CUET UG Computer Science Sample Paper -15

Duration: 1 Hour **Maximum Marks: 250**

Instructions

- This paper contains a total of 50 Multiple Choice Questions.
- Each correct answer carries **+5 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Q1. A database table 'Orders' has a column 'ShipDate'. Which SQL expression will return the name of the month (e.g., 'March') for an order shipped on '2024-03-15'?

(A) MONTHNAME('2024-03-15')

(B) EXTRACT(MONTH FROM '2024-03-15')

(C) DATENAME(MONTH, '2024-03-15')

(D) MONTH('2024-03-15')

Q2. What is the output of the SQL query: `SELECT INSTR('ENGINEERING', 'E', 2);`

(A) 1

(B) 5

(C) 6

(D) 0

Q3. Which SQL function is used to return the current date and time of the system?

(A) CURDATE()

(B) NOW()

(C) SYSDATE()

(D) Both (B) and (C)

Q4. What will be the result of `SELECT SUBSTR('COMMUNICATION', -5, 3);`

(A) ATI

(B) CAT

(C) ICA

(D) ION

Q5. To remove all leading and trailing occurrences of a specific character '#' from a string '###Data###', which SQL command is used?

(A) TRIM('#' FROM '###Data###')

(B) REMOVE('#', '###Data###')

(C) STRIP('###Data###')

(D) CLEAN('#', '###Data###')

Q6. What is the output of `SELECT MOD(25, -7);`

(A) 4

(B) -4

(C) 3

(D) -3

Q7. Which function would you use to find the smallest integer value that is greater than or equal to a number X?

(A) FLOOR(X)

(B) ROUND(X)

(C) CEIL(X)

(D) ABS(X)

Q8. The SQL expression `SELECT RIGHT('Standard', 4);` returns:

(A) Stan

(B) dard

(C) and

(D) nard

Q9. In Relational Algebra, if you want to filter rows where the 'Salary' is greater than 50000, which operator is used?

(A) Π (Projection)

(B) σ (Selection)

(C) ρ (Rename)

(D) $\cup$ (Union)

Q10. Which of the following keys is a minimal set of attributes that can uniquely identify a tuple in a relation?

(A) Super Key

(B) Candidate Key

(C) Foreign Key

(D) Alternate Key

Q11. The result of a 'Natural Join' between two relations is based on:

(A) All possible combinations of tuples

(B) Common attributes with same values

(C) Primary key and Foreign key match only

(D) Distinct attributes only

Q12. Which property of a database ensures that all parts of a transaction are completed; otherwise, none of them are?

(A) Consistency

(B) Isolation

(C) Atomicity

(D) Durability

Q13. Which network device operates at the Data Link Layer and uses MAC addresses to forward data to specific ports?

(A) Hub

(B) Router

(C) Switch

(D) Repeater

Q14. In which topology is every node connected to exactly two other nodes, forming a single continuous pathway for signals?

(A) Star

(B) Mesh

(C) Ring

(D) Bus

Q15. Which of the following is the correct representation of a MAC address?

(A) 192.168.1.1

(B) 00-1A-2B-3C-4D-5E

(C) http://www.google.com

(D) 255.255.255.0

Q16. A binary search is conducted on a sorted array of 1023 elements. In the worst-case scenario, what is the maximum number of comparisons required to determine if a target element exists in the array?

(A) 10

(B) 11

(C) 512

(D) 1023

Q17. Consider the following list: [23, 15, 38, 5, 42]. If we use the Selection Sort algorithm, what will be the state of the list after the second complete pass?

(A) 5, 15, 38, 23, 42

(B) 5, 15, 23, 38, 42

(C) 15, 23, 5, 38, 42

(D) 5, 23, 15, 38, 42

Q18. Which sorting algorithm is generally considered the most efficient for a list that is already nearly sorted, often achieving a time complexity close to $O(n)$?

(A) Selection Sort

(B) Bubble Sort

(C) Insertion Sort

(D) Quick Sort

Q19. Evaluate the following Postfix expression using a stack: 8 4 / 5 3 − ∗ 10 +. What is the final result?

(A) 14

(B) 12

(C) 24

(D) 4

Q20. In a Circular Queue implemented using an array of size 6, if 'Front' is at index 4 and 'Rear' is at index 1, how many elements are currently present in the queue?

(A) 3

(B) 4

(C) 2

(D) 5

Q21. Which of the following Python snippets is used to handle a situation where a file might not exist, preventing the program from crashing?

(A) `if file.exists(): open()`

(B) `try: ... except FileNotFoundError: ...`

(C) `catch (IOError e): ...`

(D) `throw FileMissingError`

Q22. When opening a file in Python using `open("data.bin", "rb+")`, what does the ”rb+” mode signify?

(A) Read only in binary mode

(B) Read and Write in text mode

(C) Read and Write in binary mode

(D) Append and Read in binary mode

Q23. Which Python function is used to move the file pointer to a specific position within a file?

(A) tell()

(B) move()

(C) seek()

(D) locate()

Q24. In a Stack data structure, if the elements ’A’, ’B’, and ’C’ are pushed in that order, what is the sequence of elements when they are all popped?

(A) A, B, C

(B) C, B, A

(C) B, C, A

(D) C, A, B

Q25. Which sorting technique involves repeatedly partitioning the array into two halves around a 'pivot' element?

(A) Merge Sort

(B) Insertion Sort

(C) Quick Sort

(D) Bubble Sort

Q26. Which network protocol is specifically designed for the secure transfer of files between a client and a server by providing an encrypted channel?

(A) FTP

(B) SFTP

(C) HTTP

(D) SMTP

Q27. A type of malware that self-replicates and spreads across a network without any human intervention is known as a:

(A) Virus

(B) Trojan Horse

(C) Worm

(D) Spyware

Q28. Which switching technique divides data into small units that are routed independently through the network based on the destination address?

(A) Circuit Switching

(B) Message Switching

(C) Packet Switching

(D) Line Switching

Q29. In a relational database, what does the 'Projection' (Π) operation specifically do?

(A) Selects specific rows based on a condition

(B) Joins two tables based on a common key

(C) Selects specific columns and removes duplicate rows

(D) Re-orders the data in ascending order

Q30. Which of the following describes a 'Denial of Service' (DoS) attack?

(A) Stealing user passwords using fake websites

(B) Flooding a system with traffic to make it unavailable

(C) Encrypting user files and demanding a ransom

(D) Monitoring network traffic secretly

Q31. If a Queue is implemented using a Python List, and elements are added using `append()`, which method should be used for the 'Dequeue' operation to maintain FIFO order?

(A) pop()

(B) pop(0)

(C) remove()

(D) delete(0)

Q32. What is the time complexity of the Bubble Sort algorithm in the average case?

(A) $O(n)$

(B) $O(n \log n)$

(C) $O(n^2)$

(D) $O(1)$

Q33. Which layer of the OSI model is responsible for logical addressing (IP addresses) and routing of data packets?

(A) Physical Layer

(B) Data Link Layer

(C) Network Layer

(D) Transport Layer

Q34. Which SQL function is used to convert a string into all lowercase characters?

(A) DOWN()

(B) LOWER()

(C) SMALL()

(D) CASE()

Q35. Which protocol is used to translate a human-readable domain name (like www.example.com into a machine-readable IP address?

(A) DHCP

(B) DNS

(C) ARP

(D) ICMP

Q36. A list contains the elements [7, 12, 9, 11, 3]. Using the Insertion Sort algorithm, what will be the content of the list after the third pass (after the element 11 is processed)?

(A) 7, 9, 11, 12, 3

(B) 3, 7, 9, 11, 12

(C) 7, 9, 12, 11, 3

(D) 7, 11, 12, 9, 3

Q37. Which Python method is used to read all the lines of a text file and return them as a list of strings?

(A) read()

(B) readlines()

(C) readline()

(D) getlines()

Q38. In Python, what is the purpose of the `finally` block in a try-except-finally structure?

(A) To catch exceptions that were missed by the except block

(B) To execute code only if no exception occurred

(C) To execute code regardless of whether an exception occurred or not

(D) To terminate the program immediately

Q39. Which protocol is used to securely log into a remote computer and execute commands via a command-line interface?

(A) TELNET

(B) SSH

(C) SMTP

(D) SNMP

Q40. What is the main disadvantage of a Mesh topology in a large-scale network?

(A) Single point of failure

(B) High cost and complexity of cabling

(C) Difficulty in adding a new node

(D) Slow data transmission speed

Q41. In SQL, which mathematical function returns the value of π (3.14159...)?

(A) PI()

(B) VAL_PI()

(C) CONST(PI)

(D) RADIANS(180)

Q42. When evaluating the performance of a Linear Search on an array of size n, what is the complexity in the best-case scenario?

(A) $O(n)$

(B) $O(\log n)$

(C) $O(1)$

(D) $O(n^2)$

Q43. Which Python module is required to perform serialization and deserialization of Python objects into binary files?

(A) binary

(B) pickle

(C) serial

(D) objectio

Q44. Which layer of the OSI model is responsible for data compression, encryption, and translation of data formats?

(A) Application Layer

(B) Session Layer

(C) Presentation Layer

(D) Transport Layer

Q45. What does the SQL command `SELECT ROUND(15.678, 2);` return?

(A) 15.67

(B) 15.68

(C) 16.00

(D) 15.70

Q46. A Queue is being used to manage print jobs. If the jobs 'Report', 'Invoice', and 'Letter' are submitted in that order, which job will be printed first?

(A) Letter

(B) Invoice

(C) Report

(D) None of the above

Q47. In data communication, what is 'Bandwidth'?

(A) The speed of a processor in GHz

(B) The physical length of the cable

(C) The data transfer capacity of a network channel

(D) The number of computers on a network

Q48. Which type of threat is specifically designed to record every keystroke made by a user to steal passwords and sensitive data?

(A) Ransomware

(B) Keylogger

(C) Adware

(D) Rootkit

Q49. What will be the result of the following Python code:

```
f = open("test.txt", "w")
f.write("Hello World")
f.close()
```

if ”test.txt” already contained the text ”Python”?

(A) The file will contain ”PythonHello World”

(B) The file will contain ”Hello WorldPython”

(C) The file will contain ”Hello World”

(D) An error will occur

Q50. Which relational algebra operator is used to combine all rows from two relations, provided they have the same set of attributes?

(A) Intersection ($\cap$)

(B) Cartesian Product ($\times$)

(C) Union ($\cup$)

(D) Division ($\div$)

Detailed Solutions

Q1.

Solution

Concept:

In SQL, date and time functions are used to manipulate and extract specific parts of a date value. When we need to retrieve the name of a month (like 'January' or 'March') rather than its numeric index (like 1 or 3), we use descriptive functions provided by the Database Management System (DBMS).

Solution:

1. The input provided is a date string '2024-03-15'. 2. The function `MONTHNAME()` takes a date as an argument and returns the full name of the month associated with that date. 3. In the given date '2024-03-15', the month part is '03'. 4. The third month of the calendar year is 'March'. 5. Other options like `MONTH()` would return the integer 3, while `EXTRACT(MONTH...)` is more commonly used in specific SQL dialects like PostgreSQL but often returns the numeric value. `MONTHNAME()` is the most direct way to get the string representation.

Final Answer: The correct SQL expression is MONTHNAME('2024-03-15').

Answer: (A)

Q2.

Solution

Concept:

The `INSTR()` function is used to find the position of the first occurrence of a substring within a larger string. The syntax is `INSTR(string, substring, [start_position])`. If a start position is specified, the search begins from that index, but the returned index is always relative to the very beginning of the string.

Solution:

1. The main string is 'ENGINEERING' and the substring we are looking for is 'E'. 2. The instruction specifies starting the search at index 2. 3. The string starting from index 2 is 'NGINEERING'. 4. Within 'NGINEERING', the first occurrence of 'E' is at the 4th position of this segment. 5. Mapping this back to the original string 'ENGINEERING':

E (1)

N (2)

G (3)

I (4)

E (5) 6. Since we started searching from position 2, we skipped the 'E' at position 1. The next 'E' is at position 5.

Final Answer: The output is 5.

Answer: (B)

Q3.

Solution

Concept:

Standard SQL and specific dialects like MySQL provide functions to capture the current state of the system clock. While some functions return only the date, others return a combined timestamp of date and time.

Solution:

1. `CURDATE()` returns only the current date in 'YYYY-MM-DD' format without time information. 2. `NOW()` is a common function that returns the current date and time as a 'YYYY-MM-DD HH:MM:SS' value. 3. `SYSDATE()` similarly returns the current date and time. 4. While `NOW()` returns the time when the statement began to execute, `SYSDATE()` returns the exact time at which the function itself executes. 5. Since both functions provide the "current date and time," option (D) is the most accurate.

Final Answer: Both (B) and (C) are correct.

Answer: (D)

Q4.

Solution

Concept:

The `SUBSTR()` or `SUBSTRING()` function extracts a sequence of characters from a string. If the starting position is a negative number, the extraction starts from the end of the string and moves towards the right.

Solution:

1. The string is 'COMMUNICATION'. 2. We identify the starting point using -5 (counting from the right):

N is -1

O is -2

I is -3

T is -4

A is -5 3. The starting character is 'A'. 4. The function asks for a length of 3 characters starting from 'A'. 5. The sequence is: A (1st), T (2nd), I (3rd). 6. Therefore, the result is 'ATI'.

Final Answer: The result of the expression is ATI.

Answer: (A)

Q5.

Solution

Concept:

The `TRIM()` function is used to remove prefixes or suffixes from a string. By default, it removes spaces, but it can be configured to remove any specific character from the "LEADING", "TRAILING", or "BOTH" ends of a string.

Solution:

1. The objective is to remove the '#' character from both the start and the end of '###Data###'. 2. The syntax `TRIM(character FROM string)` is used for this purpose. 3. `TRIM('#' FROM '###Data###')` will strip all occurrences of '#' from the beginning and the end. 4. This will leave only the middle portion 'Data'. 5. Other functions listed like REMOVE or STRIP are not standard SQL functions for this specific character-trimming operation.

Final Answer: The correct command is TRIM('#' FROM '###Data###').

Answer: (A)

Q6.

Solution

Concept:

The `MOD(N, M)` function returns the remainder of N divided by M. In many SQL implementations (like MySQL), the result of the `MOD` function takes the sign of the dividend (the first number). The mathematical formula used is:

$$\text{Result} = N - (M \times \text{FLOOR}(N/M))$$

or simply the remainder after division.

Solution:

1. We are given the expression `MOD(25, -7)`. 2. Here, the dividend $N = 25$ and the divisor $M = -7$. 3. When we divide 25 by 7, the quotient is 3 and the remainder is 4 ($7 \times 3 = 21$; $25 - 21 = 4$). 4. In SQL, if the dividend is positive, the result of `MOD` is typically positive, regardless of the sign of the divisor. 5. Therefore, $25 \pmod{-7}$ results in 4.

Final Answer: The output is 4.

Answer: (A)

Q7.

Solution

Concept:

Numeric functions in SQL allow for different types of rounding and approximation. - `FLOOR(X)` returns the largest integer less than or equal to X. - `CEIL(X)` or `CEILING(X)` returns the smallest integer greater than or equal to X. - `ROUND(X)` rounds to the nearest integer.

Solution:

1. The requirement is to find an integer Y such that $Y \geq X$ and Y is the smallest such integer. 2. For a positive number like 4.2, the integers ≥ 4.2 are $\{5, 6, 7, \dots\}$. The smallest is 5. 3. For a negative number like -4.2, the integers ≥ -4.2 are $\{-4, -3, -2, \dots\}$. The smallest is -4. 4. The function that performs this specific mathematical mapping is `CEIL(X)`.

Final Answer: The function is CEIL(X).

Answer: (C)

Q8.

Solution

Concept:

The `RIGHT(string, n)` function extracts a specific number of characters from the right side (end) of a string.

Solution:

1. The input string is 'Standard'. 2. The number of characters to extract is 4. 3. We count 4 characters from the end of the string 'Standard':
'd' (1st from right)
'r' (2nd from right)
'a' (3rd from right)
'd' (4th from right) 4. Reading them in their original order from left to right, these four characters form 'dard'.

Final Answer: The expression returns 'dard'.

Answer: (B)

Q9.

Solution

Concept:

Relational Algebra uses Greek symbols to represent operations on data. - Selection (σ): Filters rows (tuples) based on a condition. - Projection (Π): Selects specific columns (attributes). - Union ($\cup$): Combines results of two queries.

Solution:

1. The task is to "filter rows" based on a condition (`Salary > 50000`). 2. Filtering rows is equivalent to the `WHERE` clause in SQL. 3. In Relational Algebra, this horizontal filtering is performed by the Selection operator, denoted by the lowercase Greek letter sigma (σ). 4. Therefore, the operation would be written as $\sigma_{\text{Salary}>50000}(\text{Relation})$.

Final Answer: The operator is σ (Selection).

Answer: (B)

Q10.

Solution

Concept:

Database keys serve to uniquely identify records. - **Super Key:** Any set of attributes that uniquely identifies a tuple. - **Candidate Key:** A minimal Super Key (no proper subset is a Super Key). - **Primary Key:** The candidate key chosen by the DBA.

Solution:

1. A Super Key can have extra attributes (e.g., {RollNo, Name} is a super key, but 'Name' is redundant). 2. The definition of a "minimal" set of attributes that ensures uniqueness is specifically the definition of a **Candidate Key**. 3. It means you cannot remove any attribute from the set without losing the property of unique identification.

Final Answer: The minimal set is the Candidate Key.

Answer: (B)

Q11.

Solution

Concept:

A Natural Join is a specific type of join operation in relational databases that creates a result based on the columns that have the same name in both tables. It automatically detects these common attributes and performs an equijoin on them, while also removing duplicate columns from the final result set.

Solution:

1. Unlike a Cartesian Product (Cross Join), which combines every row of one table with every row of another, a Natural Join looks for a relationship. 2. It specifically identifies columns with the exact same header (name) in both relations. 3. For each pair of rows, it checks if the values in these common columns are identical. 4. If they match, the rows are joined and included in the output. 5. In SQL syntax, this is represented by `SELECT * FROM table1 NATURAL JOIN table2`. 6. Because it relies on attribute name matching and value equality, the correct description is ”Common attributes with same values.”

Final Answer: The result is based on common attributes with same values.

Answer: (B)

Q12.

Solution

Concept:

The ACID properties (Atomicity, Consistency, Isolation, Durability) define the core requirements for a reliable database transaction. - **Atomicity** refers to the ”all or nothing” principle. - **Consistency** ensures the database moves from one valid state to another. - **Isolation** ensures concurrent transactions don’t interfere. - **Durability** ensures committed data is permanent.

Solution:

1. The question describes a scenario where a transaction is treated as a single, indivisible unit. 2. If any part of the transaction fails (like a bank transfer where money is debited but not credited), the entire transaction must be rolled back. 3. If all parts succeed, the transaction is committed. 4. This specific characteristic of being ”atomic” or indivisible is known as Atomicity. 5. Therefore, the property that ensures ”all or nothing” execution is Atomicity.

Final Answer: The property is Atomicity.

Answer: (C)

Q13.

Solution

Concept:

Network devices operate at different layers of the OSI model. - **Hubs** are Layer 1 (Physical) devices that broadcast data to all ports. - **Switches** are Layer 2 (Data Link) devices that use MAC addresses. - **Routers** are Layer 3 (Network) devices that use IP addresses.

Solution:

1. The device in question operates at the Data Link Layer (Layer 2). 2. It maintains a MAC address table (CAM table) to map physical addresses to specific physical ports. 3. When a frame arrives, the device looks at the destination MAC address and forwards it only to the corresponding port, rather than broadcasting it to everyone. 4. This ”intelligent” bridging functionality is the hallmark of a Network Switch. 5. Repeaters and Hubs do not look at MAC addresses; they simply regenerate or broadcast signals.

Final Answer: The device is a Switch.

Answer: (C)

Q14.

Solution

Concept:

Network topologies define the layout of connections between nodes. - **Star:** All nodes connect to a central hub. - **Bus:** All nodes connect to a single backbone cable. - **Ring:** Each node connects to exactly two neighbors. - **Mesh:** Nodes have multiple redundant connections.

Solution:

1. In a Ring topology, the nodes are arranged in a circular fashion. 2. Each workstation is connected to its two immediate neighbors (one ”upstream” and one ”downstream”). 3. Data travels in one direction (usually) around the ring. 4. Because each node has exactly two connections forming a continuous loop or pathway, it perfectly fits the description in the question. 5. If one connection or node fails in a simple ring, the entire network can be disrupted.

Final Answer: The topology is Ring.

Answer: (C)

Q15.

Solution

Concept:

A Media Access Control (MAC) address is a unique identifier assigned to a Network Interface Controller (NIC). It is a hardware address. - It is 48 bits (6 bytes) long. - It is expressed as six groups of two hexadecimal digits (0-9, A-F). - Groups are usually separated by hyphens (-) or colons (:).

Solution:

1. Option (A) `192.168.1.1` is a 32-bit IPv4 address in dotted-decimal format. 2. Option (B) `00-1A-2B-3C-4D-5E` follows the 6-byte hexadecimal format with hyphen separators. Each group (e.g., 1A) represents 8 bits. 3. Option (C) is a URL (Uniform Resource Locator). 4. Option (D) is a Subnet Mask (IPv4). 5. Therefore, (B) is the only correct representation of a physical MAC address.

Final Answer: The correct representation is 00-1A-2B-3C-4D-5E.

Answer: (B)

Q16.

Solution

Concept:

Binary Search is an efficient algorithm for finding an item from a sorted list of items. It works by repeatedly dividing in half the portion of the list that could contain the item. The maximum number of comparisons (worst-case) for an array of size n is given by the formula:

$$\text{Comparisons} = \lfloor \log_2(n) \rfloor + 1$$

Solution:

1. The number of elements n is 1023. 2. We apply the formula: $\log_2(1023)$. 3. We know that $2^9 = 512$ and $2^{10} = 1024$. 4. Therefore, $\log_2(1023)$ is slightly less than 10 (approximately 9.99). 5. Taking the floor value: $\lfloor 9.99 \rfloor = 9$. 6. Adding 1 for the final comparison: $9 + 1 = 10$. 7. In a worst-case scenario, every time we divide the search space by 2, we eventually reach a single element. For $2^{10} - 1$ elements, this takes exactly 10 steps.

Final Answer: The maximum number of comparisons is 10.

Answer: (A)

Q17.

Solution

Concept:

Selection Sort works by repeatedly finding the minimum element from the unsorted part and putting it at the beginning. - In Pass 1: The smallest element is found and swapped with the element at index 0. - In Pass 2: The smallest element from index 1 to the end is found and swapped with the element at index 1.

Solution:

Initial List: [23, 15, 38, 5, 42] 1. **Pass 1:**

Find minimum in [23, 15, 38, 5, 42]. Minimum is 5.

Swap 5 with the first element (23).

List after Pass 1: [5, 15, 38, 23, 42] 2. **Pass 2:**

Find minimum in the remaining part [15, 38, 23, 42].

The minimum is 15.

Since 15 is already at its correct position (index 1), the swap results in no change.

List after Pass 2: [5, 15, 38, 23, 42]

Final Answer: After the second pass, the list is [5, 15, 38, 23, 42].

Answer: (A)

Q18.

Solution

Concept:

Different sorting algorithms react differently to the initial order of data. - Selection Sort always takes $O(n^2)$. - Bubble Sort can be optimized to $O(n)$ but usually takes $O(n^2)$. - Insertion Sort is particularly efficient for small or nearly sorted datasets.

Solution:

1. In Insertion Sort, each element is compared with the sorted elements to its left. 2. If the list is already sorted, each element is compared only once with its immediate left neighbor and found to be in the correct place. 3. This results in $n - 1$ comparisons and zero swaps/shifts. 4. Consequently, the time complexity becomes linear, i.e., $O(n)$. 5. This makes it the preferred choice for checking if a list is sorted or for adding a few elements to a sorted list.

Final Answer: Insertion Sort is the most efficient for nearly sorted lists.

Answer: (C)

Q19.

Solution

Concept:

Postfix evaluation uses a stack. When an operand is encountered, it is pushed onto the stack. When an operator is encountered, the top two operands are popped, the operation is performed, and the result is pushed back.

Solution:

Expression: $8, 4, /, 5, 3, -, *, 10, +$ 1. Push 8, Push 4. Stack: [8, 4] 2. Operator '/': Pop 4, Pop 8. Calculate $8/4 = 2$. Push 2. Stack: [2] 3. Push 5, Push 3. Stack: [2, 5, 3] 4. Operator '-': Pop 3, Pop 5. Calculate $5 - 3 = 2$. Push 2. Stack: [2, 2] 5. Operator '*': Pop 2, Pop 2. Calculate $2 * 2 = 4$. Push 4. Stack: [4] 6. Push 10. Stack: [4, 10] 7. Operator '+': Pop 10, Pop 4. Calculate $4 + 10 = 14$. Push 14.

Final Answer: The result is 14.

Answer: (A)

Q20.

Solution

Concept:

In a Circular Queue implemented with an array of size N, the number of elements is not just `Rear - Front`. Because it wraps around, we use the formula:

$$\text{Count} = (\text{Rear} - \text{Front} + N) \pmod N$$

(Note: This assumes the 'Rear' points to the last element. If 'Rear' points to the next free slot, the formula varies slightly, but standard Academic questions typically follow the element count logic).

Solution:

1. Array Size $N = 6$. 2. Front = 4, Rear = 1. 3. Since Rear < Front, the queue has wrapped around the end of the array. 4. Elements are at index 4, index 5, index 0, and index 1. 5. Using the formula: $(1 - 4 + 6) \pmod 6$ 6. $(3) \pmod 6 = 3$. 7. Let's verify: Index 4 (1st), Index 5 (2nd), Index 0 (3rd), Index 1 (4th). 8. In a standard implementation where Front points to the first element and Rear points to the last, the elements are at 4, 5, 0, 1. That is 4 elements.

Final Answer: There are 4 elements in the queue.

Answer: (B)

Q21.

Solution

Concept:

Exception handling in Python is a mechanism to manage errors during program execution (runtime) so the script doesn't terminate abruptly. The 'try' block contains code that might raise an exception, and the 'except' block handles specific errors.

Solution:

1. To prevent a program from crashing when a file is missing, we must catch the 'FileNotFoundError'. 2. Python uses the 'try...except' syntax for this purpose. 3. In the provided snippet: - The 'try' block would contain 'open("filename.txt")'. - If the file does not exist, Python raises a 'FileNotFoundError'. - Instead of crashing, the control jumps to the 'except FileNotFoundError:' block. 4. Option (A) is a logic check but not the standard "exception handling" snippet. Option (C) uses Java/C++ syntax ('catch'), and Option (D) is for raising (throwing) errors, not handling them.

Final Answer: The correct snippet is `try: ... except FileNotFoundError: ....`

Answer: (B)

Q22.

Solution

Concept:

Python's 'open()' function uses mode strings to define how a file is accessed. - 'r': Read mode (default). - 'b': Binary mode (for non-text files like images or compiled data). - '+': Opens a file for updating (both reading and writing).

Solution:

1. The mode string provided is '"rb+"'. 2. The letter 'r' indicates the file is opened for reading. 3. The letter 'b' indicates the file is treated as a binary file (not a text file). 4. The '+' symbol adds the capability to write to the file as well as read from it. 5. Combining these, '"rb+"' stands for "Read and Write in binary mode." 6. Note: In 'r+' or 'rb+', the file must already exist, or an error will occur.

Final Answer: The mode signifies Read and Write in binary mode.

Answer: (C)

Q23.

Solution

Concept:

When working with files in Python, a ”file pointer” keeps track of the current position where reading or writing occurs. Python provides two main methods for position management: ‘tell()‘ and ‘seek()‘.

Solution:

1. The ‘tell()‘ function returns the current position of the file pointer (an integer representing the byte offset). 2. The ‘seek(offset, whence)‘ function is used to **change** or **move** the file pointer to a new position. 3. The ‘offset‘ is the number of bytes to move, and ‘whence‘ (optional) defines the reference point (0 for start, 1 for current position, 2 for end). 4. Since the question asks for the function to *move* the pointer, ‘seek()‘ is the correct tool.

Final Answer: The function is seek().

Answer: (C)

Q24.

Solution

Concept:

A Stack is a LIFO (Last-In, First-Out) data structure. This means the last element added (pushed) to the stack is the first one to be removed (popped).

Solution:

1. **Step 1: Pushing** - Push ’A’: Stack = [A] - Push ’B’: Stack = [A, B] - Push ’C’: Stack = [A, B, C] (Top is ’C’) 2. **Step 2: Popping** - The first pop retrieves the top-most element: ’C’. - The second pop retrieves the next element: ’B’. - The third pop retrieves the last remaining element: ’A’. 3. The sequence of elements as they are removed is C, then B, then A.

Final Answer: The sequence is C, B, A.

Answer: (B)

Q25.

Solution

Concept:

Quick Sort is a highly efficient, Divide and Conquer sorting algorithm. It works by selecting a 'pivot' element from the array and partitioning the other elements into two sub-arrays, according to whether they are less than or greater than the pivot.

Solution:

1. In Quick Sort, a pivot is chosen (could be the first, last, or a random element). 2. The partitioning step rearranges the array so that elements smaller than the pivot go to the left and larger ones go to the right. 3. This process is then applied recursively to the sub-arrays. 4. Unlike Merge Sort, which divides the array into two equal halves regardless of value, Quick Sort divides the array based on the value of the pivot. 5. Therefore, the description provided matches Quick Sort perfectly.

Final Answer: The technique is Quick Sort.

Answer: (C)

Q26.

Solution

Concept:

File transfer protocols are used to move data across networks. - **FTP (File Transfer Protocol)** is the standard but transmits data in plain text (unencrypted). - **SFTP (SSH File Transfer Protocol)** provides secure file transfer by leveraging the SSH (Secure Shell) protocol for encryption.

Solution:

1. The requirement is for the "secure" transfer of files. 2. HTTP and SMTP are used for web browsing and email, respectively, not primarily for bulk file transfer. 3. While FTP is a file transfer protocol, it lacks security. 4. SFTP encrypts both commands and data, preventing sensitive information like passwords and file content from being intercepted over the network. 5. Therefore, SFTP is the protocol designed for secure encrypted file transfers.

Final Answer: The protocol is SFTP.

Answer: (B)

Q27.

Solution

Concept:

Malware is categorized by its behavior and method of infection. - **Viruses** require a host file and human action (like opening an attachment) to spread. - **Worms** are standalone programs that can replicate themselves and move across network connections automatically.

Solution:

1. The question specifies two key traits: self-replication and spreading without human intervention. 2. A Trojan Horse disguises itself as useful software but does not self-replicate. 3. Spyware focuses on monitoring user activity. 4. Because a Worm is designed to exploit network vulnerabilities to jump from one computer to another autonomously, it fits the description perfectly.

Final Answer: The malware is a Worm.

Answer: (C)

Q28.

Solution

Concept:

Switching methods determine how data moves from source to destination. - **Circuit Switching** establishes a dedicated path (like old phone lines). - **Packet Switching** breaks data into chunks (packets) that can take different paths.

Solution:

1. The data is divided into ”small units.” These are called packets. 2. The description says they are ”routed independently.” This means each unit contains a destination header, and the network devices (routers) decide the best path for each one individually. 3. This is the foundation of the modern Internet (TCP/IP). 4. Therefore, Packet Switching is the correct technique.

Final Answer: The technique is Packet Switching.

Answer: (C)

Q29.

Solution

Concept:

The Projection (Π) operator in Relational Algebra is used for vertical filtering. It selects specific columns from a relation while discarding others.

Solution:

1. Selection (σ) filters rows (horizontal). 2. Projection (Π) filters columns (vertical). 3. A key characteristic of Relational Algebra operations is that the result is a set. In set theory, duplicates are not allowed. 4. Therefore, the Projection operator selects the specified attributes and automatically removes any duplicate tuples that might result from the exclusion of key columns. 5. This corresponds to the `SELECT DISTINCT column_name` command in SQL.

Final Answer: It selects specific columns and removes duplicate rows.

Answer: (C)

Q30.

Solution

Concept:

A Denial of Service (DoS) attack is a cyber-attack in which the perpetrator seeks to make a machine or network resource unavailable to its intended users.

Solution:

1. The goal of a DoS attack is not to steal data (Phishing) or encrypt data for money (Ransomware).
2. Instead, it aims to exhaust the resources of a target (like CPU, memory, or network bandwidth).
3. This is usually achieved by sending a massive volume of requests or traffic to the server, overwhelming it so that legitimate users cannot access the service. 4. When multiple systems coordinate this attack, it is called a Distributed Denial of Service (DDoS) attack.

Final Answer: It is flooding a system with traffic to make it unavailable.

Answer: (B)

Q31.

Solution

Concept:

A Queue is a linear data structure that follows the First-In, First-Out (FIFO) principle. This means the first element added to the queue must be the first one to be removed. In Python, a list can be used to simulate a queue, but the operations must be chosen carefully to maintain the correct order.

Solution:

1. The `append()` method adds an element to the end of the list (the "rear" of the queue). 2. To maintain FIFO, the "dequeue" operation must remove the element from the very beginning of the list (the "front" of the queue). 3. The `pop()` method without arguments removes the last element (LIFO/Stack behavior). 4. The `pop(0)` method removes and returns the element at index 0, which is the oldest element in the list. 5. While `pop(0)` is functionally correct for a queue, it is important to note that it has $O(n)$ time complexity because all subsequent elements must be shifted one position to the left.

Final Answer: The correct method for dequeue is `pop(0)`.

Answer: (B)

Q32.

Solution

Concept:

The efficiency of a sorting algorithm is measured by its time complexity, which describes how the number of operations grows with the size of the input n. Bubble Sort is a comparison-based algorithm that repeatedly steps through the list, compares adjacent elements, and swaps them if they are in the wrong order.

Solution:

1. In the average case, the elements are in a random order. 2. For an array of size n, the first pass requires $n-1$ comparisons, the second pass $n-2$ comparisons, and so on. 3. The total number of comparisons is approximately:

$$\frac{(n-1)+(n-2)+\cdots+1}{1} \approx \frac{n^2}{2}$$

4. Since we ignore constant coefficients in Big O notation, the quadratic term n^2 dominates the expression. 5. Therefore, both the average case and the worst-case time complexity of Bubble Sort are $O(n^2)$.

Final Answer: The average case time complexity is $O(n^2)$.

Answer: (C)

Q33.

Solution

Concept:

The Open Systems Interconnection (OSI) model is a conceptual framework that standardizes the functions of a telecommunication or computing system into seven abstraction layers. Each layer has a specific responsibility in the process of data transmission.

Solution:

1. The Physical Layer deals with the hardware and bit transmission. 2. The Data Link Layer handles physical addressing (MAC addresses) and framing. 3. The Network Layer is responsible for ”logical addressing” and ”routing.” It uses IP addresses to determine the best path for data to travel across interconnected networks. 4. Data units at this layer are referred to as ”packets.” 5. Protocols like IP (IPv4/IPv6), ICMP, and IGMP operate at this level.

Final Answer: The Network Layer is responsible for logical addressing and routing.

Answer: (C)

Q34.

Solution

Concept:

SQL provides several built-in string functions to format and manipulate text data retrieved from a database. Case conversion is a common requirement for standardizing data output or performing case-insensitive searches.

Solution:

1. To convert a string to uppercase, the `UPPER()` function is used. 2. To convert a string to lowercase, the `LOWER()` function is used. 3. For example, `SELECT LOWER('Computer Science');` would return ’computer science’. 4. Other options like `DOWN()` or `SMALL()` are not standard SQL functions. 5. Note: In some database systems like Oracle, the function `LCASE()` is also available as an alias, but `LOWER()` is the standard ANSI SQL function.

Final Answer: The SQL function is `LOWER()`.

Answer: (B)

Q35.

Solution

Concept:

Computers communicate using numerical IP addresses (e.g., 142.250.190.46), but humans find it easier to remember names (e.g., www.google.com). A system is required to map these user-friendly names to the actual network addresses.

Solution:

1. The Domain Name System (DNS) acts as the ”phonebook” of the Internet. 2. When you enter a URL in your browser, a DNS query is sent to a DNS server. 3. The server looks up its database and returns the corresponding IP address for that domain. 4. This allows your computer to establish a connection to the correct web server. 5. Other protocols like DHCP assign IP addresses to local devices, and ARP maps IP addresses to physical MAC addresses.

Final Answer: The protocol is DNS.

Answer: (B)

Q36.

Solution

Concept:

Insertion Sort builds the final sorted array one item at a time. It takes each element from the unsorted part and finds its appropriate position within the sorted part of the list to its left.

Solution:

1. Initial List: [7, 12, 9, 11, 3] 2. **Pass 1:** Consider ’12’. Since 12 > 7, it stays. List: [7, 12, 9, 11, 3]. 3. **Pass 2:** Consider ’9’. Compare with 12 (9 < 12, move 12 right) and 7 (9 > 7). Place 9 between 7 and 12. List: [7, 9, 12, 11, 3]. 4. **Pass 3:** Consider ’11’. Compare with 12 (11 < 12, move 12 right) and 9 (11 > 9). Place 11 between 9 and 12. 5. Result after the third pass (processing ’11’): [7, 9, 11, 12, 3].

Final Answer: The list will be [7, 9, 11, 12, 3].

Answer: (A)

Q37.

Solution

Concept:

Python provides different methods to retrieve data from a file object. - `read()` returns the entire file as a single string. - `readline()` returns one line as a string. - `readlines()` reads all lines and stores them in a list format.

Solution:

1. The requirement is to read "all the lines." 2. The requirement also specifies that the output must be a "list of strings." 3. The `readlines()` method performs exactly this task, treating each line (including the newline character
`n`) as an individual element in the returned list.

Final Answer: The method is `readlines()`.

Answer: (B)

Q38.

Solution

Concept:

The `finally` block is used in Python's exception handling to ensure that certain cleanup actions are performed.

Solution:

1. A `try` block is followed by `except` (to catch errors). 2. Sometimes, you have tasks like closing a file or releasing a database connection that must happen whether the code worked or crashed. 3. The `finally` block is guaranteed to run after the `try` and `except` blocks, regardless of whether an exception was raised or handled.

Final Answer: To execute code regardless of whether an exception occurred or not.

Answer: (C)

Q39.

Solution

Concept:

Remote login protocols allow a user to access a computer's command line over a network. - **TELNET** is an old protocol that sends data in plain text. - **SSH (Secure Shell)** is the modern standard that encrypts the entire session.

Solution:

1. The question specifies "securely" logging in. 2. TELNET is insecure. 3. SMTP is for email and SNMP is for network management. 4. SSH provides a secure, encrypted channel over an insecure network, making it the correct choice for executing remote commands safely.

Final Answer: The protocol is SSH.

Answer: (B)

Q40.

Solution

Concept:

Mesh topology connects every node to every other node. The number of links required for n nodes is given by $n(n-1)/2$.

Solution:

1. While Mesh is highly redundant and reliable (no single point of failure), the physical requirements are massive. 2. For a network of just 10 computers, you would need 45 separate cables. 3. This leads to a massive increase in the cost of hardware (cables and ports) and extreme complexity in management as the network grows.

Final Answer: High cost and complexity of cabling.

Answer: (B)

Q41.

Solution

Concept:

The `PI()` function is a built-in mathematical function in SQL that returns the constant value of π (Pi). It is a nullary function, meaning it does not require any arguments to be passed within the parentheses.

Solution:

1. In many mathematical and engineering queries, the value of π is required for calculations involving circles, spheres, or trigonometry. 2. The standard SQL function provided for this purpose is `PI()`. 3. When executed, it returns a high-precision floating-point value (approximately 3.141592653589793). 4. Option (D) `RADIANS(180)` also mathematically results in π because 180 degrees equals π radians, but it is a conversion function rather than the direct constant function for π. 5. The most direct and standard mathematical function is `PI()`.

Final Answer: The SQL function is `PI()`.

Answer: (A)

Q42.

Solution

Concept:

Linear Search (or Sequential Search) scans each element of a list one by one starting from the first element until the desired element is found or the end of the list is reached.

Solution:

1. The ”best-case” scenario occurs when the search operation finishes in the minimum possible number of steps. 2. In Linear Search, this happens when the target element is located at the very first position (index 0) of the array. 3. In this case, the algorithm performs exactly one comparison and then terminates. 4. Since the number of operations does not depend on the size of the input n, the time complexity is constant. 5. In Big O notation, a constant time complexity is represented as $O(1)$.

Final Answer: The best-case complexity is $O(1)$.

Answer: (C)

Q43.

Solution

Concept:

Serialization is the process of converting a Python object hierarchy into a byte stream, and ”de-serialization” is the inverse operation. This allows objects to be saved to a file or sent over a network.

Solution:

1. Python provides a built-in module specifically for this purpose called `pickle`. 2. The `pickle.dump()` function is used to write (serialize) the object to a binary file. 3. The `pickle.load()` function is used to read (deserialize) the object back from the file. 4. Other modules like `json` can perform serialization into text format, but for native Python objects and binary files, `pickle` is the standard.

Final Answer: The required module is `pickle`.

Answer: (B)

Q44.

Solution

Concept:

The Presentation Layer (Layer 6) of the OSI model acts as the data translator for the network. It ensures that the data sent by the Application Layer of one system can be read by the Application Layer of another system.

Solution:

1. The Presentation Layer handles the syntax and semantics of the information exchanged. 2. Its primary responsibilities include: - **Translation:** Converting between different encoding formats (like EBCDIC to ASCII). - **Encryption:** Securing data for transmission (SSL/TLS logic often resides here conceptually). - **Compression:** Reducing the number of bits to be transmitted to improve efficiency. 3. Therefore, tasks like compression and encryption are the hallmarks of the Presentation Layer.

Final Answer: The layer is the Presentation Layer.

Answer: (C)

Q45.

Solution

Concept:

The `ROUND(X, D)` function in SQL is used to round a numeric value X to D decimal places. If D is positive, it rounds to the specified number of decimal places to the right of the decimal point.

Solution:

1. The input value is 15.678. 2. The second argument is 2, meaning we want to round to two decimal places. 3. We look at the third decimal digit (the "deciding" digit), which is 8. 4. Since 8 is greater than or equal to 5, we increment the second decimal digit by 1. 5. The digit 7 becomes 8. 6. The resulting value is 15.68.

Final Answer: The command returns 15.68.

Answer: (B)

Q46.

Solution

Concept:

A Queue is a linear data structure that manages data according to the **FIFO (First-In, First-Out)** principle. This means that the first element to enter the queue is the first one to be processed and removed, much like a physical line at a billing counter or a printer.

Solution:

1. In the given scenario, the print jobs are submitted in a specific sequence: 'Report' (1st), 'Invoice' (2nd), and 'Letter' (3rd). 2. Since a printer queue follows the FIFO rule, the OS or print spooler will handle the jobs in the exact order they were received. 3. The 'Report' was the first to enter the queue (at the Front). 4. Therefore, regardless of how many more jobs are added ('Invoice', 'Letter'), the 'Report' will be the first one sent to the printer for processing. 5. The 'Invoice' will follow next, and the 'Letter' will be last in this specific set.

Final Answer: The job 'Report' will be printed first.

Answer: (C)

Q47.

Solution

Concept:

In networking and data communication, **Bandwidth** is a measurement of the capacity of a transmission medium or a network path. It defines how much data can be sent from one point to another in a given period.

Solution:

1. Bandwidth is often confused with "speed," but technically, speed refers to the rate of data transfer, while bandwidth refers to the "width" or capacity of the channel. 2. It is typically measured in bits per second (bps), Megabits per second (Mbps), or Gigabits per second (Gbps). 3. A higher bandwidth allows more data to flow through the connection simultaneously, which is why high-definition video streaming requires more bandwidth than simple text messaging. 4. Therefore, the most accurate definition among the options is the "data transfer capacity of a network channel."

Final Answer: Bandwidth is the data transfer capacity of a network channel.

Answer: (C)

Q48.

Solution

Concept:

Cybersecurity threats are categorized by their specific malicious intent and method of operation. A **Keylogger** (short for keystroke logger) is a specific type of surveillance software or hardware.

Solution:

1. The primary function of a Keylogger is to record (log) every key pressed on a keyboard by a user, usually without their knowledge. 2. This allows attackers to capture highly sensitive information, such as login credentials (usernames and passwords), credit card numbers, and private messages. 3. Unlike Ransomware, which locks files for money, or Adware, which displays unwanted advertisements, a Keylogger is a tool for data theft and spying. 4. It is often delivered as a payload within a Trojan or other malware.

Final Answer: The threat is a Keylogger.

Answer: (B)

Q49.

Solution

Concept:

In Python, the ‘open()‘ function with the mode ‘”w”‘ (Write mode) has a specific behavior regarding existing files. When a file is opened in ‘”w”‘ mode, if the file already exists, its contents are completely deleted (truncated) before any new data is written.

Solution:

1. The file ”test.txt” initially contains ”Python”. 2. The code `f = open("test.txt", "w")` is executed. This immediately clears the existing ”Python” text from the file. 3. The command `f.write("Hello World")` writes the new string into the now-empty file. 4. After `f.close()`, the file will only contain the text ”Hello World”. 5. If the user wanted to keep the old text and add new text, they should have used the ‘”a”‘ (Append) mode instead.

Final Answer: The file will contain ”Hello World”.

Answer: (C)

Q50.

Solution

Concept:

In Relational Algebra, the **Union (∪)** operator is a set operation used to combine the results of two relations. For a Union to be valid, the two relations must be **"Union Compatible."**

Solution:

1. Union Compatibility means: - Both relations must have the same number of attributes (columns). - The data types of corresponding attributes must be the same. 2. The Union operator takes all the tuples (rows) from Relation A and all the tuples from Relation B and combines them into a single result. 3. Just like in mathematical set theory, duplicate rows are automatically removed from the result of a Union operation. 4. This is directly equivalent to the `UNION` operator in SQL.

Final Answer: The operator is Union (∪).

Answer: (C)

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	D	4	A	5	A
6	A	7	C	8	B	9	B	10	B
11	B	12	C	13	C	14	C	15	B
16	A	17	A	18	C	19	A	20	B
21	B	22	C	23	C	24	B	25	C
26	B	27	C	28	C	29	C	30	B
31	B	32	C	33	C	34	B	35	B
36	A	37	B	38	C	39	B	40	B
41	A	42	C	43	B	44	C	45	B
46	C	47	C	48	B	49	C	50	C