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. Which of the following represents the minimum number of bytes that are required to represent the number 2719 in binary?

   (A) 1 byte
   (B) 2 bytes
   (C) 3 bytes
   (D) 4 bytes

2. Dania has a rectangular garden of $(11011110100)_2$-foot length and $(10101111000)_2$-foot width; she wants to fence her garden where the fence costs $5 per foot. Which of the following represents the total cost of fencing Dania's garden?

   (A) $15,300
   (B) $20,100
   (C) $25,100
   (D) $31,800

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3. Which of the following represents the correct descending order (from greatest to least) of the numbers given below?

$$(1101101)_2, (176)_{10}, (10001111)_2$$

(A) $(1101101)_2 > (176)_{10} > (10001111)_2$
(B) $(10001111)_2 > (1101101)_2 > (176)_{10}$
(C) $(1101101)_2 > (10001111)_2 > (176)_{10}$
(D) $(176)_{10} > (10001111)_2 > (1101101)_2$

4. Consider the Guess procedure below which is intended to receive a binary number constructed of zeros and ones:

```
PROCEDURE Guess Num
    IF NUM MOD 10=1
        RETURN "ODD"
    ELSE
        RETURN "EVEN"
```

Which of the following procedure calls results in displaying "EVEN" as an output?

(A) DISPLAY (Guess(100101010010))
(B) DISPLAY (Guess(101101011011))
(C) DISPLAY (Guess(111011010011))
(D) DISPLAY (Guess(111111000111))

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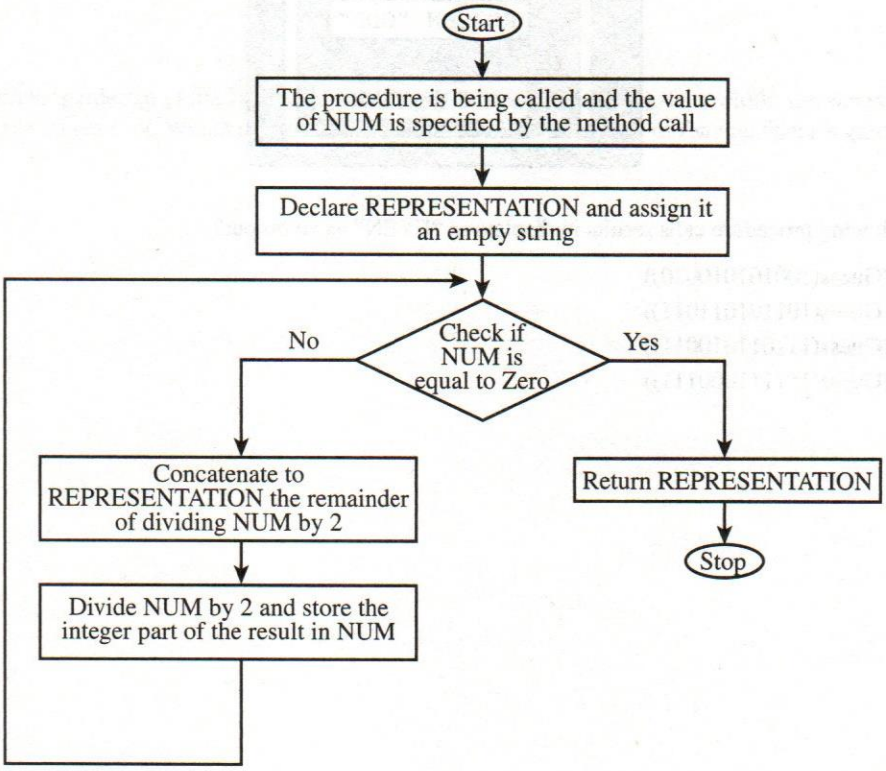
5. The procedure Guess below is intended to receive an integer and return its binary representation in a string.

```
PROCEDURE Guess(NUM)
{
    REPRESENTATION ← ""
    REPEAT UNTIL (NUM=0)
    {
    REPRESENTATION ← REPRESENTATION + NUM MOD 2
    NUM ← "Missing expression"
    }
    RETURN REPRESENTATION
}
```

The algorithm of the method is illustrated in the flowchart below:



Of the following, which option should replace "Missing expression" in order to make the procedure work properly as intended?

(A) `NUM / 2`
(B) `(NUM MOD 2) / 2`
(C) `NUM / 2 - (NUM MOD 2) / 2`
(D) `(NUM MOD 2) * 2 - (NUM MOD 2) / 2`

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6. Which of the following is the LEAST accurate about analog data and digital data?
   (A) Values represented in analog data change smoothly and continuously, whereas digital data have discrete values.
   (B) When representing an analog image digitally, the greater the resolution of the digital image, the closer it represents the analog image.
   (C) When representing an analog picture digitally, the number of bits used per a regular interval doesn't affect the accuracy of the resulting image.
   (D) When representing an analog image digitally, the physical dimensions of the digital image have no correlation to the accuracy of the resulting image.

Questions 7–8 refer to the information below.

American Standard Code for Information Interchange (ASCII) is an encoding scheme that assigns numeric codes for keyboard characters, numbers, and symbols.

The table below represents part of the ASCII table and shows some English letters along with their decimal ASCII codes. Each symbol is represented using 7 binary digits in ASCII.

Character	Decimal Code
S	83
L	76
A	65
V	86
D	68
U	85
G	71
T	84

7. What is the maximum number of symbols can be represented using the ASCII system according to the specifications given above?
   (A) 64
   (B) 128
   (C) 256
   (D) 512

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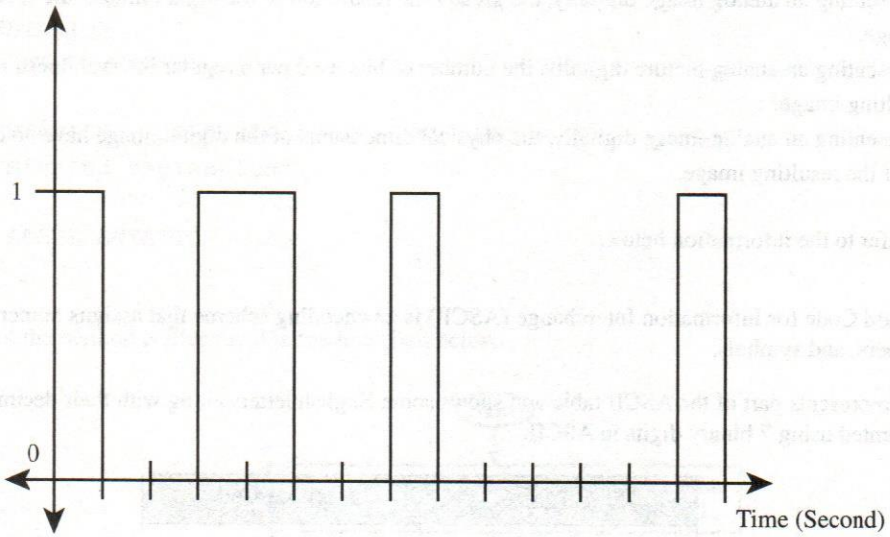
8. Using some of the ASCII characters given in the table, Joe created a digital signal with a bitrate of 1 bit/ second to represent the letters he used. What are the characters that Joe used as shown in the digital signal below?



(A) DS
(B) UG
(C) ST
(D) LA

9. Which of the following is/are correct about lossy and lossless compression techniques?

I. In lossy compression techniques, the exact original data can't be restored.
II. Lossy compression techniques work better than lossless techniques in terms of reducing files sizes.
III. If the quality of the file after the compression is done matters, then it is better to use lossy compression techniques.

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

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10. Suzy is texting her mother; she wants to save her time and send the message as soon as she can, so she wrote this message:

"I am wrtng to infrm y tht my mbl is ot of chrg and gng to trn off..dn't wry"

the original intended message was:

"I am writing to inform you that my mobile is out of charge and going to turn off……don't worry"

Which of the following best describes what Suzy did to compress her text message?

I. Suzy used a lossy compression technique to reduce the size of the message so it can be sent as soon as possible.
II. Lossless compression was used by Suzy as the recipient will receive the compressed message along with a dictionary of symbols to substitute for where symbols were used to reconstruct the original message.
III. The technique that Suzy used is not suitable for text compression as it relies on the recipient's ability to fill in the gaps to understand the message.

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

Questions 11–12 refer to the information below.

The table below summarizes data collected from people of different ages about the number of cups of water they consume per day.

Number of people	Age (years)	Number of cups
113	3	1
65	5	2
99	8	4
78	11	6
60	14	8
86	17	10
75	21	10
93	25	10

11. Which hypothesis is true based on the data given above?

I. Little kids need to consume water much more that adults.
II. Teenagers consume the least number of water cups.
III. People tend to consume more water as they are getting older.

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

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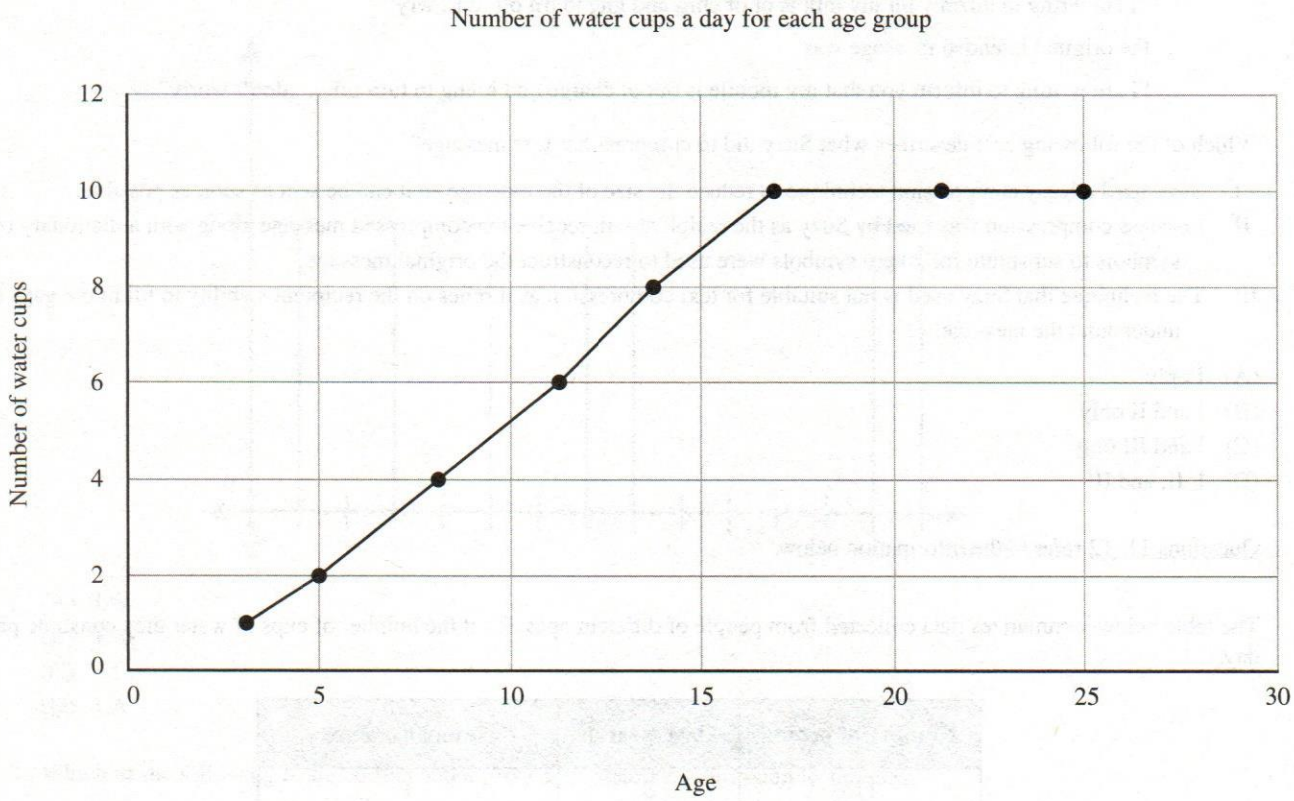
12. The graph below was created to visualize a portion of the data given in the dataset above.



Which of the following is correct about the given graph and data?

I. The graph shows a positive correlation among the two variables age and number of water cups from the age of 3 until the age of 17.
II. It is impossible to identify a correlation among variables based on the available data.
III. There is a linear relationship among the age and number of water cups variables from the age of 3 until the age of 17.

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

13. Which of the following is the final value assigned to the variable a after executing the code segment below?

```
a ← 10
b ← 6
c ← 5
b ← a - c
c ← b*2
a ← b MOD c
```

(A) 0
(B) 2
(C) 5
(D) 10

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14. Which of the following is correct about the metadata of a dataset of images?

    I. It can include the date of creation, the size of the dataset, and its content.
    II. It can increase the effective use of the dataset by providing additional information about it.
    III. It helps in pre-curating the dataset such as exporting, saving, and structuring it.

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

15. In order for an employee of a particular company to access a workstation, the employee must first provide a user name and password. Once this is done, the employee is prompted to input a code received on their mobile phones via SMS message. Only when this code is inputted, can the user access the workstation. This process is an example of which of the following?

    (A) Digital divide
    (B) Lossless compression
    (C) Public key encryption
    (D) Multifactor authentication

16. Which of the following represents the final output of the code segment below?

```
x ← 1
y ← 2
z ← 3
temp ← "x"+"y"+"z"
DISPLAY(temp)
```

    (A) 3
    (B) 4
    (C) 6
    (D) xyz

17. Messy datasets lead to inaccurate results when they are used in applications. Of the following, which is incorrect about cleaning and filtering datasets?

    (A) Filtering data helps in finding information and recognizing patterns in data.
    (B) Filtering allows you to keep the full dataset unchanged but shows the portion that needs work.
    (C) Manually applying cleaning and filtering processes on big datasets is much faster and more accurate than using computer programs.
    (D) Cleaning data makes the data uniform without changing its meaning by fixing problems related to incomplete data, invalid data, and duplicated data.

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Questions 18–19 refer to the information below.

A researcher is going to publish on the Internet some research that he conducted on his own. He wants to make some of his research available for users' distribution and modification under certain conditions.

18. Which of the following represents the material created by this researcher?

(A) Crowdsourcing
(B) Intellectual property
(C) Citizen science
(D) Documentaries

19. Which of the following is correct if the researcher decided to use the Creative Commons license?

(A) The researcher will make his research open source.
(B) The researcher wants to sell his research.
(C) The researcher has the capacity to decide how his works can be legitimately utilized and conveyed.
(D) The research is going to make his research open access.

20. Which of the following represents the final value assigned to the variable `flag`?

```
x ← 1
y ← 2
z ← 3
flag ← NOT(x ≥ y OR z ≠ y)
```

(A) True
(B) False
(C) 5
(D) 4

21. A string is an ordered sequence of characters where each character is given an index number starting from 1. For example, in the string "ABCDXYZ", the character A has the index 1, B has the index 2, and so on.

The procedure substring has two versions **substring(String, start, end)** and **substring(String, start)**. Both substring versions return string value.

The table below shows both versions of substring along with examples showing how can they be called and the returned string after calling each one of them:

Substring method	Example of how to call the procedure	Returned value
substring(String, start, end)	Substring("Hello CSP", 4, 6)	lo
substring(String, start)	Substring("Hello CSP", 2)	Hello CSP

What is the final value assigned to the variable temp after executing the program below?

```
str ← "Computer Science"
temp ← substring(str, 4, 7)+" "+substring(str, 10)
```

(A) put Science
(B) Science Com
(C) Com Computer
(D) Science Scie

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22. Which of the following represents the final contents of aList after executing the code segment below?

```
aList ← [4, 5, 3, 4, 2, 5, 1]
mark1 ← aList[1]
mark2 ← aList[2]
mark3 ← aList[3]
APPEND(aList, (mark1+mark2+mark3)/3)
```

(A) [4, 5, 3, 4, 2, 5, 1]
(B) [4, 5, 3, 4, 2, 5, 1, 4]
(C) [4, 5, 3, 4, 2, 5, 1, 1]
(D) [4, 5, 3, 4, 2, 5, 1, 5, 4]

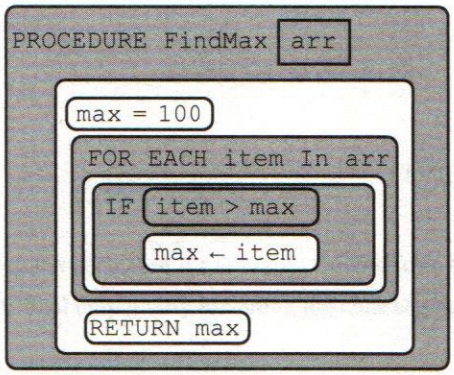
23. Refer to the code segment below:

```
List1 ← [12, 13, 22, 4, 7]
List2 ← [-4, -5, -21, -8]
INSERT(List1, 2, list2[3])
REMOVE(List2, LENGTH(List1) - 2)
APPEND(List1, LENGTH(List2)+ 5)
```

Which of the following represents the final values assigned to List1 and List2?

(A) List1: [12, -21, 13, 22, 5]
List2: [-4, -5, -21, -5]
(B) List1: [12, -21, 13, 22, 4]
List2: [-4, -5]
(C) List1: [12, -21, 13, 22, 4, 9]
List2: [-4, -5, -21, -1]
(D) List1: [12, -21, 13, 22, 4, 7, 8]
List2: [-4, -5, -21]

24. Refer to the procedure below. The procedure is intended to find and return the biggest number in the list arr that is received as an argument:



The procedure above is not working properly as intended with all test cases. Which of the following test cases should be passed to FindMax and results in returning an incorrect value?

(A) [0, 205]
(B) [-1, 0, 101]
(C) [1, 6, 9, 13]
(D) [105, 105, 93]

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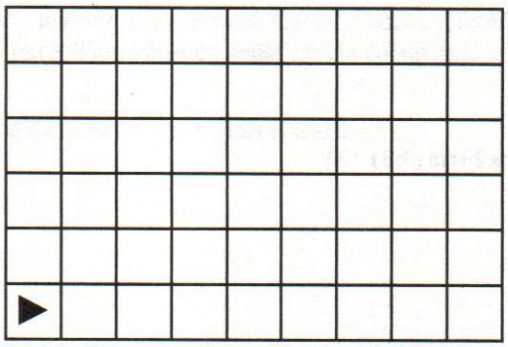
25. The following grid contains a robot represented as a triangle. The robot is initially facing right.



The procedure RollingDice() does not receive any arguments. The procedure controlRobot controls the robot to move it as instructed, the procedure receives two arguments: round and direction.

```
PROCEDURE RollingDice()
{
 temp ← RANDOM(1, 6)
  RETURN temp
}

PROCEDURE controlRobot(rounds, direction)
{
 REPEAT rounds TIMES
 {
   IF(direction)
        {
        ROTATE_RIGHT()
        }
   ELSE
        {
     ROTATE_LEFT()
      }
   steps←RollingDice()
   REPEAT steps TIMES
   {
              MOVE_FORWARD()
   }
 direction←NOT(direction)
 }
}
```

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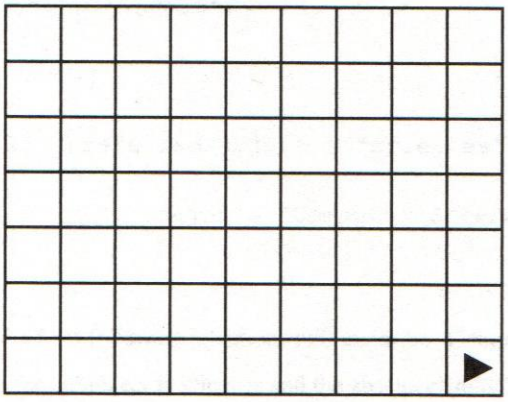
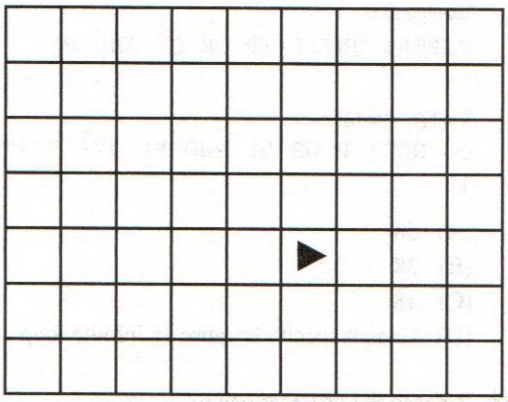
Which of the following is a possible placement for the robot after executing the procedure call below?

```
controlRobot(2, false)
```

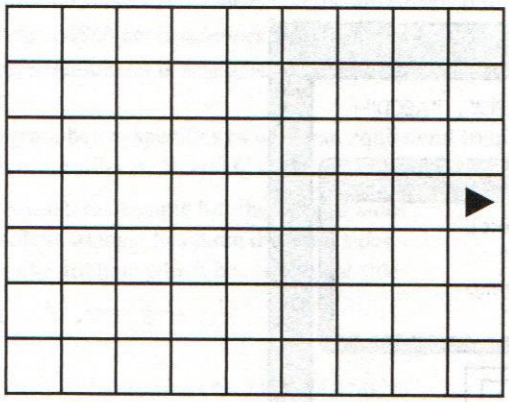
(A)



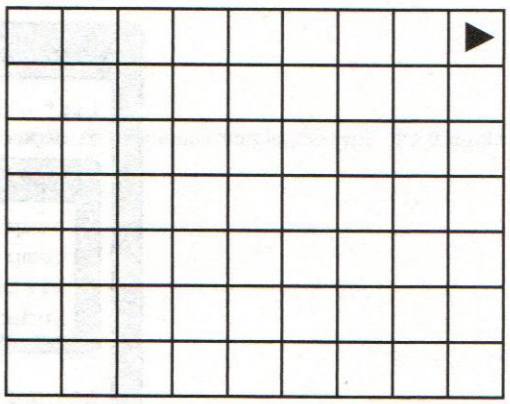
(C)



(B)



(D)



26. Refer to the program below:

```
temp←31
str←"Programming is interesting"
REPEAT UNTIL(temp MOD 15=0)
{
str←substring(str, 5 )
temp←temp - 4
}
DISPLAY(str)
```

The procedure substring(str, value) returns portion of the string str starting from the character at index value till the end of str. Which of the following represents the final output after executing the code segment above?

(A) ing
(B) esting
(C) is interesting
(D) ing is interesting

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27. Which of the following represents the final value assigned to the variable temp after executing the code segment below?

```
P←false
Q←true
temp←88
REPEAT UNTIL((P OR Q) AND P)
{
temp←temp-10
Q← NOT((P OR Q) AND P)
}
```

(A) 58
(B) 38
(C) 18
(D) Cannot specify because an infinite loop

28. Refer to the program below:

```
PROCEDURE proc
  list ← ["A", "AB", "ABC", "ABCD"]
  index ← 1
  REPEAT 5 TIMES
    temp ← list1[index]
    temp ← temp + "Z"
    list1[index] ← temp
    index ← index + 1
  RETURN LENGTH list1
```

Which of the following represents the return of the above procedure?

(A) 3
(B) 4
(C) 5
(D) An error message will be produced and the program will be terminated.

29. A computer program for teenagers indicates that it should be used only if the player's age is 12 or more and the player has agreed to the program's use terms and conditions.

The variable age holds the age of the player, and the variable terms holds a Boolean value of true if the player agreed on the terms and conditions or false otherwise.

Which of the following expressions evaluates to true if and only if a player meets the criteria?

(A) `(age ≥ 12) AND NOT(terms)`
(B) `(age > 12 OR age = 12) AND terms`
(C) `(age > 12 AND age = 12) OR terms`
(D) `(age ≥ 12) OR NOT(terms)`

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30. The program below uses a conditional to help a student to decide which major he can study in the university.

```
IF (preferredSubject = "sciences" AND absenteeism< 5)
{
   Major ← "Chemistry"
}
ELSE
{
     IF (preferredSubject = "sciences" AND absenteeism<10)
     {
              major ← "Computer Science"
     }
}
```

In which of the following situations will major be "Computer Science"?

(A) preferredSubject is sciences and the absenteeism is 7
(B) preferredSubject is sciences and the absenteeism is 1
(C) preferredSubject is sciences and the absenteeism is 3
(D) preferredSubject is sciences and the absenteeism is 10

31. The program below specifies as either an equilateral triangle, an isosceles triangle, or a scalene triangle, the type of a triangle which has the sides A, B, and C as described below:

- An equilateral triangle has three equal sides
- A scalene triangle has three different sides
- Isosceles triangle which has two equal sides

```
IF (A = B AND B = C)
{
   type ← "equilateral triangle"
}
ELSE
{
   IF (A ≠ B AND B ≠ C)
   {
     type ← "scalene triangle"
   }
   ELSE
   {
     IF (A = B OR B = C OR A = C)
     {
         type ← "isosceles triangle"
     }
   }
}
```

The program is not working properly with all test cases.

Which of the following yields an incorrect result after executing the program?

(A) When A = 5, B = 5, and C = 5
(B) When A = 5, B = 5, and C = 8
(C) When A = 5, B = 8, and C = 5
(D) When A = 8, B = 5, and C = 5

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32. Refer to the program below:

```
X ← 5
Y ← 10
Z ← -3
temp ← 100

IF ( X > 4 AND Y MOD 2 = 1)
{
   temp ← temp + 15
}
ELSE
{
   IF (Y MOD 3 = 1 AND temp / 10 = 5)
   {
     temp ← temp - 20
   }
   ELSE
   {
     IF (Z ← 0 OR (X + Y) MOD 4 = 0)
     {
         temp ← 10
     }
   }
}
```

Which of the following represents the final value assigned to the variable temp?

(A) 115
(B) 100
(C) 80
(D) 10

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Questions 33–34 refer to the procedure below.

Consider that each of arr1 and arr2 have the same number of values.

```
PROCEDURE Mystery(arr1, arr2)
{
    index ← 1
    status ← false
    REPEAT UNTIL(index > LENGTH(arr1))
    {
        value ← arr1[index]
        FOR EACH item IN arr2
        {
            IF(value = item)
            {
                status ← true
            }
        }
        IF(status = false)
        {
            APPEND(arr2, value)
        }
        index ← index+1
        status ← false
    }
    RETURN (arr2)
}
```

33. Which of the following correctly describes the main function of the procedure Mystery?

(A) Making two lists identical
(B) Duplicating the common values among two lists
(C) The values that are not in one list are to be copied from another list
(D) The common values among two lists are to be removed from one of them

34. Which of the following represents the content of `arr3` after executing the code segment below?

```
arr1 ← [5, 7, 9, 2]
arr2 ← [3, 7, 8, 5]
arr3 ← Mystery (arr2, arr1)
```

(A) [5, 7, 9, 2, 3, 8]
(B) [3, 7, 8, 5, 9, 2]
(C) [5, 7, 9, 2]
(D) [3, 7, 8, 5]

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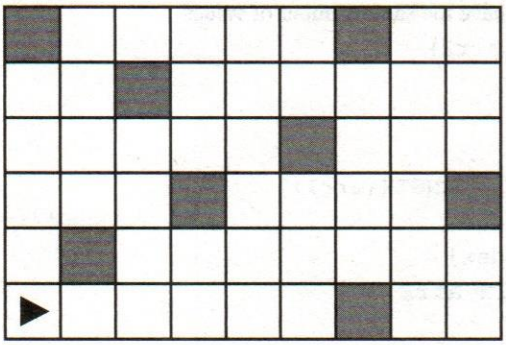
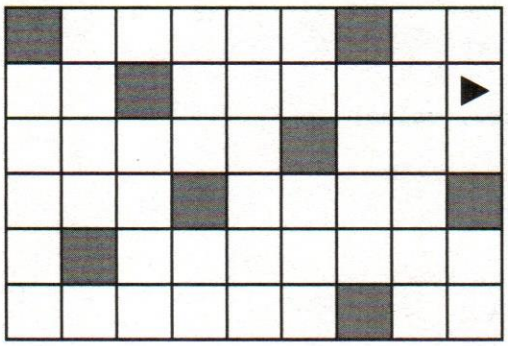
35. The following grid contains a robot represented as a triangle. The robot is initially facing right.



The robot can move into the white square only.

Which of the following programs will place the robot as illustrated below?



The procedure below controls the robot to move it as instructed, the procedure receives two arguments: round and direction.

I.
```
REPEAT 4 TIMES
{
    MOVE_FORWARD()
}
ROTATE_LEFT()
REPEAT 4 TIMES
{
    MOVE_FORWARD()
}
ROTATE_RIGHT()
REPEAT 4 TIMES
{
    MOVE_FORWARD()
}
```

II.
```
PROCEDURE goAhead(steps)
{
    REPEAT steps TIMES
    {
        MOVE_FORWARD()
    }
}
goAhead(4)
ROTATE_LEFT()
goAhead(4)
ROTATE_RIGHT()
goAhead(4)
```

(A) I only
(B) II only
(C) I and II
(D) Neither I nor II

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Questions 36–37 refer to the procedure below.

```
PROCEDURE CheckIt(arr)
{
    size ← LENGTH(arr)
    index1 ← 1
    REPEAT UNTIL (index1 > size)
    {
        index2 ← 1
        REPEAT UNTIL (index2 > size)
        {
            IF(index1 = index2)
            {
                index2 ← index2 + 1
            }
            IF(arr[index1] = arr[index2])
            {
                RETURN false
            }
            index2 ← index2 + 1
        }
    index1 ← index1 + 1
    }
    RETURN true
}
```

The procedure above was called as shown below but an error message was generated:

```
aList ← [5, 7, 9, 2]
CheckIt(aList)
```

36. Which of the following best describes the error in the program?

(A) At the last iteration, the index will exceed the length of the argument list. Index2 in the comparison (`arr[index1] = arr[index2]`) will be out of the list bounds.

(B) The index used to access the argument list will be negative in the last iteration, which results in terminating the program and producing an error message.

(C) Having two return statements in the program will cause a problem that terminates the program.

(D) Having nested iterations will cause an error of accessing values that are not existing in the list.

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37. The procedure `CheckIt` is fixed as shown below:

```
PROCEDURE CheckIt(arr)
{
        size ← LENGTH(arr)
        index1 ← 1
        REPEAT UNTIL index1 > size
    {
            index2 ← 1
            REPEAT UNTIL index2 > size
            {
                IF(index1 = index2)
              {
                  index2 ← index2 + 1
              }
                IF(index2 ≤ size)
                {
                    IF(arr[index1] = arr[index2])
                    {
                    RETURN false
                    }
                    index2 ← index2 + 1
                }
              }
            index1 ← index1 + 1
    }
     RETURN true
}
```

Which of the following represents the returned value after the procedure call below?

```
aList ← [5, 7, 9, 2]
CheckIt(aList)
```

(A) false
(B) true
(C) true false
(D) false true

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38. Refer to the search algorithm below that should be applied on a list of integers of n values indexed from 1 to n.

Step 1: Create the variable number and set it to the value you are looking for.
Step 2: Create the variable index and set it to 1.
Step 3: Check if the value at index is equal to number, if so, then return index and stop. Otherwise, add 1 to index.
Step 4: Repeat step 3 until index is greater than n.
Step 5: Return –1 and stop.

Of the following, which is the search algorithm that is described above?

I. Linear Search
II. Binary Search
III. Sequential Search

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

39. Which of the following is true about the binary search algorithm?

I. Data must be in sorted order to use the binary search algorithm.
II. The maximum number of comparisons when applying binary search on a list of 800 elements is less than 15.
III. Most of the time, applying binary search algorithm on a sorted list is less efficient than applying sequential search algorithm.

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

40. Natural Language processing HCI is a subfield of artificial intelligence that helps machines to understand human spoken or written words. Sam is a computer programmer, who is specialized in creating smart applications. Sam creates a language recognition application to be used on smart phones. The application accepts the user input and analyzes the meaning of it to perform the task or reply accordingly. For example, when a user asks to open a specific program or wants to save a text on the phone notes, the user instructs the application verbally and the algorithm tries to make sense of the user inputs. Word associations, analysis of context, and previous queries can be used to help the algorithm give satisfying results as well as speed up the process, but in all cases the solution can't be guaranteed to be optimal.

Which of the following best describes Sam's application and algorithm?

(A) It is impossible for an application to perform this task or it may not be able to perform it in a reasonable amount of time.
(B) The application uses a heuristic algorithm as no optimal solution is guaranteed.
(C) The problem is undecidable as the algorithm's given solution can't solve all instances of it.
(D) The algorithm has a polynomial efficiency and can't run in a reasonable amount of time.

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41. The two algorithms below are intended to display the result of the following series where n is a positive number:

$n^2 + (n-1)^2 + (n-2)^2 + \ldots\ldots + 25 + 16 + 9 + 4 + 1$

For example, if n is 6, then the method should display 91 as illustrated below:

$36 + 25 + 16 + 9 + 4 + 1 = 91$

Algorithm 1:

```
i ← n
REPEAT n TIMES
    sum ← 0
    sum ← (i * i) + sum
    i ← i - 1
DISPLAY [sum]
```

Algorithm 2:

```
i ← n
sum ← 0
REPEAT n TIMES
    sum ← (i * i) + sum
    i ← i - 1
DISPLAY [sum]
```

Which of the following correctly describes the result of using both of algorithm 1 and algorithm 2?

(A) Algorithm 1 correctly displays the series result but algorithm 2 does not.
(B) Algorithm 2 correctly displays the series result but algorithm 1 does not.
(C) Both of algorithm 1 and algorithm 2 display the correct result.
(D) Neither of the algorithms work correctly as intended.

42. Which of the following is correct about computer networks and routing?

I. Computer networks are interconnected computers and computing devices that have the ability to send and receive data within the network.
II. To send data from a computer to another in a network, the routing process finds a path from the sender to the receiver.
III. The Internet is the network of the interconnected networks that use standardized protocols to manage sending and receiving data through it.

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

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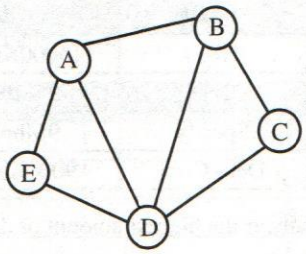
43. Refer to the figure below that represents a network that connects 5 computing devices:



Of the following, which is incorrect about the network above?

(A) The network is fault tolerant as it is able to support failures that happen.
(B) There is redundancy of rounding between all the computing devices in the network.
(C) If the line that connects station E with station A is disconnected, the whole network will stop working.
(D) If station C is out of response due to a technical issue, the network will keep working by avoiding it and using different routes.

44. Transmission Control Protocol (TCP) is an Internet protocol that facilitates exchanging messages on the Internet. Which of the following is not correct about the TCP protocol?

I. TCP has its own addressing system, and unlike other protocols, it doesn't use the IP protocol.
II. When sending messages, the TCP layer on the sender's side divides the messages into smaller packets to be forwarded by routers in the network.
III. The TCP layer on the sender's side numbers the packets to help the TCP layer on the receiver side put them in the correct order.

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

45. Which of the following is the Internet protocol that is described as an application level, client-server protocol, used to transmit hypermedia documents from servers to clients' computing devices and allows users to communicate data on the World Wide Web?

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

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46. The following Internet service providers (ISPs) offer Internet service for individuals as per the table below:

ISP	Bandwidth
Hi-Fi	15000Kbps
Tele	25Mbs
Speedy	9Mbps
Data-Com	9000Kbps

Of the following, which is the ISP that can transfer the highest amount of data per second?

(A) Hi-Fi
(B) Tele
(C) Speedy
(D) Data-Com

47. An IA solutions company has 850 employees, and each employee needs a computer and a mobile phone to be connected to the Internet at the same time during the whole workday.

Suppose that all employees are at work, what is the minimum number of bits needed in a binary number to provide addresses for all these devices so every single device in the company is assigned a unique address for connection to the Internet?

(A) 9
(B) 10
(C) 11
(D) 12

48. Refer to the steps below that describe how to send a message from computer A to computer B via the Internet using TCP/IP after establishing the connection between them:

- IP generates the IP addresses of the sender and the receiver and TCP breaks the message into packets and adds metadata to packets.
- Every packet will be sent through the connections and can take a different route between the source and the destination, depending on whether the original route becomes congested or unavailable.
- Packets may arrive out of order or even they may not arrive at all.
- Packets reception is acknowledged by TCP at the destination and they are reassembled.

Which of the following is guaranteed when using TCP?

I. Speed
II. Accuracy
III. Reliability

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

49. Which of the following represents an instance where UDP is better to be used than TCP?

(A) Emails
(B) Online video games
(C) Online payments
(D) Loading websites

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Questions 50–51 refer to the information below.

A computational task consists of 6 processes where each process should be executed on one processor only. The amount of time needed for each process is shown in the table below:

Process	Time needed to be executed on a processor
A	35 seconds
B	10 seconds
C	50 seconds
D	60 seconds
E	40 seconds
F	25 seconds

To execute and perform the task, two computers will be used. Computer 1 has one processor and computer 2 has two processors that can work in parallel. All processors in both computers are identical and can execute one process at a time.

The processes of the task are to be executed as follows, assuming that all processes and independent:

Process	Time needed to be executed on a processor	Computer to execute the process
A	35 seconds	Computer 2
B	10 seconds	Computer 2
C	50 seconds	Computer 1
D	60 seconds	Computer 2
E	40 seconds	Computer 2
F	25 seconds	Computer 1

50. Which of the following is a computational model that is followed when the executing the task?

I. Parallel computing
II. Sequential computing
III. Distributed computing

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

51. Which of the following represents the approximate least possible time needed to execute the six process by the two computers when all processors in computer 1 and computer 2 work simultaneously?

(A) 55
(B) 75
(C) 85
(D) 95

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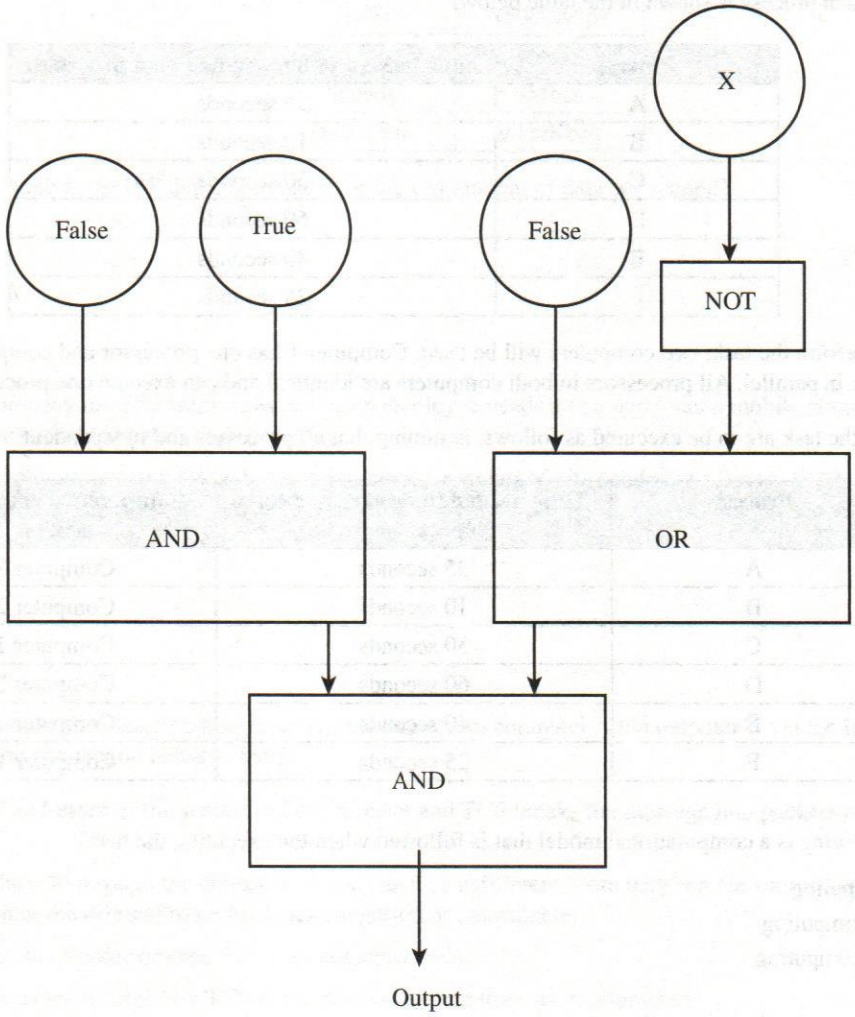
52. Refer to the circuit shown below that is composed of two AND operators, one OR operator and one NOT operator. The AND and OR operators take two inputs and each one of the generate one output while the NOT operator takes one input that is unknown in the given circuit and generates one output.



Which of the following correctly describes the final output of the circuit?

(A) The output of the circuit is true if X is true.
(B) The output of the circuit is true if X is false.
(C) The output of the circuit is always true regardless of what is the value of X.
(D) The output of the circuit is always false regardless of what is the value of X.

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53. Which of the following best describes Keylogging?

(A) The use of a program to record every keystroke made by a computer user in order to gain fraudulent access to passwords and other confidential information
(B) A technique that attempts to trick a user into providing personal information
(C) A malicious program that can copy itself and gain access to a computer in an unauthorized way
(D) A software intended to damage a computing system or to take partial control over its operation

54. Consider the following program:

```
i ← n
REPEAT 5 TIMES {
    i ← i + i
}

REPEAT 3 TIMES {
    i ← i * i
}
DISPLAY(i)
```

Which of the following expressions represents the result of the program?

(A) $(5 * n)^8$
(B) $(8 * n)^4$
(C) $(16 * n)^4$
(D) $(32 * n)^8$

55. A nutrition specialist maintains a dataset of different products of cereals with the following information about each item in the dataset:

- Product name
- Manufacturer
- Calories
- Carbohydrates
- Vitamins
- Ratings by people

Of the following, which can't be determined using his dataset?

(A) The product name with the highest number of ratings for each manufacturer
(B) The number of products that are produced by the same manufacturer
(C) The product that has the highest number of sales
(D) The products that should be avoided by people who are on a diet

56. Which of the following situations reveals digital divide?

(A) COVID-19 pandemic forced schools to close and have students all over the world, in cities and rural areas, to follow online studying models while not all students have stable access to the Internet and to computing devices
(B) A teacher conducts classes in the computer lab of a school where every student has a computer to perform his tasks on
(C) A group of students are conducting a research using their computers of the same model that are connected to the Internet at their homes
(D) A school changed the teaching model to online and offered every student and teacher a laptop and a tablet to be used to conduct lessons and perform tasks

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57. A programming team is developing an ordering procedure for products sold on a company's website.

The model website began with a simple version of the ordering procedure. Based on feedback received from its testers, the programming team developed new features and improved existing features that the testers sought. The process kept repeating until the final version of the program was produced.

Which of the following is the development model that was followed by the programming team?

I. Iterative development model
II. Incremental development model

(A) I only
(B) II only
(C) Both I and II
(D) Neither I nor II

Questions 58–62 refer to the information below.

A small bank has decided to develop a mobile app for its users, which the bank will create. All data at will be stored the local branch. The bank has resisted making this change because its users live in a small town where everyone knows each other. The bank realizes that by making the system online, there will be some concerns that require additional features.

The mobile app is requiring its customers to come to the bank and sign a form agreeing to the risks of the system and choose a pin number. When current customers come to the bank, they only need to provide their names to the bank teller to access their account information. When users accesses the new system, however, they will be required to provide their email addresses and chosen pin numbers. The app will then tell the user to do only the following:

- Access account #
- Read account balance
- Retrieve bank statement and transaction history from the last 60 days
- Process current checks/payments being processed
- Close bank account

58. Which of the following is the most plausible data storage concern of the new mobile banking system?

(A) The new mobile banking app will require a large amount of storage for the computer system and may cause the cost of banking for customers to rise.
(B) Since the bank is storing all data at their local branch, storage capacity may be a concern. It may require additional server updates or additional computer hardware.
(C) Storage of the data will require almost the identical amount of storage of the traditional bank and therefore no data storage concerns will occur with the new system.
(D) Storage of customer data may require cloud storage, which will leave bank customers with more privacy and security concerns due to possible hacking.

59. Which of the following statements is most likely to be true about the tradeoffs of customers enrolling in the mobile bank app?

(A) The mobile banking app will allow customers to have more ease of access but will limit functionality.
(B) Customers can travel more and have more protection of their money due to the security of the mobile banking app.
(C) The mobile banking app will improve the digital divide for customers of the bank but will limit customer-banker interactions.
(D) The bank tellers are able to more easily access information for customers due to their training, but using the app may take more time to access information due to customer inexperience.

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60. Which of the following is most likely to be a benefit of having a mobile banking app?

(A) The mobile banking app will allow its customers who are traveling to deposit checks and see information on their account.

(B) The mobile banking app will allow customers easier access to their accounts as less information is required to access them.

(C) Customers will be able to deposit checks, transfer money, and access account information from their own homes.

(D) Customers will be able to access bank information and close bank accounts outside of normal banking hours.

61. Which of the following input data is needed by the mobile banking app that was NOT needed by the original system?

(A) Email address, account number, and pin number

(B) Pin number, signed agreement, and email address

(C) Email address and account number

(D) No additional information is needed.

62. Which of the following data is necessary for the mobile bank app to allow customer access to bank statement data from 3 months ago?

(A) The customer is required to sign a form agreeing to risks of the new system and choose a pin number.

(B) No additional data is necessary to access bank statement data; using the mobile app will be identical to going to the physical bank location.

(C) Although use of the new system requires you to sign a form agreeing to risks of the mobile banking app and choose a pin number, the app will be unable to access bank statement data older than 60 days.

(D) To access bank statement data, the user will be required to input email address and pin number.

63. Consider the following program:

```
i ← RANDOM(5, 8)
n ← 3
REPEAT UNTIL n > 5
{
    i ← 2 * i + 1
    n ← n + 1
}
    DISPLAY(i)
```

Of the following, which is a possible output of the program?

Select two answers.

(A) 42

(B) 55

(C) 62

(D) 71

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64. The head pharmacist for a group of pharmacies plans to create a program that contains all 80,000 medicine products, their expiration dates, and warns when any product is going to expire in one month.

Of the following, which must be used within his program?

Select two answers.

(A) Selection
(B) Iteration
(C) Procedures
(D) Sorting

65. Which of the following is correct about computing innovations?

Select two answers.

(A) The creators of the computing innovations can't limit and consider all the possible ways their innovations are going to be used, but they should consider the potential beneficial and harmful effects of new uses.
(B) Computing innovations are specialized to computer science and they cannot be related to other fields such as medicine, art, engineering, and agriculture.
(C) Computing innovations have regularly had unintended advantageous impacts by driving progress in other areas.
(D) Unintended consequences of computing innovations are generally problematic.

66. In an event-driven program, an event associated with an action supplies input data for a program. Which of the following generates an event to execute program statements?

Select two answers.

(A) Calling a procedure
(B) Clicking a mouse
(C) Pressing a keyboard key
(D) Opening an application

67. A list of integers has n values indexed from 1 to n. The algorithm shown below is intended to add 5 to each number in the list and display the average of the list after the modification.

Step 1: Create the variable index and set it to 1.
Step 2: Create the variable total and set it to 0.
Step 3: Add the value at index to total, then Add 5 to the value at index.
Step 4: Increase index by 1.
Step 5: Repeat steps 2, 3 and 4 until index is greater than n.
Step 6: Create average variable and set it to total / n.
Step 7: Display the value of average.

The algorithm above is not doing the task properly. Which of the following modifications must be applied to the algorithm to fix it?

Select two answers.

(A) Swap steps 5 and 6.
(B) Swap steps 2 and 3.
(C) Change Step 3 into: Add 5 to the value at index, the add the value at index total.
(D) Change step 5 into: Repeat steps 3 and 4 until index is greater than n.

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68. Jone is designing a cooking program that is intended to explain how to cook a recipe.

The segment below is a portion of his big program and is supposed to do the following:

- The user will enter the recipe name.
- The user will enter the number of items needed for the recipe.
- Using a loop, the user will enter the ingredients one by one to a list that was previously declared as an empty list.
- A loop to iterate through the list is used to display all the content of the list that holds the ingredients to display them.

```
aList ← []
recipe ← INPUT()
NumberOfItems ← INPUT()
REPEAT NumberOfItems TIMES
{
 Ingredient ← INPUT()
 APPEND(aList, Ingredient)
}
DISPLAY("These are the ingredients of "+ recipe+": ")
index ←  /*MISSING VALUE */
REPEAT UNTIL(index<1)
{
 DISPLAY( aList[index])
 index ← index - 1
}
```

Which of the following values should be assigned to index variable so that the code will work properly as intended and all ingredients in the list are displayed with no errors?

Select <u>two</u> answers.

(A) NumberOfItems
(B) LENGTH (aList)
(C) LENGTH (aList) + 1
(D) NumberOfItems * 2

69. A machine learning model was created to classify students into either eligible to sit for the AP Computer Science Principles Exam or not eligible. The model was trained using a dataset composed of entries representing the student gender and a programming diagnostic test score. The dataset contains a total of 4323 records with the following details:

500 female records and 3823 male records
600 Java records and 2823 Python records

Which of the following best describes a problem in using this model in all schools to decide the students' eligibility to test the CSP?

Select <u>two</u> answers.

(A) It is unfair to use this model because the dataset contains biased data that checks Java and Python programming languages only and is not fair for students with other programming language skills.
(B) The model will help in making proper decisions about the students' eligibility to sit for the AP Computer Science Principles Exam.
(C) The model may give poor results for female students compared to male students because of bias in the dataset.
(D) The model will be able to specify the eligibility of the student if he/she sat for statistics AP Exam with a score of 3 or higher.

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Refer to the table below for information that was taken from a bigger dataset:

Year	% of Internet Usage
2016	42%
2017	46%
2018	54%
2019	56%
2020	60%

70. Of the following, which option best describes the given information in the table?

Select two answers.

(A) It represents metadata of the dataset, which describes the dataset and provides additional information about its content.
(B) It is considered part of the dataset content.
(C) Changes or deletions to it will cause an update to the primary content of the dataset.
(D) It helps in making the data structured and clean and can be used for finding, organizing, and managing information.

STOP

END OF EXAM