

COMPUTER SCIENCE PRINCIPLES**SECTION I****Time—2 hours****Number of Questions—70****Percent of total exam grade—70%**

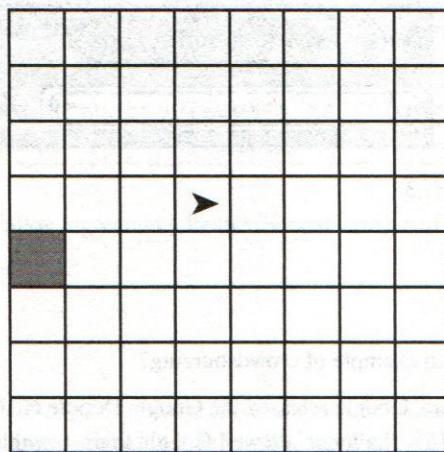
Directions: Choose one best answer for each questions. Some questions at the end of the test will have more than one correct answer; for these, you will be instructed to choose two answer choices.

1. The metadata from an image you took was released. Which of the following information could not be determined from the metadata?
 - (A) The names of the people in the picture
 - (B) Where you took the picture
 - (C) When you took the picture
 - (D) Size of the image
2. A student is designing a new classroom library record system. She has based it on 9 bits. How many possible books can she store in the library?
 - (A) 18
 - (B) 81
 - (C) 511
 - (D) 512
3. Which of the following would be an example of multifactor authentication?
 - (A) Requiring a password to login to the main website and an additional password to enter a chatroom feature of the website
 - (B) Requiring an email to verify joining a website
 - (C) Requiring both a text message code and password to login to a website
 - (D) Allowing users to setup a password or use their fingerprint to login to an application
4. Elon Musk, CEO of SpaceX, is currently planning a launch of thousands of Starlink satellites which will create constellations that can offer high-speed Internet anywhere on the planet. The plan is to ultimately create an interconnected network of about 12,000 small satellites in low orbit around Earth. Which of the following descriptions best describes his actions?
 - (A) Through the launching of these satellites, Elon Musk is increasing the chance of crowdsourcing.
 - (B) Elon Musk and SpaceX's actions will most likely help reduce the digital divide.
 - (C) Elon Musk and his Starlink satellites are an example of citizen science.
 - (D) Starlink satellites will most likely become a rogue access point.

READ THESE DIRECTIONS CAREFULLY

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5. The following grid contains a robot represented as a triangle. The robot is initially facing right. Which of the following code lines can replace the missing code to move the robot to the grey square?



REPEAT 3 TIMES

```
{
    <missing code>
}
MOVE_FORWARD()
REPEAT 2 TIMES
{
    ROTATE_LEFT()
    MOVE_FORWARD()
}
```

ROTATE_RIGHT()

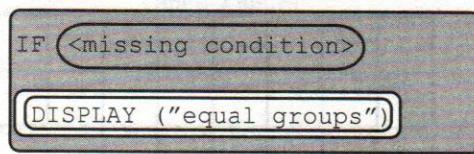
MOVE_FORWARD()

MOVE_FORWARD()

- (A) MOVE_FORWARD()
ROTATE_RIGHT()
- (B) ROTATE_RIGHT()
MOVE_FORWARD()
- (C) MOVE_FORWARD()
ROTATE_LEFT()
- (D) ROTATE_LEFT()
MOVE_FORWARD()

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6. A teacher is dividing her students in groups of 3 for an in-class project. She has created a computer program that will tell her whether or not she is able to equally distribute her students into groups of 3. Which of the following can replace the missing code to evaluate whether her classes can be divided into groups of 3 students evenly?



- (A) $\text{numStudents} \bmod 2 + 1 = 3$
 - (B) $\text{numStudents} \bmod 3 = 0$
 - (C) $\text{numStudents} / 3 = 0$
 - (D) $\text{numStudents} / 3 - 3 = 0$
7. Which of the following best describes an example of crowdsourcing?
- (A) In 2020, similar to the past 12 years, Google released the Google Doodle challenge, which asked students to design a doodle that expressed kindness. This challenge allowed Google to deepen their engagement with users.
 - (B) Code.org presents Hour of Code each year for students to engage in different types of coding to promote the idea that anyone can code.
 - (C) FoxSports.com streams the Super Bowl to allow anyone with Internet access to watch the game free. This increased the availability of the Super Bowl to many people.
 - (D) In July 2020, Loon, a part of Google's parent company Alphabet, launched high-altitude balloons in Kenya to deliver the Internet to rural and remote areas. These balloons would allow more people access to the Internet.
8. Which of the following provides an example of identity theft in relation to Personally Identifiable Information?
- (A) You receive an email from your bank stating that your savings and checking accounts have been locked because of suspicious withdrawals. The email instructs you to click on the link in order to reset your passwords and receive more details about the suspicious activity.
 - (B) A friend sends you an email with an attachment. You expect that it's something important and download it. Your computer then starts acting strange and is slow responding.
 - (C) Your credit report shows a fraudulent identity, where your social security number has been combined with fake details. This identity was used to file a tax return and open several credit card accounts.
 - (D) A friend posts on social media from your account, pretending to be you.
9. A picture has been compressed and each pixel value was averaged and converted to greyscale. Which of the following statements best describes the compression?
- (A) The original image cannot be restored since the above compression was lossy compression.
 - (B) The original image cannot be restored since the above compression was lossless compression.
 - (C) The original image can be restored since the above compression was lossy compression.
 - (D) The original image can be restored since the above compression was lossless compression.

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10. The following data table below shows how long each of the processes take depending on the number of binary bits.

Task	8 bits	80 bits	800 bits
Backing up an audio file	0.5 seconds	2.0 seconds	8 seconds
Creating a copy of an audio file	1 second	2 second	3 second
Searching an audio file	0.5 seconds	5 seconds	50 seconds
Deleting an audio file	0.25 seconds	0.75 seconds	2.25 seconds

Using this information, which of the following would take the shortest amount of time for 1000 bytes?

- (A) Deleting an audio file
- (B) Backing up an audio file
- (C) Searching an audio file
- (D) Creating a copy of an audio file

11. Which of the following descriptions shows computing bias for the facial recognition system?

- (A) Sylvia uses facial recognition in order to open the doors of her apartment when she is carrying heavy bags, but it doesn't allow the delivery driver access.
- (B) The facial recognition system is being used in the subway to reduce crime but not for fare collection and subway access.
- (C) In China, interlocking facial recognition cameras track where people are, what they are up to, and who they associate with—and are ultimately used to help assign people a single score based on whether the government considers them trustworthy.
- (D) Rekognition, Amazon's face-ID system, once identified Oprah Winfrey as male and is why many companies are abandoning facial recognition research.

12. Currently, the list of processes below are being completed sequentially. Since there are 2 processors available, what 2 processes could be done in parallel to best improve execution time?

Task	Processing Time
X	110 sec
Y	85 sec
Z	20 sec

- (A) Y and Z would be done sequentially and X would be run parallel.
- (B) X and Y would be done sequentially and Z would be run parallel.
- (C) Z and Y would be done sequentially and X would be run parallel.
- (D) Execution time would not be improved by running a parallel process.

13. What type of data is returned by the following procedure, equalNums?

```

PROCEDURE equalNums (num)
{
    counter ← 1
    done ← true
    REPEAT UNTIL(counter ≥ num)
    {
        counter ← counter + 1
    }
    IF (counter > num)
    {
        done ← false
    }
    DISPLAY(counter)
    RETURN (done)
}

```

- (A) Boolean
 (B) String
 (C) Number
 (D) Expression
14. Space-X has provided a set of criteria to determine whether an applicant is eligible for the next Mars mission. The person must be between the ages of 25 through 35, inclusive, and must be able to lift 50 lbs. The algorithm has a variable called age which represents the applicant's age and a variable called capable which stores the amount of weight an applicant can lift. Which of the following Boolean expressions will correctly evaluate whether an applicant is allowed to go on the next Mars mission?
- (A) $age \geq 25 \text{ OR } (age \leq 35 \text{ AND } capable \geq 50)$
 (B) $age \geq 25 \text{ OR } age \leq 35 \text{ AND } capable \geq 50$
 (C) $(age \geq 25 \text{ AND } age \leq 35) \text{ AND } capable \geq 50$
 (D) $age > 25 \text{ OR } age < 35 \text{ OR } capable \geq 50$
15. For which of the following situations below would it be best to use a heuristic in order to find a solution that runs in a reasonable amount of time?
- I. How many moves it will take for a computer to beat a human player
 - II. Finding the route to multiple desired destinations
 - III. Calculating student GPA
- (A) II only
 (B) I and II
 (C) III only
 (D) I, II, and III

16. Comparing the 2 algorithms below, which statement best compares time and identifies the algorithm that runs faster, given that calling the procedure `countX()` takes approximately 1 minute to run each time it is called?

Algorithm A

```
x ← 0
y ← 0
REPEAT n TIMES {
    x = countX();
}
REPEAT n TIMES {
    y = countX();
}
```

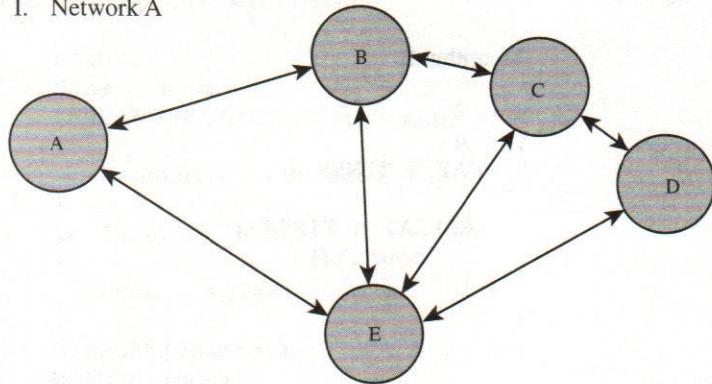
Algorithm B

```
x ← 0
y ← 0
REPEAT n TIMES {
    REPEAT n TIMES {
        countX();
    }
}
```

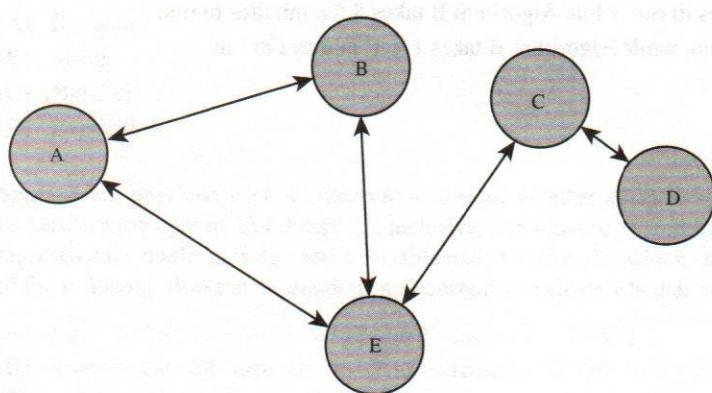
- (A) Both algorithms take the same amount of time.
- (B) Algorithm B is faster as it takes $2 * n$ minutes to run, while Algorithm A takes $4 * n$ minutes to run.
- (C) Algorithm A is faster as it takes $4 * n$ minutes to run, while Algorithm B takes $8 * n$ minutes to run.
- (D) Algorithm A is faster as it $2 * n$ minutes to run, while Algorithm B takes $1 * n^2$ minutes to run

17. Given the following network configurations, which shows fault tolerance due to redundancy between terminals A and C?

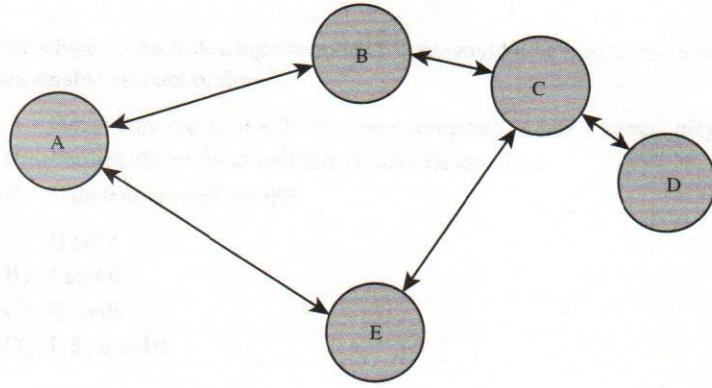
I. Network A



II. Network B



III. Network C



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

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18. Which of the following situations shows the use of Creative Commons?

- (A) Sally needs images of dogs for her presentation at school, she googles pictures of dogs and, even though they are copyrighted, she doesn't have to credit the photographer.
- (B) Preston is working on creating a new song to raise money by putting together sounds others have created; he uses audio clips which he found that had an attribution license.
- (C) Mrs. Alexander photocopies pages out of her book to share with students in her class who haven't purchased the book.
- (D) Steven quotes and cites an author who he interviewed for his book report.

19. Which of the following shows is not an example of phishing?

- (A) A user installs new software that they downloaded and then notices their computer is running slower and unexpected pop-up windows appear while browsing the Internet.
- (B) The user receives a link to a spoofed version of a popular website, designed to look like the real one, that asks them to confirm or update their account credentials.
- (C) Using an email address of the CEO of the company, the email asks the user to install a new app on their computer.
- (D) An email alerts users that there is an issue with their order and to confirm their payment information by opening the attachment and responding via email.

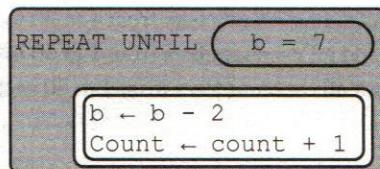
20. Given the following code, which expression is equivalent to the output displayed after this code segment is run?

```
x ← 8
y ← 5
```

```
REPEAT UNTIL(x < y)
{
    y ← y - 2
    x ← x - 5
}
DISPLAY (x*y)
```

- (A) $4 + 3 * -2 / 7$
- (B) $4 + 3 * -2 / 1$
- (C) $2 - 14 * -6 / 1$
- (D) $-2 + 14 * -2 / 4$

21.



Currently the programmer wants this loop to take a value of b and decrease it until the value of b is 7 and count how many times it takes to change the value of b to 7. Unfortunately, it only works part of the time. What code could be changed to ensure that it works regardless of the value of b initially?

- (A) Change condition for b to be equal to or greater than 7
- (B) Change so that it sets b to 7 in loop
- (C) Change so loop will repeat n times
- (D) Change so that b is decreased by 1 each time

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22. Steve has created 2 variables which hold integer values named num1 and num2. He needs to switch the values held in these variables so that the data in num1 is now contained in num2 and the data in num2 will now be contained in num1. Which of the following codes below will switch the data correctly?
- $\text{num2} \leftarrow \text{num1}$
 $\text{num} \leftarrow \text{num2}$
 $\text{num1} \leftarrow \text{num2}$
 - $\text{temp} \leftarrow \text{num2}$
 $\text{num1} \leftarrow \text{num2}$
 $\text{num2} \leftarrow \text{temp}$
 - $\text{temp} \leftarrow \text{num1}$
 $\text{num1} \leftarrow \text{num2}$
 $\text{num2} \leftarrow \text{temp}$
 - $\text{num1} \leftarrow \text{num2}$
 $\text{num2} \leftarrow \text{num1}$
23. A programmer wants to write code which will evaluate each number from 1 to 30 and determine whether it is an odd number. Odd numbers will be added to the list oddNum and displayed. Evaluate the 2 code segments below to determine whether they will output the correct list.

Code Segment #1

```

oddNum ← []
number ← 1
REPEAT 30 TIMES
{
    IF(number MOD 2 = 1)
    {
        oddNum[number] ← number
    }
    number ← number + 1
}
DISPLAY(oddNum)

```

Code Segment #2

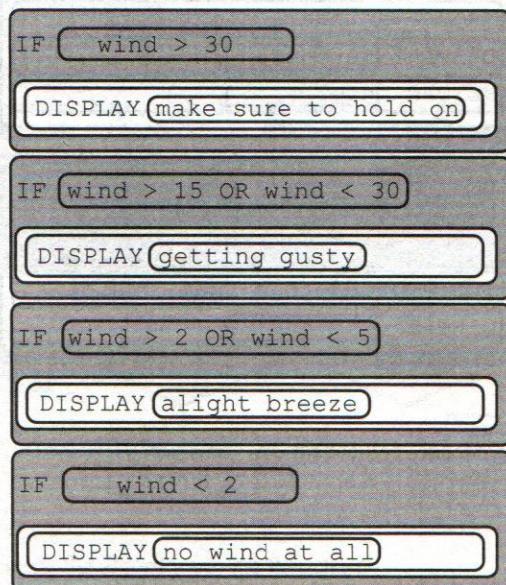
```

oddNum ← []
number ← 1
REPEAT 30 TIMES
{
    IF(number MOD 2 = 0)
    {
        APPEND(oddNum, number + 1)
    }
    number ← number + 1
}
DISPLAY(oddNum)

```

- Both code segments will correctly add all even numbers from 1 to 30 to the list.
- Only Code segment #1 will correctly add all even numbers from 1 to 30 to the list.
- Only Code segment #2 will correctly add all even numbers from 1 to 30 to the list.
- Neither code segment will correctly add all even numbers from 1 to 30 to the list.

24. The following code segment should allow a person to know how much the wind is blowing: If wind is less than 2 miles per hour, it should output “no wind at all”; if between 2 and 5 mph, it should output “a light breeze”; if greater than 15 mph but less than 30, it should say “getting gusty”; and if greater than 30 mph, it should say “make sure to hold on.” The following conditional statement does not function properly for all cases.

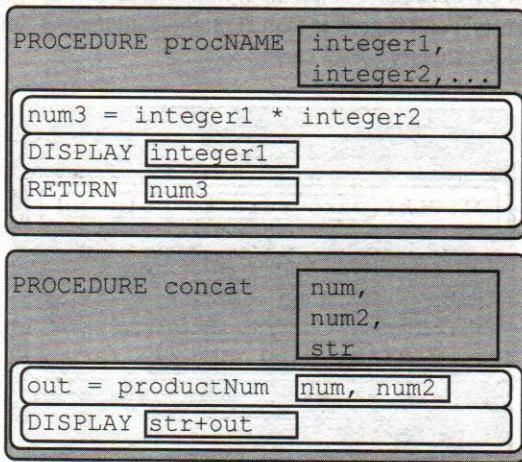


Which of the following corrections would allow the code to work for all cases?

- (A) Make IF statements nested
 - (B) Reverse the order of the IF statements
 - (C) Change the OR to AND in both complex IF statements
 - (D) Make all comparisons for Boolean conditions greater than or less than and equal to
25. The `createNew` procedure takes 2 string parameters and concatenates the first 2 letters of the first string parameter in reverse order with the last 2 letters of the second string parameter and return a string. The precondition of the procedure is that all strings will have a length greater than 3. Which of the following inputs will correctly create a variable name word containing acid?
- (A) `word ← createNew(acute, rapid)`
 - (B) `word ← createNew(castle, avoid)`
 - (C) `word ← createNew(car, paid)`
 - (D) `word ← createNew(caper, disk)`

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26.



What is displayed as a result of the procedure call concat(3,5, " answer")?

- (A) 3 answer 5
 (B) 15 answer 15
 (C) 5 answer 3
 (D) 3 answer 15
27. Procedure doSomething takes in 2 parameters, a list and integer, and follows the following algorithm.
1. Let min be the value at index 0 and max be the value at index of length – 1.
 2. If max < min, then stop: target is not present in array. Return –1.
 3. Compute mid as the average of max and min, rounded down (so that it is an integer).
 4. If array[guess] equals target, then stop. Return guess.
 5. If the guess was too low, that is, array[guess] < target, then set min = guess + 1.
 6. Otherwise, the guess was too high. Set max = guess – 1.
 7. Go back to step 2, repeat until procedure returns –1 or guess.

Which of the following are true statements about the procedure?

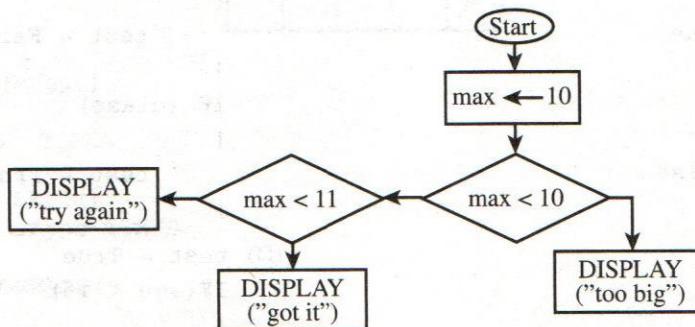
- I. It implements a binary search.
 - II. It implements a sort of list from greatest to least.
 - III. It only works as intended when the list is sorted.
- (A) I only
 (B) II only
 (C) I and III
 (D) II and III

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28. A flowchart is a way to visually represent an algorithm. The flowchart below is used to display a message under certain Boolean conditions. The flowchart uses the integer variable max.

Block	Explanation
Oval	The start or end of the algorithm
Diamond	A conditional or decision step, where execution proceeds to the side labeled true if the condition is true and to the side labeled false otherwise
Rectangle	One or more processing steps, such as a statement that assigns a value to a variable



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

- (A) Got it
 (B) Too big
 (C) Try again
 (D) Not enough information is provided to determine the output.
- 29.

```

IF(closed)
{
    DISPLAY("Check back")
}
ELSE
{
    IF(code < 10)
    {
        DISPLAY("Open in next hour")
    }
    ELSE
    {
        DISPLAY("Open Now")
    }
}
  
```

If the variable *closed* has the value false and *code* has the value 10, what is displayed as a result of running the code segment above?

- (A) Check back
 (B) Open in next hour
 (C) Check back Open in next hour
 (D) Open Now

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30. The division of motor vehicles uses the following system to determine whether a driver needs to take a driving test, which is stored in a Boolean variable called *test*. The program for the system contains 2 variables: *age*, which holds a numeric value for the applicant's age, and *class*, which is a Boolean variable, whether or not they have taken a class. Which of the following code segments correctly sets the value of *test* variable?

Fifteen-year-old drivers need to have taken a course but do not require a driving test. Those drivers 16 years and older must take a course but are still required to take a driving test.

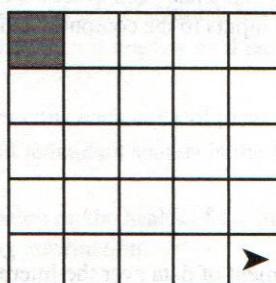
(A) `test ← False
IF (class)
{
 test ← True
}
IF(age = 15)
{
 test ← False
}`

(B) `test ← False
IF (class)
{
 test ← True
}
IF(age ≥ 16)
{
 test ← False
}`

(C) `test ← False
IF(age ≠ 16)
{
 test ← False
}
IF (class)
{
 test ← True
}`

(D) `test ← True
IF(age < 16)
{
 test ← False
}
IF (class)
{
 test ← True
}`

31. Which of the following code segments will allow the robot to get to the grey square from its current position?



```

PROCEDURE TARGET(steps)
over ← steps/2
    REPEAT over TIMES
    {
        ROTATE LEFT()
        REPEAT steps TIMES
        {
            FORWARD()
        }
    }

```

(A) TARGET(2)
(B) TARGET(4)
(C) TARGET(1)
(D) TARGET(5)

- 32.

```

list ← [5, 3, 12, 8, 9, 10]
a ← 1
b ← LENGTH(list)

REPEAT UNTIL (b < a)
{
    temp ← list[a]
    list[a] ← list[b]
    list[b] ← temp
    a++
    b--
}

```

Which of the following describes what is contained in the variable list after the code above runs?

- (A) 5, 3, 12, 8, 9, 10
(B) 10, 9, 8, 12, 3, 5
(C) 10, 9, 8, 5, 3, 12
(D) 10, 9, 8, 12, 5, 3

33. The police contacted Claire because they believed her identity had been stolen. New credit card accounts were opened with her personal information and certain existing accounts had been accessed by someone other than her. The police determined that software on her computer was recording all inputs to the computer and transmitting that data to another user. This best describes what type of cyberthreat?
- (A) Malware
(B) Phishing
(C) Virus
(D) Keylogger
34. Which of the following are true about the movement of data over the Internet?
- (A) If a packet is not received or is “dropped,” all packets, not just the dropped packet, need to be resent.
(B) Packets of data must be delivered in the same order they were sent otherwise the data will be corrupted.
(C) Packets may choose longer paths as they process the information and addressing data.
(D) A packet is divided into three parts; the header, payload and trailer, either containing data or address information so that the packet will be able to put together at the desired destination.
35. What is the benefit of having fault tolerant Internet routing?
- (A) Fault tolerance increases downtime, which may cause substantial data loss.
(B) Fault tolerance allows the reduction of redundancy allowing for best cost efficiency of the system.
(C) Fault tolerance allows packets to follow the same paths, which allows for more traceability of data.
(D) Fault tolerance increases the complexity of the Internet and has worked so well that so far no one has managed to break the entire Internet.
36. Which of the following demonstrates the largest privacy concern?
- (A) Katherine’s bank sends her an email asking her to call her local branch about a potential security breach.
(B) A website uses cookies to track what users do when they visit it.
(C) When Anna searches using Google, the company is able to share data from its search engine across a wide variety of services, including 3rd party companies.
(D) Steve logs on to the personal Wi-Fi at his home.
37. Which of the following would NOT be an unethical use of computer technology?
- (A) Looking up code for an assignment that you are struggling with as you prepare for the Create Task
(B) Weird Al Yankovic using the instrumental composition of the song “Smells Like Teen Spirit” as a base for his own lyrics, which poke fun at the band Nirvana
(C) Downloading the newest Star Wars movie since you aren’t able to go see it in the theater
(D) A student putting images in his presentation from the Internet without checking the sources to determine copyright
38. Which of the following cannot be represented by a single binary digit?
- (A) Result in MOD
(B) Grade in school
(C) Black and white pixels in an image
(D) Position of a light switch

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39. Which of the following best describes lossless compression?
- (A) A sound file is compressed and now has reduced size of data but has reduced sound quality.
 - (B) A sound file is compressed and emailed and when it reaches final recipient it is restored to its original details, quality, and size.
 - (C) An image file has been compressed by averaging each color of pixel.
 - (D) A sound file is compressed by removing all redundant sounds in the file.
40. In Florida, sharks are tagged to provide information on the health of the different species and also migration patterns. Tags that researchers place on sharks collect the following information.
- Location of shark
 - Speed of shark
 - Internal temperature of shark
 - Depth of shark movements
- Additionally, when the shark is tagged, data is collected on the species and gender of it.
- What cannot be determined by this data alone?
- (A) Whether sharks travel in groups
 - (B) Average body temperature of great white sharks
 - (C) How fast sharks can swim while in 30' deep water
 - (D) How location of shark causes a change in body temperature and speed
41. The bookstore assigns a binary number to each reading level in the children's book section. Reading level 0 are picture books and those in the young adult section are assigned 1011101, which is equal to what decimal number?
- (A) 93
 - (B) 101
 - (C) 109
 - (D) 189
42. Which best describes the terms Internet and World Wide Web?
- (A) Both are the same and are interchangeable terms.
 - (B) The World Wide Web is what the Internet was called before it expanded to be world wide.
 - (C) The Internet is a link of computers and servers, while the World Wide Web is a protocol which specifies how people can use the Internet.
 - (D) World Wide Web is a system of linked pages, programs, and files and it uses the Internet.
43. During a storm, Bob's computer is having difficulty loading websites, and when they do load, they seem to take a much longer time than normal. Which best describes what could be occurring?
- (A) The storm is causing issues and the network is fault tolerant, which is causing a slow connection.
 - (B) Due to lower available bandwidth, Bob's computer is having issues loading the websites.
 - (C) Redundancy is causing Bob's computer to be slow when loading web pages.
 - (D) Packets may have not arrived at the correct router, which is causing Bob's computer to be unable to load the web page.

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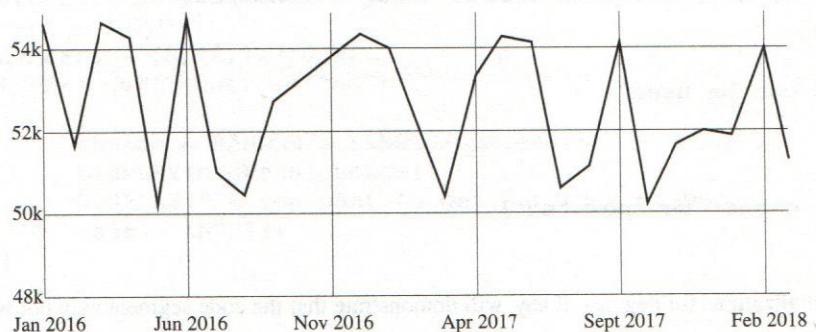
44. Johnny snaps his friend via SnapChat and tells him about a party in which there was illegal activity that he went to. He then realizes that this wasn't smart and deletes it. The following week, his school principal calls him into the office to discuss the party. Which best describes how this occurred?
- (A) Johnny's friend had to tell the principal because since Johnny deleted the message it is not possible for the data to be available.
 - (B) The principal is able to see snap messages that Johnny sent as it is public information.
 - (C) The principal is talking to all students in the high school about the party and doesn't know if Johnny was there or not.
 - (D) It is possible Johnny's snap was reshared or used for an unintended purpose even if he deleted it because once information is placed online it is very difficult completely delete.
45. Which of the following statements are most true about program documentation?
- (A) Program documentation is not required as it is mostly a tool for unskilled programmers and those just learning who do not know to make descriptive variable names.
 - (B) Program documentation only needs to be done when the program is complete; otherwise it is redundant.
 - (C) Programming documentation should be done throughout program development so that what code segments do and how they were developed is documented.
 - (D) Documentation is only required if you use code from other sources.
46. When making a program, a student encounters code that, although it has no syntax issues and runs, it still does not work correctly. What type of error is most likely occurring?
- (A) Syntax error
 - (B) Run-time error
 - (C) A user error
 - (D) A logic error

STOP! TURN THIS PAGE OVER.

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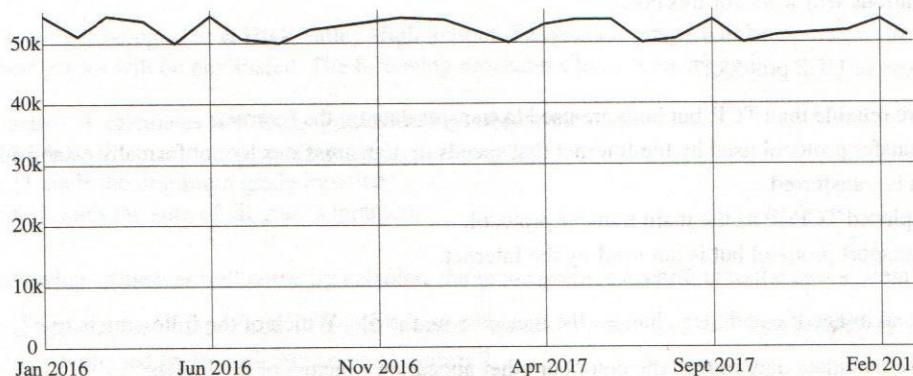
47. What explanation best fits the data about Monthly Revenue over different periods of time in the graphs shown below?

Monthly Revenue



Graph 1

Monthly Revenue



Graph 2

- (A) Monthly revenue for these years was almost identical as shown by Graph 2. Graph 1 must show outlier data.
- (B) Although the data looks fairly stable, when the axis is adjusted to better fit the data range, the visualization in Graph 1 shows there was variation across these years.
- (C) The 2 graphs must be 2 different data sets as they show different information and trends.
- (D) In order to best understand what is occurring with monthly revenue over these years, more data must be analyzed.

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48. A chef is unable to use the ovens in the kitchen when their temperature is at or below 120°C. The following code segment is intended to print a message indicating whether or not the chef is able to use the ovens based on the temperature. Assume that the variable degrees has been properly declared and initialized with the outside temperature.

```
IF (degrees ≥ 120)
{
    DISPLAY("Ovens can be used")
}
ELSE
{
    DISPLAY("Ovens cannot be operated")
}
```

- Which of the following initializations for degrees, if any, will demonstrate that the code segment may not work as intended?
- (A) degrees = 120
(B) degrees = 119
(C) degrees = 130
(D) All initializations will work for this code.
49. What is the purpose of UDP protocol?
- (A) UDP is more reliable than TCP, but both are used to transfer data on the Internet.
(B) UDP is a transfer protocol used by the Internet that speeds up transmissions by not formally establishing a connection before data is transferred.
(C) UDP has replaced TCP/IP as the main transfer protocol.
(D) UDP is a transport protocol but is not used by the Internet.
50. A student creates an image file and then changes the metadata on the file. Which of the following is true?
- (A) Changing the metadata may impact the colors or other appearance factors of the image.
(B) Although the metadata has been removed, the file will still contain information on when the image was created.
(C) Changing metadata will not affect the main data of the image.
(D) When metadata is deleted, it will not impact the image file size.
51. Which of the following is not an effective tool for extracting information from a large dataset?
- (A) Search tools
(B) Data filtering systems
(C) Visualization of data through graphs and charts
(D) Compressing data

DO NOT TURN OVER UNTIL TOLD.

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52. Which of the following lines in the code segment show a data abstraction?

```

Line 1: DISPLAY("Welcome to the Random Number Picker")
Line 2: DISPLAY("Do you want to get a random number")
Line 3: user ← INPUT()
Line 4: numbers ← [5,12,7,3,0,9]
Line 5: REPEAT UNTIL(user == "no")
Line 6: {
Line 7:     choice ← RANDOM(1,LENGTH(numbers)-1)
Line 8:     DISPLAY(numbers[choice])
Line 9:     DISPLAY("Do you want to get a random number")
Line 10:    user ← INPUT()
Line 11: }
```

- (A) Line 5
- (B) Line 3
- (C) Line 4
- (D) Line 7

53. A new grading system is being used at High Valley High School. The grade average will be calculated traditionally, but the lowest and highest grades will be eliminated. The following procedures have been created:

1. NumberGrades () calculates how many grades are inputted by the user.
2. MaxGrade () finds the maximum grade inputted.
3. MinGrade () finds the minimum grade inputted.
4. SumGrades () finds the sum of all grades inputted.

Which of the following sequences will correctly calculate the grade average according to the new system?

- (A) First MaxGrade () and MinGrade () are subtracted from SumGrades () and then divided by NumberGrades ()
- (B) SumGrades () divided by NumberGrades () minus 2
- (C) SumGrades () divided by NumGrades () minus MaxGrade () minus MinGrade ()
- (D) First MaxGrade () and MinGrade () are subtracted from SumGrades () and then divided by NumberGrades () minus 2

54. Consider the following code segment.

```

oldValues = [True, False, True, True]
Values2 = []
for EACH item IN oldValues
{
    IF (item)
    {
        APPEND (Values2, item)
    }
}
```

What, if anything, will be the contents of Values2 as a result of executing the code segment?

- (A) [True, False, True, True]
- (B) [True, True, True]
- (C) []
- (D) [False]

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55. A medical device R&D team has a new drug delivery system to test and plans to use a simulation. Which of the following is not an advantage of using simulation?
- (A) A simulation will allow researchers to help find unexpected behavior of the drug delivery system.
(B) Running a simulation will lessen the cost of developing the new drug delivery system.
(C) A simulation of a drug delivery system can allow researchers to examine possible long-term effects of system itself.
(D) A simulation will allow a greater population to understand all possible effects of the new drug delivery system without having complete knowledge of the system.
56. Computing innovations can be used in ways their original inventors did not intend or imagine. Which of the following is an unintended consequence of 3D printing?
- (A) Production of small tools and parts for robotics has become easily accessible and has no health, monetary, or proprietary down-sides.
(B) Toy makers may lose millions and have had to deal with increased piracy issues.
(C) Model making for architects and designers is becoming an increasingly specialized field.
(D) 3D printing is less of a health risk than most manufacturing processes, which has led to a healthier workforce.
57. How does the computer system verify that a website is secure?
- (A) The server hosting the website will present a digital certificate and your browser determines whether it is trusted.
(B) The trust model allows you to trust any website which claims it is secure without verification.
(C) Secure websites automatically encrypt all data using symmetric encryption.
(D) Computer systems use standard protocols to determine ownership by examining the IP address of the website.

Questions 58–62 refer to the information below:

A company is developing an upgrade to its VR system. The current system uses a full room of equipment to create an experience so that a person is able to look around the artificial world, move around in it, and interact with virtual features or items. The new upgraded system will use a headset for a similar experience. Both systems incorporate sensory and force feedback that collect data on position, movement, and response, using haptic technology to ensure an immersive experience. The old system was a stationary system and used a single static IP at the company's location. A user would enter their height and gender in order to start a simulation each time they used the system. Data was collected on simulations and haptic sensor data.

The new headset has a built-in screen processor and battery, as well as several viewfinders that provide stable spatial orientation and position recognition relative to the coordinates of peripheral devices. A single processor is self-contained in the headset, in comparison to the older model which used to render better, higher quality images. The new system is able to be used with any stable Internet connection and will enable users to create an account. The account setup will require an email address, name, height, and gender to access the VR system. The new system will log data on length of play, scores, simulations used and log haptic data. The company is hoping, that by creating a system that can be used in any environment where the Internet is available, more users will be able to use their system.

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58. Which of the following is the MOST plausible data privacy concern of the upgraded system?
- (A) The company could analyze which simulations are most popular and use this information to create new simulations of that type.
 - (B) Medical professionals could analyze the data to determine the effects of use of the system on response time of users.
 - (C) The storage of the upgraded system data will be much larger and could possibly require the company to utilize cloud storage.
 - (D) The new system will contain your information including email address, simulations used, and time spent in simulations. Since there is no disclosure by the company of how this data will be used, it may be possible for the company to sell your information to third party vendors for targeted advertising.
59. Which of the following is a potential effect of the VR application, rather than a purpose of the application?
- (A) The immersive nature of virtual and augmented reality can induce stress or anxiety after wearing a full occlusion headset for more than a few minutes.
 - (B) Medical colleges are able train doctors and nurses in complex medical procedures easier.
 - (C) Students are able to interactively experience historical events while remaining in the classroom.
 - (D) A scientist is able to manipulate atoms and molecules without the use of an electron microscope, using VR simulation instead to analyze reactions.
60. Which of the following statements is most likely to be true about the tradeoffs of using the new VR system?
- (A) Processing time and graphic quality may be decreased on the new stand-alone headset system.
 - (B) More people will be able to experience VR, but the company will have more control over personal data and the applications being used on their systems.
 - (C) Due to the less efficient processor in the stand-alone system, the stand-alone system will be less expensive but also run less detailed simulations.
 - (D) Although graphic quality may decrease, the processing time and types of simulations will increase on the new stand-alone headset.
61. Which of the following data is necessary for the new VR system to process in order to enable a user to run it?
- (A) IP address, email address, name, height, and gender
 - (B) E-mail address, height, gender, and name
 - (C) None: it can be run the same as the old system
 - (D) E-mail address, name, and age
62. Which of the following data is not provided directly from the user but is necessary for the upgraded system to operate as described?
- (A) Height of user
 - (B) Head movement and position data
 - (C) Age of user
 - (D) Choice of simulation

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63. What are the advantages of procedural abstraction?

Select **two** answers.

- (A) An advantage of using procedural abstractions is that coding time is reduced.
- (B) Procedural abstraction reduces debugging time since, when the same code is used in multiple places, changes to the code or fixing errors in the code only need to occur in a single spot.
- (C) Procedural abstraction eliminates the need for global variables, which will cause the program to be much less complex.
- (D) Procedural abstraction allows the solving of complex issues by focusing on the intricacies and not hiding any details.

64. Which of the following are examples of distributed computing?

Select **two** answers.

- (A) A one player game where puzzles are complex
- (B) Verizon cellular communication system
- (C) Program which calculates GPA of an individual student
- (D) Air traffic control systems

65. Which of the following statements are always true about data compression?

Select **two** answers.

- (A) When data compression is completed, fewer bits means less information.
- (B) When data compression is completed, quality is not always impacted, but you cannot revert to the original file.
- (C) Data compression is dependent on 2 factors: the amount of redundancy and the type of compression used.
- (D) Data compression reduces the number of bits of data but does not always impact the amount of information stored.

66. Which of the following are challenges that are found with processing data, regardless of data size?

Select **two** answers.

- (A) Data processing may require parallel systems since data may not be able to be processed with a single computer.
- (B) Data may contain invalid or incomplete data.
- (C) Data may need to be processed in order to make it uniform without changing the meaning of the data.
- (D) Data processing may affect the amount of information that is able to be extracted from it.

67. Which of the following are examples of analog data?

Select **two** answers.

- (A) Position of a runner on a cross country course
- (B) Measure of weight on bathroom scale
- (C) Blood pressure reading on blood pressure cuff
- (D) Volume of music playing on cell phone

68. Which of the following describes asymmetric encryption?

Select **two** answers.

- (A) Alice sends an encrypted message to Bob and tells him the key she used to encrypt the message so he can read it.
- (B) Alice sends Bob an encrypted message which she used a private key to encrypt and then Bob uses a public key that Alice published online to decrypt the message.
- (C) Alice stores her tax information on her computer and uses a password to protect it. Without the password, Alice will be unable to open the documents.
- (D) A server at Bob's work generates both a public and private key so that different users can access the data.

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69. Ron and Brenda are designing a computer program together. They have produced a beta version for testing and want users to test the functionality of the program. What are some advantages of this collaboration?

Select two answers.

- (A) Users are able to test the limitations of the program and report bugs, which will help both Ron and Brenda.
- (B) Users are able to add code to the program and increase functionality that Ron and Brenda did not originally include in it.
- (C) Having a diverse group of testers will allow for varied responses, enabling Ron and Brenda to anticipate the needs of varied users.
- (D) Using collaboration for developing the program may increase because of the wide variety of possible users.

70. If this code executes what value could be displayed?

Select two answers.

```
x ← 2
b ← RANDOM(1, 5)
REPEAT UNTIL (b < 1)
{
    IF(b MOD 2 = 1)
    {
        x ← x * 2
    }
    ELSE
    {
        x ← x + 2
    }
    b ← b - 1
}
DISPLAY(x)
```

- (A) 1
- (B) 4
- (C) 28
- (D) 160

STOP

END OF EXAM
