 3: Repeat Step 2
Step 4: Display counter
(D) Step 1: If the value of index position in list equals "Jenny", increment counter by 1.
Step 2: Increment position by 1.
Step 3: Display counter
Step 4: Repeat Step 2

55. A company wants to run a website that stores pictures for users and hires a programmer to create it. The programmer is told that the website will be a low-cost alternative to more expensive websites, so they want the programmer to find the cheapest ways to upload, store, and download the images without losing quality.

Which of the following would be good examples of ways to keep the cost down?

I. Store all the pictures without any compression since that is the only way they will not lose any quality.
II. Make all the images lossy since it will be quicker to download them from the site.
III. Make all the images lossy, but make sure you do not lose any quality that would be visible to the human eye when uploading and downloading them.

(A) I
(B) II
(C) I and II
(D) II and III

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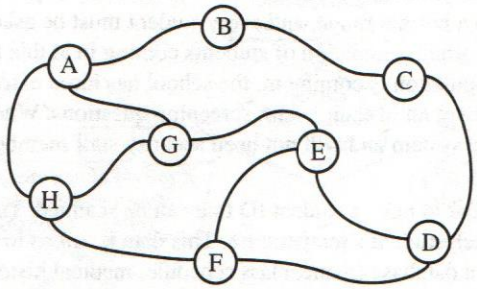
56. The figure below represents a network of physically linked devices. Any line that is drawn between two devices means they are connected. A device can communicate with any other device through these connections.



Which of the following statement(s) are true about this connection?

I. If devices B and D were to fail, then device C would not be able to receive any data from any other device.
II. If devices C and F were to fail, then device B could not connect to device D.
III. If devices G and E were to fail, no devices would be able to communicate with each other.

(A) I only
(B) III only
(C) I and II
(D) I, II and III

57. Which of the following would be the MOST appropriate citizen's science project, and why?
(A) Have non-scientists request people from different regions to track animals throughout the wild to see where they migrate during certain seasons
(B) A group of scientists requesting people from different regions take pictures of the sky at night, sending the pictures to them, and then having the scientists analyze light pollution from these regions
(C) Have people from different regions purchase science kits and analyze water samples in their kitchen, and then analyze their data individually
(D) A non-for-profit group having users download an app that tracks users as they go about their day. They use this data as open source to show where people frequently visit in different locations

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Questions 58–62 refer to the information below.

A school is trying to figure out a more efficient way to sign in students every day. Due to a recent health crisis, every student's temperature must be verified to be in a normal range, and every student must be asked a series of questions about their recent health history. The school only has a small population of students coming in at this time, but soon the entire school will be back. During the time the smaller population is coming in, the school has hired extra security members at each door to take each student's temperature and ask them all of their health screening questions. When the entire population returns, the school is planning to switch to an automated system and will not need security staff members at each door.

This new system requires every student to have a student ID that can be scanned. The school also purchased a walk-through temperature scanner that will take each student's temperature. This data is linked to each student's ID number, which is linked to all of the student's information in a database (name, class schedule, medical history, etc.). Before each student shows up to school each day, they must have answered a series of questions about their current health using devices such as a cell phone, laptop, etc. To do this, they must log in to a system that is linked to all their school information. Here is a flowchart of the system and the use of each block in the flowchart.

Block	Explanation
Oval	The start of the algorithm
Parallelogram	An input or output step
Diamond	A conditional or decision step, where execution proceeds to the side labeled "Yes" if the answer to the question is yes and to the side labeled "No" if the answer to the question is no
Rectangle	The result of the algorithm

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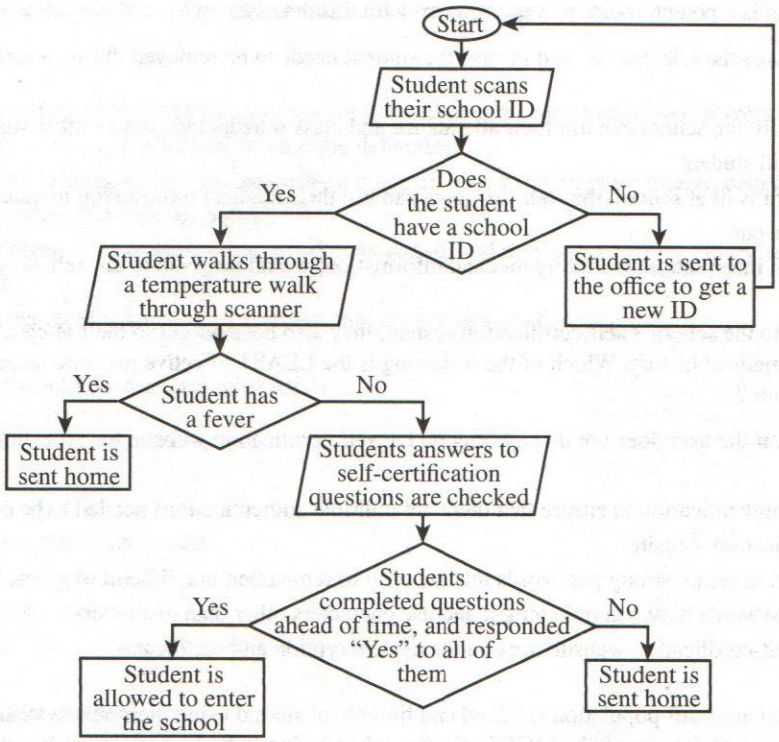

58. Which of the following has a potential harmful effect on society, culture, or economy when using the new system?

(A) The entire process of students entering the building will be sped up, resulting in less lost time.
(B) The need to hire more security personnel is eliminated, saving money, but resulting in job loss.
(C) Having an automated attendance system will help track the spread of the health crisis within their school and community.
(D) There will be less contact with the security staff since students' temperatures will be taken by a machine.

59. Which of the following actions would do the LEAST to address any problems that may occur due to a possible digital divide in this school's population?

(A) Provide every student with a device and Internet connectivity so they are all able to answer the self-certification questions ahead of time.
(B) Allow students to answer the self-certification questions on school devices when they get to school, instead of ahead of time.
(C) Make sure that every student has an ID before they come to school, and if they do not have an ID, send them to the office to get one for free.
(D) Ensure that every student has knowledge of how to use a device and how to use the self-certification system before starting to use the new system.

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60. Which of the following is a potential data privacy concern with this new system?

(A) The student's class schedule can be used in case the student needs to be removed during a certain class period because of a medical issue.
(B) If a student falls ill, the school can use their attendance and class schedule to contact other students about them being in contact with an ill student.
(C) When a student falls ill at school, the staff members can use their medical information to quickly assist with any major issues that can occur.
(D) Access to student information, including medical information, would be given to all staff, security, and district personnel.

61. When students log in to the school's self-certification system, they also have access to their attendance, personal information, school schedule, and medical history. Which of the following is the LEAST effective measure taken to ensure that this information stays private?

(A) After each login, if the user does not do anything on the self-certification website for 30 minutes, it automatically logs out.
(B) Use multifactor authentication to ensure that there are multiple authentications needed to be completed before logging in to the self-certification website.
(C) Require the users to create strong passwords that are easy to remember, but difficult to guess. This would include requiring the passwords have a certain length and use characters other than just letters.
(D) Make sure the self-certification website uses public key encryption and certificates.

62. When the entire student and staff population returned and the school started using their new system, several students still got sick. Which of the following data would be MOST effective when trying to find a correlation between which students got sick, and if they got other students sick, with the hopes of proving a causal relationship between sick students getting other students sick due to proximity?

(A) Comparing all the students who got sick to their medical history
(B) Checking for overlap in each sick student's class schedules
(C) Checking the time each student answers their self-certification questions in the morning
(D) Comparing the students' temperatures each day with their medical history

63. Which of the following actions can help bridge the digital divide for people with disabilities?

Select <u>two</u> answers.

(A) Make sure that these devices are not covered by insurance because then only those with insurance will be able to afford them.
(B) Making assistive technology less costly or free through the government so more people with disabilities can obtain them.
(C) Create grants for more research into technologies.
(D) Increase the cost of assistive technologies so there is more money available to enhance these technologies.

64. What are some examples that would make a system fault tolerant?

Select <u>two</u> answers.

(A) A system is able to send packets as quickly as possible over the Internet.
(B) The World Wide Web using HTML is able to read in website data sent over the Internet.
(C) The Internet allows data to be rerouted in case a connection has failed, guaranteeing that it will find a path to its destination.
(D) If there is a user error occurring somewhere within a system, it will be corrected automatically so there is no loss in production.

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65. Which of the following tasks would require a heuristic approach to solving a problem?

Select <u>two</u> answers.

(A) A programmer is tasked with creating a program for a trucking company to have their drivers find the approximate quickest daily routes through a full day of multiple deliveries.

(B) Creating a better lossy compression algorithm for a company that will compress images better than the current compression algorithm that they are using.

(C) A programmer is given a list of names that are already sorted, and they must create a binary search of an already sorted database of names.

(D) Creating a linear search of a database of accounts that are not in alphabetical order.

66. Which of the following would produce the same result as

```
num ≥ 10 AND num ≤ 20
```

Select <u>two</u> answers.

(A) `NOT (num < 10 OR num > 20)`

(B) `num = 10 OR num = 20`

(C) `num  10 OR num ≥ 20`

(D) `num ≥ 10 AND (NOT (num > 20))`

67. What is true about Internet protocols?

Select <u>two</u> answers.

(A) Internet protocols are open and allow people to connect as many devices as they want to the Internet.

(B) Internet protocols are established so everyone has the same bandwidth when sending and receiving information.

(C) Internet protocols are set so that only users that are using the same devices can connect to each other.

(D) Internet protocols make it so data gets where it needs to go through routing and addressing packets.

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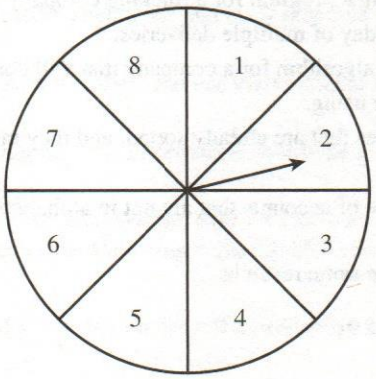
68. A board game has a spinner that has 8 different, evenly spaced numbers on it. The spinner looks like the following.

The game is played in the following way:



- A random number is chosen from 1 to 8 to simulate the spinner. The player gets the amount of points as the random number.
- If the first spin was an 8, the player gets another spin. Whatever the player gets on the second spin counts as 10 times the amount of that spin. The first spin does not count towards their score.

Example 1: If the player spins a 5 on their first spin, the score returned is 5.
Example 2: If the player spins an 8 on their first spin, the players gets a second spin. If the player spins a 3 on the second spin, the score returned is 3 times 10, which is 30.

The procedure `game()` was created to return the correct value from the spin(s).

```
PROCEDURE game()
{
      spin1 ← RANDOM(1,8)
      <missing code>
}
```

Which of the following can be used to replace `<missing code>` so that the code segment works as intended?

Select <u>two</u> answers.

(A)
```
IF (spin1 = 8)
      RETURN(RANDOM(1, 8) * 10)
ELSE
      RETURN(spin1)
```

(B)
```
IF (spin1 = 8)
      RETURN(spin1)
ELSE
      RETURN(RANDOM(10, 80))
```

(C)
```
IF (spin1 < 8)
      RETURN(spin1)
ELSE
{
      spin2 ← RANDOM(1,8)*10
      RETURN(spin2 * 10)
}
```

(D)
```
IF (spin1 < 8)
      RETURN(spin1)
ELSE
{
      spin2 ← RANDOM(1,8)
      RETURN(spin2 * 10)
}
```

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69. The price of going to a local waterpark depends on a person's age and if they have a coupon or not. A person's age will be stored at the variable age and will be an integer. If the person has a coupon, it will be stored as a Boolean `coupon`, which is true if they have the coupon, false otherwise.

If a person is under the age of 6, they do not pay to go to the waterpark. If they are 6 years old or older, they are charged $10. If they have a coupon, they are charged half.

Which of the following code segments correctly sets the value of cost?

Select <u>two</u> answers.

(A)

```
cost ← 0
IF age ≥ 6 AND coupon
    cost = 5
ELSE
    cost = 10
```

(B)

```
cost ← 0
IF age ≥ 6 AND coupon
    cost = 5
ELSE IF age ≥ 6 AND NOT coupon
    cost = 10
```

(C)

```
cost ← 0
IF age < 6 AND NOT coupon
    cost = 0
ELSE
    cost = 10
```

(D)

```
cost ← 0
IF age ≥ 6
{
    cost = 10
    IF coupon
        cost = cost / 2
}
```

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70. A teacher gives out three grades, "Exceeds" if a score is 90 or above, "Meets" if a score is greater than or equal to 70, but lower than 90, or "Does not meet" if a score is below 70. Which of the following would work for these specifications?

Select <u>two</u> answers.

(A)

```
IF score ≥ 90
    DISPLAY "Exceeds"
ELSE IF score ≥ 70
    DISPLAY "Meets"
ELSE
    DISPLAY "Does not meet"
```

(B)

```
IF score ≥ 90
    DISPLAY "Exceeds"
IF score ≥ 70
    DISPLAY "Meets"
IF score < 70
    DISPLAY "Does not meet"
```

(C)

```
IF score ≥ 90
    DISPLAY "Exceeds"
IF score ≥ 70 AND score < 90
    DISPLAY "Meets"
ELSE
    DISPLAY "Does not meet"
```

(D)

```
IF score ≥ 90
    DISPLAY "Exceeds"
IF score ≥ 70 AND score < 90
    DISPLAY "Meets"
IF score < 70
    DISPLAY "Does not meet"
```

STOP

END OF EXAM