

Beijing National Day School
Department of Mathematics & Computer Science

AP Computer Science Principles

Test 3: The Internet and Algorithms

English Name: _____

Pinyin Name: _____

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Exam Record

Multiple Choice _____ / 39 pts

Total: _____ / 39 pts

Grade: _____

Section I: Multiple Choice (39 points)

- Decide which is the best of the choices given, and select the correct answer by placing an "X" in the corresponding box.

(1^{pt}) 1. The algorithm below is used to simulate the results of flipping a coin 4 times. Consider the goal of determining whether the simulation resulted in an equal number of heads and tails.

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

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

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

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

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

- `coin_flip = 1`
- `flip_counter = 1`
- `flip_counter = 2`
- `heads_counter = 2`

1 pt

(1^{pt}) 2. An algorithm has been developed to compute the sum of all the elements in a list of integers. Which of the following programming structures must be added to the existing algorithm so that the new algorithm computes the sum of only the even integers in the list?

- Iteration
- Searching
- Selection
- Sequencing

1 pt

(1^{pt}) 3. A programmer is writing a program that is intended to be able to process large amounts of data. Which of the following considerations is LEAST likely to affect the ability of the program to process larger data sets?

- How long the program takes to run.
- How many programming statements the program contains.
- How much memory the program requires, as it runs.
- How much storage space the program requires, as it runs.

1 pt

(1^{pt}) 4. Computers are often used to search through large sets of data, to discover useful patterns. Which of the following tasks is NOT an example where searching for patterns is needed, to produce useful information?

- A credit card company analyzing credit card purchases, to identify potential fraudulent charges.
- A grocery store analyzing their customers' past purchases, to suggest new products that the customer may be interested in.
- A high school analyzing student grades, to identify those students with the top ten highest grade point averages.
- An online retailer analyzing customers' viewing habits, to suggest other products, based on the purchasing history of the other customers.

1 pt

4 pts

(1^{pt}) 5. Which of the following statements is true?

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

1 pt

(1^{pt}) 6. An algorithm will be used to identify the maximum value in a list of one or more integers. Consider the two versions of the algorithm below:

1 pt

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

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

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

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

(1^{pt}) 7. Which of the following programs is most likely to benefit from the use of a heuristic?

- A program that calculates a student's grade based on the student's quiz and homework scores.
- A program that encrypts a folder of digital files.
- A program that finds the shortest driving route between two locations on a map.
- A program that sorts a list of numbers in order, from smallest to largest.

1 pt

(1^{pt}) 8. A certain computer game is played between a human player and a computer-controlled player. Every time the computer-controlled player has a turn, the game runs slowly because the computer evaluates all potential moves, and then selects the best one. Which of the following best describes the possibility of improving the running speed of the game?

- The game's running speed can only be improved if the game is played between two human players, instead of with the computer-controlled player.
- The game's running speed might be improved by using a process that finds approximate solutions every time the computer-controlled player has a turn.
- The game's running speed cannot be improved, because computers can only be programmed to find the best possible solution.
- The game's running speed cannot be improved, because the game is an example of an algorithm that does not run in a reasonable time.

1 pt

4 pts

- (1pt) 9. A programmer is developing a word game. The programmer wants to create an algorithm that will take a list of words, and return a list containing the first letter of all words that are palindromes(words that read the same, forwards or backwards). The returned list should be in alphabetical order. For example, if the list contains the words ["banana", "kayak", "mom", "apple", "level"], the returned list would contain ["k", "l", "m"], because "kayak", "level", and "mom" are palindromes. The programmer knows that the following steps are necessary for the algorithm, but they are not certain about the particular order in which they should be executed.

1 pt

Step	Explanation
Shorten	Takes a list of words, and returns a new list that contains only the first letter of each word from the input list.
Keep palindromes	Takes a list of words, and returns a list that contains only the palindromes from the input list.
Sort	Takes a list of words, and returns a copy of the list in alphabetical order.

Executing which of the following sequences of steps will enable the algorithm to work as intended?

- I. First shorten, then keep palindromes, then sort.
- II. First keep palindromes, then shorten, then sort.
- III. First sort, then keep palindromes, then shorten.

- I only
- II only
- I and III
- II and III

- (1pt) 10. An online retailer uses an algorithm to sort a list of n items, by price. The table below shows the approximate number of steps that the algorithm takes, to sort lists of different sizes.

1 pt

Number of Items	Number of Steps
10	100
20	400
30	900
40	1600
50	2500
60	3600

Based on the values in the table, which of the following best characterizes the algorithm for very large values of n ?

- The algorithm runs in reasonable time.
- The algorithm runs, but not in reasonable time.
- The algorithm attempts to solve an undecidable problem.
- The algorithm attempts to find an approximate solution, whenever it fails to find an exact solution.

2 pts

- (1^{pt}) **11.** A student wants to create an algorithm that can determine, given any program and program input, whether or not the program will go into an infinite loop for that input. The problem that the student is attempting to solve is considered an undecidable problem. Which of the following is true?

- It is possible to create an algorithm that will solve the problem for all programs and inputs, but the algorithm can only be implemented in a low-level programming language.
- It is possible to create an algorithm that will solve the problem for all programs and inputs, but the algorithm requires simultaneous execution on multiple CPUs.
- It is possible to create an algorithm that will solve the problem for all programs and inputs, but the algorithm will not run in reasonable time.
- It is not possible to create an algorithm that will solve the problem for all programs and inputs.

- (1^{pt}) **12.** Four independent algorithms listed below can be executed on a row of number cards(not face cards) placed on a table. There are an even number of cards, and they are placed in no particular order. Which of the following algorithms involves both selection and iteration?

- Look over all the cards to find the smallest one, and move it to the leftmost position.
- Compare the first two cards. If the one on the left is greater, swap them.
- Swap the leftmost card with the rightmost card.
- Find the middle card, and swap it with the card in the rightmost position.

- (1^{pt}) **13.** Which of the following is true of algorithms?

- Algorithms are composed of commands which implement sequencing, iteration, and selection by which a task can be completed on a computer.
- When implementing a solution to a problem, there is only one algorithm which will typically complete the task.
- Algorithms are very specific to the language in which they are implemented.
- When creating an algorithm, it is perfectly acceptable to omit important steps, and leave out sections which should be obvious to the end user.

- (1^{pt}) **14.** Which of the following choices signifies that an algorithm is considered correct?

- If the algorithm calculates the correct output for the majority of inputs, but there are cases for which it calculates incorrect outputs.
- If the algorithm is so robust, that it runs forever.
- If, for every input, the algorithm calculates the correct output. Also, it does not cause an error, and it does not run forever.
- If the algorithm is written using perfect pseudocode syntax.

- (1^{pt}) **15.** Which of the following algorithms are considered intractable?

- Sorting a list of integers from smallest to largest.
- Searching for an element in a list of integers.
- Computing the greatest common divisor(GCD) of two integers.
- Factoring a number into its constituent primes.

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	1 pt
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	1 pt
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	5 pts
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(1^{pt}) **16.** Which of the following best explains what happens when a new device is connected to the Internet?

- A device driver is assigned to the device.
- An Internet Protocol(IP) address is assigned to the device.
- A packet number is assigned to the device.
- A Web site is assigned to the device.

1 pt

(1^{pt}) **17.** Which of the following activities poses the greatest cybersecurity risk?

- Making a purchase at an online store that uses Public-key encryption to transmit the credit card information.
- Paying a bill using a secure electronic payment system.
- Reserving a hotel room by emailing a credit card number to a hotel.
- Withdrawing money from a bank account using an automated teller machine(ATM).

1 pt

(1^{pt}) **18.** Which of the following is LEAST likely to indicate a phishing attack?

- An email from your bank, asking you to call the telephone number on the back of your credit card, to verify a recent transaction.
- An email from a merchant, asking you to click on a link, to reset your password.
- An email from a public utility company, asking you to enter your date of birth and social security number for verification purposes.
- An email from an unknown sender, saying that you are the recipient of a large sum of money, and that they need your bank account number for the successful transfer of these funds.

1 pt

(1^{pt}) **19.** An Internet Service Provider(ISP) is considering an update to its servers that would save copies of the Web pages most frequently visited by each user. Which of the following is LEAST likely to occur as a result of the update?

- Average response time for user requests might decrease.
- The privacy of the users might be negatively affected.
- Storage requirements for the servers might increase.
- Web sites that are not visited frequently might no longer be accessible to users.

1 pt

(1^{pt}) **20.** Which of the following is a characteristic of the fault-tolerant nature of routing on the Internet?

- The ability to use a hierarchical naming system, to avoid naming conflicts.
- The ability to provide data transmission, even when some connections have failed.
- The ability to resolve errors in Domain Name System(DNS) lookups.
- The ability to use multiple protocols, such as HyperText Transfer Protocol(HTTP), Internet Protocol(IP), and Simple Mail Transfer Protocol(SMTP) to transfer data.

1 pt

5 pts

(1^{pt}) **21.** Two computers are built by different manufacturers. One is running a Web server, and the other is running a Web browser. Which of the following best describes the ability of the two computers to communicate with each other across the Internet?

1 pt

- The computers cannot communicate, because different manufacturers use different communication protocols.
- The computers can communicate, but additional hardware is needed, to convert data packets from one computer's protocol to the other computer's protocol.
- The computers can communicate directly, only if the message consists of text. Other formats cannot be interpreted across computers.
- The computers can communicate directly, because Internet communication uses standard protocols.

(1^{pt}) **22.** Which of the following best describes a Distributed Denial of Service(DDoS) attack?

1 pt

- An attempt by a country to deny its citizens access to the Internet.
- An attempt to deny users access to a Web site's resources, by flooding the Web site with requests from multiple systems.
- An attempt by one user to deny service to another user, by posting material on a social network.
- An attempt by a user of the Internet to get private information from a secure database.

(1^{pt}) **23.** A bank customer receives an email from a sender, claiming to be a bank employee. The email asks the customer to provide personal information, and to call a phone number, if they have any questions. The customer suspects that the email might be a phishing attempt. Which of the following responses is most likely to be a privacy risk for the bank customer?

1 pt

- Calling the bank at its official phone number, to ask whether the request for personal information is legitimate.
- Calling the phone number given in the email, and providing the personal information over the phone.
- Checking that the domain name of the sender's email address is associated with the bank.
- Conducting a Web search to see if other people have received similar requests for personal information.

(1^{pt}) **24.** Which of the following best describes the role of the Internet Engineering Task Force(IETF)?

1 pt

- Developing standards and protocols for Internet communication.
- Preventing copyrighted materials from being illegally distributed online.
- Preventing malicious software from being distributed online.
- Verifying the ownership of encrypted keys used in secured messages.

(1^{pt}) **25.** Which of the following is a true statement about Internet communication?

1 pt

- Devices from different manufacturers are required to run the same operating system to communicate over the Internet.
- Every device connected to the Internet is assigned a digital certificate by a certificate authority.
- Every device connected to the Internet is assigned an Internet Protocol(IP) address.
- Every device connected to the Internet requires a high-bandwidth connection.

5 pts

- (1^{pt}) **26.** Which of the following allows users to refer to Web sites using names, such as `example.com`, rather than the numerical IP address, such as `93.184.216.34`? 1 pt

- A digital certificate
- The domain name system(DNS)
- The hypertext transfer protocol(HTTP)
- The simple mail transfer protocol(SMTP)

- (1^{pt}) **27.** The latency of a network connection is most appropriately measured with which of the following units? 1 pt

- Bits per byte
- Bits per second
- Bytes
- Milliseconds

- (1^{pt}) **28.** Which of the following explains a benefit of using open standards and protocols for Internet communication? 1 pt

- Open standards and protocols allow different manufacturers and developers to build hardware and software that can communicate with hardware and software on the rest of the network.
- Open standards and protocols provide ways for users to eliminate the latency of the messages that they send on the Internet.
- Open standards and protocols allow users to freely share or reuse material found on the Internet for noncommercial purposes.
- Open standards and protocols prevent developers from releasing software that contains errors.

- (1^{pt}) **29.** Internet protocol version 4(IPv4) represents each IP address as a 32-bit binary number. Internet protocol version 6(IPv6) represents each IP address as a 128-bit binary number. Which of the following best describes the result of using 128-bit addresses instead of 32-bit addresses? 1 pt

- 4 times as many addresses are available.
- 96 times as many addresses are available.
- 2^4 times as many addresses are available.
- 2^{96} times as many addresses are available.

- (1^{pt}) **30.** In public key cryptography, the sender uses the recipient's public key to encrypt a message. Which of the following is needed to decrypt the message? 1 pt

- The sender's public key.
- The sender's private key.
- The recipient's public key.
- The recipient's private key.

5 pts

(1^{pt}) **31.** Which of the following describes how a distributed denial-of-service(DDoS) attack is most likely to compromise an online store's Web site? 1 pt

- By causing incorrect information about services to be displayed.
- By making it difficult for the site to safeguard customer login information.
- By preventing customers from placing orders.
- By preventing the store from filling previously placed orders.

(1^{pt}) **32.** You decide that you are going to take your Internet privacy seriously. Which of the following actions poses the greatest risk to your Internet privacy? 1 pt

- Sharing your email address with those who request it.
- Connecting to secured networks using the provided network name and password, when visiting hotels.
- Encrypting your files and sharing your private key, so that the others with whom you share those files, can read them.
- Using cloud storage to ensure seamless access to your data, from all your devices.

(1^{pt}) **33.** In the process of digging a trench, a landscaping company cuts a networking optic fiber line. Transmission of Internet traffic is still possible, however, through additional pathways that provide alternate routes between transmitter and receiver. These additional pathways describe a concept referred to as: 1 pt

- bandwidth
- hierarchy
- latency
- redundancy

(1^{pt}) **34.** One day, you receive an email from someone you don't recognize. Upon opening the email, you discover, to your great surprise, that you have been carefully selected by a Nigerian Prince to be the recipient of US\$550 million in surplus oil revenues. In order to facilitate the transfer of funds, you simply have to reply to the email with your name, address, and bank account number. Which of the following choices best describes this type of cyber threat? 1 pt

- Phishing
- Distributed denial of service attack
- Virus/malware
- Man-in-the-middle attack

(1^{pt}) **35.** Which of the following choices is a characteristic of the fault-tolerant nature of communication on the Internet? 1 pt

- Users can be assured that any software they download is free of viruses, if the download link clearly specifies, “100% VIRUS FREE!! NO HACKERZ GUARANTEED!!!!”
- The ability to provide data transmission, even when some connection links or routers have failed.
- The ability to resolve errors in Domain Name Server lookups.
- The ability to transfer data using multiple protocols, such as HyperText Transfer Protocol(HTTP), Internet Protocol(IP), and Simple Mail Transfer Protocol(SMTP).

5 pts

- (1^{pt}) **36.** When building Internet networks, it is important to consider redundancy. Which of the following is an example of redundancy?

- Optimizing the system, so that a single request has the shortest time duration between transmitting and receiving.
- Optimizing the system, so that as much data as possible can be transferred, in a certain amount of time.
- The hierarchical nature of the Internet allows for massive growth.
- Ensuring that if any single node in the network were to fail, then data packets could still be transmitted successfully.

	1 pt
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- (1^{pt}) **37.** You hire the lowest-cost Internet Service Provider in your area, to handle your company's Internet traffic. However, after taking a tour of their facility, you become concerned that their unprofessional business practices may cause your data to become exposed to hackers. Which of the following choices is a true statement about the security of the data that is transmitted between your company and your clients?

- The security of your company's transmitted data is automatically provided. This is due to the fact that data packets can travel on different routes on the Internet, so a hacker cannot possibly collect them all.
- The anti-virus software which is included in your operating system should be sufficient in securing any data which is transmitted on the Internet.
- Encrypting the data before transmission, using a technique such as Public Key Encryption, will ensure that the information in that data is protected from adversaries.
- Any security measures that are employed by cloud computing providers should be sufficient enough to deter hackers.

	1 pt
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- (1^{pt}) **38.** You decide to go on a shopping spree on a popular merchant website. After filling your cart with a selection of goods, you are presented with several payment options. Which of the following choices would minimize your personal cybersecurity risk?

- Sending an email to the billing department of the merchant website, with the content of that email containing your name, address, credit card number, and date of expiration.
- Clicking on a link, which leads to a URL with <http://> as the prefix. At this URL, you are asked to provide your credit card information.
- Typing the phrase "cheap credit cards" into a search engine, then applying for a credit card with the first financial provider that emerges, then using that credit card to pay for your goods.
- Paying for your goods with a secure, trusted financial mechanism, such as WeChat Pay or AliPay.

	1 pt
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- (1^{pt}) **39.** Roughly how many unique Internet Protocol(IP) addresses are available under the IPv4 protocol?

- 32 billion
- 4.3 billion
- 128 billion
- 255 billion

	1 pt
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	4 pts
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