CUET UG Computer Science Sample Paper -9

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. Given the postfix expression: $10, 2, *, 5, 3, -, /$, what is the final value after evaluation using a stack?

(A) 10

(B) 5

(C) 2

(D) 15

Q2. In SQL, which function would you use to find the day of the week (e.g., Monday, Tuesday) from a given date column named 'OrderDate'?

(A) WEEKDAY(OrderDate)

(B) DAYNAME(OrderDate)

(C) DAYOFWEEK(OrderDate)

(D) DATEPART(OrderDate)

Q3. A list contains $1,000,000$ sorted elements. What is the maximum number of comparisons required to find an element using Binary Search?

(A) $1,000,000$

(B) $500,000$

(C) 20

(D) 10

Q4. In Python, which of the following code snippets will correctly write a list `L = ["Apple", "Orange"]` into a binary file 'fruits.dat'?

(A) `f.write(L)`

(B) `pickle.dump(L, f)`

(C) `f.dump(L)`

(D) `pickle.load(L, f)`

Q5. A relation $R(P, Q, R, S, T)$ has functional dependencies $P \rightarrow Q$, $Q \rightarrow R$, and $S \rightarrow T$. What is the closure of $\{P, S\}$?

(A) $\{P, S, Q\}$

(B) $\{P, S, Q, R\}$

(C) $\{P, S, Q, R, T\}$

(D) $\{P, S, T\}$

Q6. Which SQL aggregate function returns the total number of non-null values in a specific column?

(A) COUNT(*)

(B) SUM()

(C) COUNT(column_name)

(D) TOTAL()

Q7. In a double-ended queue (Deque), if insertion and deletion are allowed at both ends, which property does it NOT necessarily follow?

(A) FIFO

(B) LIFO

(C) Both (A) and (B)

(D) None of the above

Q8. Which of the following IPv4 addresses is a valid private IP address often used in local networks?

(A) 172.16.0.1

(B) 256.0.0.1

(C) 127.0.0.1

(D) 8.8.8.8

Q9. In Python, when using `seek(offset, whence)`, what does a `whence` value of 2 represent?

(A) Beginning of the file

(B) Current position of the pointer

(C) End of the file

(D) Middle of the file

Q10. Which type of malware is self-replicating and spreads across a network without requiring any human intervention or a host file?

(A) Virus

(B) Worm

(C) Spyware

(D) Keylogger

Q11. What is the best-case time complexity of the Bubble Sort algorithm when it is optimized with a 'swapped' flag?

(A) $O(n^2)$

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

(C) $O(n)$

(D) $O(1)$

Q12. Which SQL string function is used to remove leading and trailing spaces from a string?

(A) REMOVE()

(B) CLEAN()

(C) TRIM()

(D) SUBSTR()

Q13. In Python, which specific exception is raised when a dictionary is accessed using a key that does not exist?

(A) IndexError

(B) ValueError

(C) KeyError

(D) NameError

Q14. The Cartesian Product (X) of two relations $R1$ (with m rows) and $R2$ (with n rows) results in a relation with how many rows?

(A) $m + n$

(B) $m - n$

(C) $m \times n$

(D) m^n

Q15. Which network device is primarily used to connect two different networks that use different protocols?

(A) Hub

(B) Switch

(C) Bridge

(D) Gateway

Q16. Which sorting algorithm is considered stable and uses an auxiliary array for its operation, making its space complexity $O(n)$?

(A) Quick Sort

(B) Merge Sort

(C) Selection Sort

(D) Bubble Sort

Q17. In SQL, which of the following is a TCL (Transaction Control Language) command used to permanently save changes made in a transaction?

(A) SAVEPOINT

(B) COMMIT

(C) ROLLBACK

(D) UPDATE

Q18. What will be the output of the following Python code?

```
f = open("test.txt", "w")
f.write("CUET 2024")
f.seek(0)
print(f.read())
```

(A) CUET 2024

(B) (Empty String)

(C) UnsupportedOperation Error

(D) 0

Q19. Which networking protocol is used by the 'Ping' command to check the reachability of a host on an Internet Protocol (IP) network?

(A) TCP

(B) UDP

(C) ICMP

(D) HTTP

Q20. A stack is implemented with an array of size 10. If the current 'Top' index is 9, what condition occurs if another 'Push' operation is attempted?

(A) Underflow

(B) Overflow

(C) Garbage Value

(D) Null Pointer Exception

Q21. Which relational algebra operator allows us to combine rows from two relations that have a common attribute, but only where the values match?

(A) Cross Product

(B) Natural Join

(C) Set Difference

(D) Intersection

Q22. In Python file handling, which method is used to force-write any buffered data to the storage device without closing the file?

(A) write()

(B) tell()

(C) flush()

(D) close()

Q23. What is the correct SQL syntax to count the number of distinct departments in a 'EMPLOYEE' table?

(A) SELECT COUNT(DISTINCT Dept) FROM EMPLOYEE;

(B) SELECT DISTINCT(COUNT Dept) FROM EMPLOYEE;

(C) SELECT COUNT(Dept) DISTINCT FROM EMPLOYEE;

(D) SELECT DISTINCT COUNT FROM EMPLOYEE WHERE Dept;

Q24. Which of the following is a disadvantage of a Mesh topology?

(A) Low Reliability

(B) Difficult to troubleshoot

(C) High cabling cost and complexity

(D) Single point of failure

Q25. Which sorting algorithm has a worst-case time complexity of $O(n^2)$ but is generally faster than Merge Sort for small datasets due to lower overhead?

(A) Heap Sort

(B) Quick Sort

(C) Radix Sort

(D) Shell Sort

Q26. In SQL, which logical operator has the highest precedence?

(A) OR

(B) AND

(C) NOT

(D) ALL

Q27. A linear queue is implemented using an array. After several insertions and deletions, the 'Rear' reaches the end of the array, even if there is space at the front. This problem is known as:

(A) Overflow

(B) False Overflow

(C) Underflow

(D) Fragmentation

Q28. Which Python module is used to work with CSV (Comma Separated Values) files?

(A) pickle

(B) csv

(C) os

(D) sys

Q29. Which layer of the OSI model is responsible for data compression and encryption?

(A) Presentation Layer

(B) Session Layer

(C) Application Layer

(D) Transport Layer

Q30. In SQL, the `BETWEEN` operator is inclusive. Which of the following is equivalent to `Price BETWEEN 10 AND 20`?

(A) Price > 10 AND Price < 20

(B) Price >= 10 OR Price <= 20

(C) Price >= 10 AND Price <= 20

(D) Price > 10 OR Price < 20

Q31. What is the time complexity of adding an element to a stack of size n?

(A) $O(n)$

(B) $O(\log n)$

(C) $O(1)$

(D) $O(n^2)$

Q32. Which command is used to change the name of an existing table in SQL?

(A) CHANGE TABLE

(B) ALTER TABLE ... RENAME TO

(C) UPDATE TABLE NAME

(D) MODIFY TABLE

Q33. In Python, which of the following file modes will raise an error if the file does not already exist?

(A) w

(B) a

(C) r

(D) w+

Q34. Which networking device is used to regenerate a signal when it travels over long distances to prevent attenuation?

(A) Bridge

(B) Switch

(C) Repeater

(D) Router

Q35. In a relational database, what is a 'Foreign Key'?

(A) A key that must be unique

(B) A key that cannot be null

(C) A column that references the primary key of another table

(D) A key used for encryption

Q36. What will be the result of the following SQL operation: `SELECT 10 + NULL;`

(A) 10

(B) 0

(C) NULL

(D) Error

Q37. Which sorting algorithm is based on the idea of finding the 'minimum' element and swapping it to the beginning?

(A) Bubble Sort

(B) Selection Sort

(C) Insertion Sort

(D) Quick Sort

Q38. In Python, the `tell()` method returns:

(A) The total number of characters in the file

(B) The current position of the file pointer

(C) The name of the file

(D) The first line of the file

Q39. Which protocol is primarily used for secure communication over a computer network, providing encryption for web traffic?

(A) HTTP

(B) HTTPS

(C) FTP

(D) Telnet

Q40. What is the output of the Python expression `5 // 2`?

(A) 2.5

(B) 2

(C) 3

(D) 2.0

Q41. Which SQL function returns the current date and time of the system where the database is running?

(A) CURDATE()

(B) CURTIME()

(C) NOW()

(D) DATE()

Q42. In Python, what is the default behavior of the `write()` method when the file is opened in 'w' mode and it already exists?

(A) It appends to the end.

(B) It raises an error.

(C) It overwrites the existing content.

(D) It creates a temporary copy.

Q43. Which type of network topology is most prone to a complete network failure if the central connecting device (Hub/Switch) fails?

(A) Bus

(B) Star

(C) Ring

(D) Mesh

Q44. What is the postfix equivalent of the infix expression: $A + B * C$?

(A) $ABC + *$

(B) $AB + C*$

(C) $ABC * +$

(D) $+A * BC$

Q45. In a relational database, which constraint ensures that a column cannot have any empty values?

(A) UNIQUE

(B) PRIMARY KEY

(C) NOT NULL

(D) DEFAULT

Q46. Which sorting algorithm repeatedly divides the list into halves, sorts them, and then combines them back together?

(A) Quick Sort

(B) Merge Sort

(C) Bubble Sort

(D) Insertion Sort

Q47. Which Python exception is raised when an operation or function is applied to an object of inappropriate type (e.g., adding a string to an integer)?

(A) ValueError

(B) TypeError

(C) NameError

(D) AttributeError

Q48. In SQL, the `GROUP BY` clause is typically used in conjunction with which type of functions?

(A) String Functions

(B) Scalar Functions

(C) Aggregate Functions

(D) Numeric Functions

Q49. Which networking protocol is used to assign dynamic IP addresses to devices on a network automatically?

(A) DNS

(B) DHCP

(C) HTTP

(D) SMTP

Q50. Which Data Structure uses the ”Rear” for insertion and the ”Front” for deletion of elements?

(A) Stack

(B) Queue

(C) Binary Tree

(D) Linked List

Detailed Solutions

Q1.

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 applied (the second pop is the left operand, the first pop is the right operand), and the result is pushed back.

Solution:

1. Expression: $10, 2, *, 5, 3, -, /$ 2. Push 10, Push 2: Stack $[10, 2]$ 3. Encounter '*': Pop 2, Pop 10. $10 * 2 = 20$. Push 20. Stack $[20]$ 4. Push 5, Push 3: Stack $[20, 5, 3]$ 5. Encounter '-': Pop 3, Pop 5. $5 - 3 = 2$. Push 2. Stack $[20, 2]$ 6. Encounter '/': Pop 2, Pop 20. $20/2 = 10$. Push 10. Stack $[10]$ 7. The final value remaining in the stack is 10.

Final Answer: 10.

Answer: (A)

Q2.

Solution

Concept:

SQL provides various Date/Time functions to extract specific parts of a timestamp. While 'WEEKDAY()' returns an index (0-6), 'DAYNAME()' returns the full string representation of the day.

Solution:

1. 'WEEKDAY()' returns an integer where 0 might be Monday (depending on the DB). 2. 'DAYNAME()' is the standard MySQL/SQL function used specifically to return the name of the day (e.g., 'Friday'). 3. 'DAYOFWEEK()' returns a number (1-7). 4. 'DATEPART()' is used in SQL Server to extract components but requires a specific interval argument. 5. For the literal name of the day, 'DAYNAME()' is the correct choice.

Final Answer: DAYNAME(OrderDate).

Answer: (B)

Q3.

Solution

Concept:

Binary Search follows a logarithmic time complexity, $O(\log_2 n)$. The maximum number of comparisons is the smallest power of 2 that is greater than or equal to n.

Solution:

1. Total elements $n = 1,000,000$. 2. We need to find x such that $2^x \geq 1,000,000$. 3. We know $2^{10} = 1024$. 4. $2^{20} = (2^{10})^2 = 1024 \times 1024 \approx 1,048,576$. 5. Since 2^{19} is roughly $524,288$ (too small), 20 is the minimum number of steps to narrow the search range down to a single element for a million items.

Final Answer: 20.

Answer: (C)

Q4.

Solution

Concept:

To save complex Python objects (like lists or dictionaries) to a file such that their structure is preserved, we use ”Serialization” via the ‘pickle‘ module.

Solution:

1. ‘f.write()‘ only accepts strings or bytes; it cannot directly handle a list object. 2. The ‘pickle.dump(object, file)‘ function is the correct syntax to serialize the object and write it to the open file handle. 3. ‘pickle.load()‘ is used for reading, not writing. 4. ‘f.dump()‘ is not a valid method of the built-in file object.

Final Answer: pickle.dump(L, f).

Answer: (B)

Q5.

Solution

Concept:

The closure of an attribute set $\{X\}^+$ is the set of all attributes that are functionally determined by X using the given dependencies and transitivity.

Solution:

1. Start with the set itself: $\{P, S\}$. 2. Check $P \rightarrow Q$: Since P is in our set, add Q. Set is now $\{P, S, Q\}$. 3. Check $Q \rightarrow R$: Since Q is now in our set, add R. Set is now $\{P, S, Q, R\}$. 4. Check $S \rightarrow T$: Since S is in our set, add T. Set is now $\{P, S, Q, R, T\}$. 5. No more dependencies apply. The final closure includes all five attributes.

Final Answer: $\{P, S, Q, R, T\}$.

Answer: (C)

Q6.

Solution

Concept: SQL aggregate functions are used to perform calculations on a set of values. The handling of `NULL` values is a key distinction between different `COUNT` syntaxes:

- `COUNT(*)`: Counts the total number of rows in a table, regardless of whether they contain `NULL` values or not.
- `COUNT(column_name)`: Specifically evaluates the data within the named column and ignores any row where that column's value is `NULL`.
- `SUM()`: Calculates the arithmetic total of numeric values, ignoring `NULL`s.

Solution: To find the total number of non-null values in a specific column, you must pass the column name as an argument to the `COUNT` function. This tells the database to skip any records where that specific field is empty (`NULL`).

- (A) is incorrect as it counts all records.
- (B) is incorrect as it adds values together rather than counting occurrences.
- (D) is incorrect as `TOTAL()` is not a standard SQL aggregate function for counting.

Thus, `COUNT(column_name)` is the correct function.

Answer: (C)

Q7.

Solution

Concept:

A Deque (Double-Ended Queue) is a generalized version of both Stacks and Queues. It allows insertion and deletion from both the 'Front' and the 'Rear' ends.

Solution:

1. If we use the Deque by only inserting at the Rear and deleting from the Front, it behaves as a **FIFO** (Queue). 2. If we use the Deque by inserting at the Rear and deleting from the Rear, it behaves as a **LIFO** (Stack). 3. Because the Deque is flexible, it can be configured to follow either property or even a mixture of both. 4. Therefore, it does not "necessarily" follow only one strict property; it depends on how the user restricts the operations. However, in the context of the question, it can satisfy both (A) and (B).

Final Answer: Both (A) and (B).

Answer: (C)

Q8.

Solution

Concept:

IP addresses are divided into public and private ranges. Private IP addresses are reserved for use within local area networks (LANs) and are not routable on the public internet.

Solution:

1. The standard private IP ranges are: - Class A: 10.0.0.0 to 10.255.255.255 - Class B: 172.16.0.0 to 172.31.255.255 - Class C: 192.168.0.0 to 192.168.255.255 2. **172.16.0.1** falls exactly within the Class B private range. 3. **256.0.0.1** is invalid because an octet cannot exceed 255. 4. **127.0.0.1** is the loopback address (localhost). 5. **8.8.8.8** is a public IP address (Google's DNS).

Final Answer: 172.16.0.1.

Answer: (A)

Q9.

Solution

Concept:

In Python, the 'file.seek(offset, whence)' method adjusts the current file pointer. The 'whence' argument determines the reference point for the 'offset'.

Solution:

1. 'whence = 0': Offset is calculated from the **beginning** of the file (Default). 2. 'whence = 1': Offset is calculated from the **current** position of the pointer. 3. 'whence = 2': Offset is calculated from the **end** of the file. 4. For example, 'seek(-10, 2)' would move the pointer to 10 bytes before the end of the file. 5. This is particularly useful for binary files where you need to read metadata located at the end of the file.

Final Answer: End of the file.

Answer: (C)

Q10.

Solution

Concept:

Malware is categorized by its method of infection and propagation. Viruses and Worms are both malicious, but their behavior in a network differs significantly.

Solution:

1. A **Virus** requires a host file or program to attach itself to and needs human action (like opening an attachment) to spread. 2. A **Worm** is a standalone piece of software. It uses network vulnerabilities to move from one computer to another automatically. 3. Because Worms can self-replicate and propagate across a network without any human intervention, they are much more dangerous for corporate infrastructures. 4. Spyware and Keyloggers are types of malware focused on data theft rather than autonomous propagation.

Final Answer: Worm.

Answer: (B)

Q11.

Solution

Concept:

The standard Bubble Sort has a time complexity of $O(n^2)$ because it uses nested loops to compare every pair. However, it can be optimized by adding a flag to check if any swaps occurred during a pass.

Solution:

1. In the optimized version, we initialize a boolean variable ‘swapped = False‘ at the start of each pass. 2. If any two elements are swapped, we set ‘swapped = True‘. 3. If a full pass is completed and ‘swapped‘ remains ‘False‘, it means the array is already sorted, and we can break out of the loop early. 4. In the best-case scenario (where the input array is already sorted), the algorithm performs only one pass of $n - 1$ comparisons and then terminates. 5. This reduces the best-case time complexity to linear time.

Final Answer: $O(n)$.

Answer: (C)

Q12.

Solution

Concept:

When handling user input or data from external sources in SQL, strings often contain unnecessary whitespace at the beginning or end. SQL provides specific functions to ”clean” these strings.

Solution:

1. ‘LTRIM(string)‘ removes spaces from the left side (leading spaces) only. 2. ‘RTRIM(string)‘ removes spaces from the right side (trailing spaces) only. 3. ‘TRIM(string)‘ is the combined function that removes spaces from both the beginning and the end of the string simultaneously. 4. ‘SUBSTR()‘ is used to extract a portion of the string, and ‘REMOVE()‘ is not a standard built-in function for whitespace management in most SQL dialects.

Final Answer: TRIM().

Answer: (C)

Q13.

Solution

Concept:

Python uses specific built-in exceptions to signal different types of runtime errors. Dictionaries store data in key-value pairs, and accessing them requires a valid key.

Solution:

1. ‘IndexError‘ is raised when a sequence subscript (like a list index) is out of range. 2. ‘ValueError‘ is raised when a function receives an argument of the right type but inappropriate value. 3. ‘KeyError‘ is the specific exception triggered by the Python interpreter when a mapping (dictionary) key is not found in the set of existing keys. 4. ‘NameError‘ is raised when a local or global name (variable) is not found.

Final Answer: KeyError.

Answer: (C)

Q14.

Solution

Concept:

The Cartesian Product (also known as a CROSS JOIN) is a fundamental operation in set theory and relational algebra that combines every row of the first table with every row of the second table.

Solution:

1. If Relation $R1$ has tuples (rows) $\{r_1, r_2, \ldots, r_m\}$. 2. If Relation $R2$ has tuples $\{s_1, s_2, \ldots, s_n\}$. 3. The Cartesian Product $R1 \times R2$ pairs r_1 with every s in $R2$, then r_2 with every s in $R2$, and so on. 4. This results in m groups of n pairings. 5. The total number of rows in the resulting relation is therefore the product of the number of rows in the input relations.

Final Answer: $m \times n$.

Answer: (C)

Q15.

Solution

Concept:

In complex internetworks, different segments may use different communication protocols (e.g., connecting a TCP/IP network to an older AppleTalk or IPX/SPX network).

Solution:

1. A **Hub** and **Switch** connect devices within the same network using the same protocol. 2. A **Bridge** connects two network segments at the Data Link Layer, typically using the same protocol. 3. A **Gateway** is a "protocol converter." It operates at higher layers of the OSI model and is specifically designed to translate between different network architectures and protocols, allowing them to communicate. 4. It acts as an entry and exit point for a network.

Final Answer: Gateway.

Answer: (D)

Q16.

Solution

Concept:

A sorting algorithm is "stable" if it preserves the relative order of elements with equal keys. Space complexity refers to the extra memory an algorithm needs to perform its task.

Solution:

1. **Quick Sort** is generally unstable and, in its standard implementation, has $O(\log n)$ space complexity due to recursion. 2. **Merge Sort** is a stable sorting algorithm. To merge two sorted halves, it requires an auxiliary (temporary) array of the same size as the original array to store the merged elements before copying them back. 3. This requirement for extra space makes its space complexity $O(n)$. 4. **Selection Sort** and **Bubble Sort** are $O(1)$ space algorithms (in-place) but Selection Sort is typically unstable.

Final Answer: Merge Sort.

Answer: (B)

Q17.

Solution

Concept:

Transaction Control Language (TCL) commands manage the changes made by DML statements. They ensure the ACID properties of a database transaction.

Solution:

1. ‘SAVEPOINT‘ creates a point in a transaction to which you can later roll back. 2. ‘COMMIT‘ is the command used to finalize the transaction. Once executed, all changes made during the transaction are written permanently to the database disk and cannot be undone via a rollback. 3. ‘ROLLBACK‘ undoes all changes made since the last commit or to a specific savepoint. 4. ‘UPDATE‘ is a DML command, not a TCL command.

Final Answer: COMMIT.

Answer: (B)

Q18.

Solution

Concept:

Python’s ‘open(file, ”w”)‘ mode opens a file for **writing only**. It truncates the file if it already exists or creates a new one.

Solution:

1. ‘f = open(”test.txt”, ”w”)‘ opens the file in write-only mode. 2. ‘f.write(”CUET 2024”)‘ adds the text to the buffer. 3. ‘f.seek(0)‘ moves the pointer back to the beginning of the file. 4. ‘f.read()‘ is then called. However, because the file was opened in ‘”w”‘ mode, the object does not have permission to read. 5. In Python, attempting to read from a file opened in write-only mode (or vice-versa) raises an ‘io.UnsupportedOperation: not readable‘ error.

Final Answer: UnsupportedOperation Error.

Answer: (C)

Q19.

Solution

Concept:

Network diagnostics require protocols that can communicate status and error messages between devices rather than just transferring application data.

Solution:

1. **TCP** and **UDP** are Transport Layer protocols used for data delivery. 2. **ICMP** (Internet Control Message Protocol) is a Network Layer protocol used by network devices to send error messages and operational information. 3. The ‘Ping‘ utility sends an ”ICMP Echo Request” packet to a target host and waits for an ”ICMP Echo Reply.” 4. This confirms if the target is active and calculates the round-trip time.

Final Answer: ICMP.

Answer: (C)

Q20.

Solution

Concept:

A stack has a fixed capacity when implemented using an array. Two boundary conditions must be managed: when the stack is empty and when it is full.

Solution:

1. An array of size 10 has indices ranging from 0 to 9. 2. In a stack, ’Top’ typically points to the index of the last element added. 3. If ‘Top = 9‘, the array is completely full (elements at indices 0, 1, ..., 9). 4. A **Push** operation first increments ’Top’ and then attempts to insert. Since ‘Top + 1 = 10‘ is outside the array bounds, this results in a **Stack Overflow**. 5. **Underflow** occurs when you attempt to pop from an empty stack (‘Top = -1‘).

Final Answer: Overflow.

Answer: (B)

Q21.

Solution

Concept:

In Relational Algebra, combining data from different tables is achieved through Join operations. While a Cross Product combines everything, a Join applies a specific logic to filter the pairs.

Solution:

1. **Cross Product** (Cartesian Product) pairs every row of the first table with every row of the second, regardless of commonality. 2. **Natural Join** (⋈) is a specific type of join that automatically joins tables based on columns with the same name. 3. It only keeps the rows where the values in these common columns are equal (match). 4. **Set Difference** removes rows of one relation from another, and **Intersection** finds rows present in both (they require identical schemas).

Final Answer: Natural Join.

Answer: (B)

Q22.

Solution

Concept:

When writing to a file in Python, the data is often stored in a temporary memory area called a ”buffer” to improve performance. The data is written to the physical disk only when the buffer is full or the file is closed.

Solution:

1. ‘write()‘ adds data to the buffer but doesn’t guarantee it is written to the disk immediately. 2. ‘tell()‘ reports the current position of the pointer but does not affect data writing. 3. ‘flush()‘ is the specific method that forces the contents of the buffer to be written to the storage device immediately, while keeping the file open for further operations. 4. ‘close()‘ also flushes the buffer, but it terminates the connection to the file, making further writes impossible without re-opening.

Final Answer: flush().

Answer: (C)

Q23.

Solution

Concept: To count the number of unique occurrences in a column, SQL provides the `DISTINCT` keyword, which is used inside an aggregate function.

- `COUNT(column_name)`: Counts all non-null values, including duplicates.
- `COUNT(DISTINCT column_name)`: First identifies the unique values in the column, then counts them.

Solution: The correct syntax requires the `DISTINCT` keyword to be placed inside the parentheses of the `COUNT` function, preceding the column name.

- (A) `SELECT COUNT(DISTINCT Dept) FROM EMPLOYEE;`: This is the standard and correct SQL syntax.
- (B) `SELECT DISTINCT(COUNT Dept)`: Syntactically incorrect; `COUNT` requires parentheses around its argument.
- (C) `SELECT COUNT(Dept) DISTINCT`: The `DISTINCT` keyword cannot be placed after the function.
- (D) `SELECT DISTINCT COUNT`: `COUNT` is a function and cannot be used as a standalone keyword without arguments in this context.

Thus, the correct query is represented by Option (A).

Answer: (A)

Q24.

Solution

Concept:
Mesh topology is a network setup where each node is connected to every other node. While this provides maximum redundancy, it comes with significant practical drawbacks.

Solution:
1. **Reliability**: Mesh has the highest reliability because if one link fails, there are many alternative paths. 2. **Troubleshooting**: It is relatively easy to find faults because every connection is dedicated. 3. **Cabling/Cost**: The number of cables required for n nodes is $n(n-1)/2$. For a large number of nodes, the physical wiring becomes extremely complex and expensive. 4. **Single Point of Failure**: This is a disadvantage of Star topology (the Hub), not Mesh.

Final Answer: High cabling cost and complexity.

Answer: (C)

Q25.

Solution

Concept:

Time complexity and performance overhead differ across sorting algorithms. Some algorithms perform better on small datasets even if their theoretical worst-case is higher.

Solution:

1. **Merge Sort** always has $O(n \log n)$ complexity but requires extra space and has higher constant time factors due to recursive calls and array copying. 2. **Quick Sort** has a worst-case of $O(n^2)$ (when the pivot is consistently the smallest or largest element). 3. However, in the average case, Quick Sort is $O(n \log n)$ and is often faster than Merge Sort in practice because it is an "in-place" algorithm with very low overhead. 4. For small datasets, the simplicity of its partitioning logic makes it highly efficient.

Final Answer: Quick Sort.

Answer: (B)

Q26.

Solution

Concept:

Precedence rules (also known as Order of Operations) determine which logical operators are evaluated first in a complex SQL expression.

Solution:

1. The order of precedence for logical operators in SQL is: **NOT** > **AND** > **OR**. 2. **NOT** has the highest precedence; it is a unary operator and is applied first. 3. **AND** is the next in line. 4. **OR** has the lowest precedence among the three and is evaluated last. 5. If there are parentheses, the expressions inside them are evaluated first, regardless of the operator.

Final Answer: NOT.

Answer: (C)

Q27.

Solution

Concept:

A linear queue is implemented using a fixed-size array with two pointers, ‘Front‘ and ‘Rear‘. In a basic linear queue, once ‘Rear‘ reaches the end of the array, no more insertions are allowed.

Solution:

1. In a linear queue, when elements are deleted, the ‘Front‘ pointer moves forward, leaving empty spaces at the beginning of the array. 2. However, the ‘Rear‘ pointer only moves forward as new elements are added. 3. When ‘Rear‘ reaches the last index of the array ($N-1$), the condition ‘Rear == Size - 1‘ is met. 4. If a user tries to insert a new element, the program signals an ”Overflow,” even though there are empty slots available at the front of the array. 5. This specific state is called **False Overflow**. It is usually resolved by implementing a Circular Queue.

Final Answer: False Overflow.

Answer: (B)

Q28.

Solution

Concept:

Python provides specialized modules for handling common file formats. Comma Separated Values (CSV) is a standard format for representing tabular data in plain text.

Solution:

1. The **csv** module in Python is the dedicated built-in library for reading from and writing to CSV files. 2. It provides classes like ‘csv.reader‘ and ‘csv.writer‘, as well as ‘DictReader‘ and ‘DictWriter‘ for handling rows as dictionaries. 3. ‘pickle‘ is used for binary object serialization. 4. ‘os‘ and ‘sys‘ are for operating system interactions and system-specific parameters, respectively.

Final Answer: csv.

Answer: (B)

Q29.

Solution

Concept:

The OSI (Open Systems Interconnection) model divides network communication into seven layers. Each layer has a specific set of responsibilities.

Solution:

1. The **Application Layer** provides the interface for end-user software. 2. The **Presentation Layer** (Layer 6) acts as the data translator for the network. It handles syntax and semantics of the data. 3. Specifically, it is responsible for **Data Compression** (to reduce bits), **Encryption** (for security), and translation between different character encodings (like EBCDIC to ASCII). 4. The Session Layer manages connections, and the Transport Layer ensures reliable data transfer.

Final Answer: Presentation Layer.

Answer: (A)

Q30.

Solution

Concept:

The ‘BETWEEN‘ operator in SQL is used to filter the result set within a certain range. It is shorthand for a combination of comparison operators.

Solution:

1. The syntax ‘column BETWEEN value1 AND value2‘ is inclusive. 2. This means it includes both ‘value1‘ and ‘value2‘ as well as everything in between. 3. Logically, this is identical to: ‘column >= value1 AND column <= value2‘. 4. Option (A) is exclusive (doesn’t include 10 or 20). Option (B) uses ‘OR‘, which would select almost all numbers.

Final Answer: Price >= 10 AND Price <= 20.

Answer: (C)

Q31.

Solution

Concept:

A stack is an Abstract Data Type (ADT) that follows the LIFO principle. The complexity of its primary operations depends on the efficiency of accessing the ”Top” element.

Solution:

1. Adding an element to a stack is called a **Push** operation. 2. In a stack, we always have a pointer (or index) called ‘Top‘ that tracks the last inserted element. 3. To push a new element, we simply increment the ‘Top‘ pointer and place the element at that location. 4. This operation does not require shifting existing elements or iterating through the stack, regardless of whether the stack has 10 elements or 1,000,000 elements. 5. Since the operation takes a constant amount of time, the complexity is $O(1)$.

Final Answer: $O(1)$.

Answer: (C)

Q32.

Solution

Concept: In SQL, Data Definition Language (DDL) commands are used to modify the structure of database objects.

- `ALTER TABLE`: This command is the primary tool for modifying an existing table’s structure, such as adding, deleting, or renaming columns and renaming the table itself.
- `RENAME TO`: This is the specific clause used within the `ALTER TABLE` statement to change the identifier of the table.

Solution: To rename a table, the standard SQL syntax is:

```
ALTER TABLE old_table_name RENAME TO new_table_name;
```

Analyzing the options:

- (A) `CHANGE TABLE`: This is not standard SQL syntax for renaming a table.
- (B) `ALTER TABLE ... RENAME TO`: This is the correct standard command.
- (C) `UPDATE TABLE NAME`: `UPDATE` is a DML command used for modifying data within rows, not for changing structural names.
- (D) `MODIFY TABLE`: While `MODIFY` is used in some dialects (like Oracle or MySQL) to change column definitions, it is not used to rename the table itself.

Answer: (B)

Q33.

Solution

Concept:

The ‘open()‘ function in Python accepts different access modes. Some modes create files automatically, while others expect the file to exist beforehand to prevent accidental data loss or logical errors.

Solution:

1. ‘w‘ (Write) and ‘a‘ (Append) modes will automatically create the file if it does not exist. 2. ‘w+‘ (Write and Read) also creates the file if it is missing. 3. ‘r‘ (Read) mode is used exclusively for accessing existing data. If the specified file name is not found on the disk, Python will raise a ‘FileNotFoundError‘. 4. This is a safety feature to ensure the program doesn’t try to read from a non-existent source.

Final Answer: r.

Answer: (C)

Q34.

Solution

Concept:

Attenuation is the loss of signal strength as it travels through a medium (like copper wire or fiber optics). To maintain data integrity over long distances, signals must be refreshed.

Solution:

1. A **Repeater** is a physical layer device that receives a weak or corrupted signal, cleans it, regenerates it to its original strength, and retransmits it. 2. It does not look at the data (MAC or IP); its only job is to extend the physical reach of the network. 3. A **Switch** and **Bridge** manage traffic based on MAC addresses. 4. A **Router** manages traffic based on IP addresses and finds the best path.

Final Answer: Repeater.

Answer: (C)

Q35.

Solution

Concept:

Relational databases use keys to establish links between tables. This maintains referential integrity, ensuring that data across different tables remains consistent.

Solution:

1. A **Primary Key** uniquely identifies a row within its own table. 2. A **Foreign Key** is a column (or set of columns) in one table that refers to the Primary Key in another table. 3. It creates a relationship between the two tables (e.g., a ‘CustomerID‘ in an ‘Orders‘ table points to the ‘CustomerID‘ in a ‘Customers‘ table). 4. The purpose is to ensure that the value in the foreign key column actually exists in the parent table.

Final Answer: A column that references the primary key of another table.

Answer: (C)

Q36.

Solution

Concept:

In SQL, ‘NULL‘ represents a missing or unknown value. It is not equivalent to zero or an empty string. Therefore, arithmetic operations involving ‘NULL‘ follow specific logic.

Solution:

1. According to SQL standards, any arithmetic operation (+, −, ∗, /) performed with a ‘NULL‘ value results in ‘NULL‘. 2. This is because the result of adding 10 to an ”unknown” value is still ”unknown.” 3. To treat ‘NULL‘ as 0, functions like ‘IFNULL()‘, ‘COALESCE()‘, or ‘NVL()‘ must be used. 4. Since no such function is used here, the expression 10 + NULL evaluates to ‘NULL‘.

Final Answer: NULL.

Answer: (C)

Q37.

Solution

Concept:

Selection Sort is a comparison-based sorting algorithm that works by logically dividing the array into two parts: a sorted sublist and an unsorted sublist.

Solution:

1. The algorithm repeatedly finds the smallest (minimum) element in the unsorted sublist. 2. It then swaps this minimum element with the first element of the unsorted sublist. 3. This ”selected” element is now part of the sorted sublist. 4. The process repeats, moving the boundary of the sorted sublist one element to the right until the entire list is sorted. 5. **Bubble Sort** focuses on adjacent swaps; **Insertion Sort** focuses on placing elements in a pre-sorted sequence.

Final Answer: Selection Sort.

Answer: (B)

Q38.

Solution

Concept:

Python provides two primary methods to track and move the file pointer during I/O operations: ‘seek()‘ to move it and ‘tell()‘ to report it.

Solution:

1. The ‘tell()‘ method takes no arguments. 2. It returns an integer representing the current position of the file object’s pointer measured in bytes from the beginning of the file. 3. For example, if you open a file and read 10 characters, ‘f.tell()‘ will return 10. 4. This is essential when you want to bookmark a specific location in a file to return to it later using ‘seek()‘.

Final Answer: The current position of the file pointer.

Answer: (B)

Q39.

Solution

Concept:

Standard web traffic uses HTTP, which transmits data in plain text. For sensitive data like passwords or credit card numbers, an encrypted version is required.

Solution:

1. **HTTPS** (Hypertext Transfer Protocol Secure) is an extension of HTTP. 2. It uses **SSL/TLS** (Secure Sockets Layer/Transport Layer Security) to encrypt the communication between the browser and the server. 3. This prevents ”Man-in-the-Middle” attacks where a third party could intercept and read the data. 4. **Telnet** is an older protocol that is inherently insecure as it transmits everything (including passwords) in clear text.

Final Answer: HTTPS.

Answer: (B)

Q40.

Solution

Concept:

Python provides different types of division operators. The standard '/' performs float division, while '//' performs floor (integer) division.

Solution:

1. In the expression '5 // 2', the '//' operator divides the first number by the second. 2. 5/2 = 2.5. 3. Floor division ('//') takes the result and rounds it down to the nearest whole number (integer). 4. Therefore, 2.5 becomes 2. 5. Note: If it were '-5 // 2', the result would be '-3' because -3 is the largest integer less than or equal to -2.5.

Final Answer: 2.

Answer: (B)

Q41.

Solution

Concept:

SQL provides several functions to fetch the current system date and time. While some extract only the date or only the time, one specific function combines both into a single timestamp.

Solution:

1. 'CURDATE()' returns only the current date in 'YYYY-MM-DD' format. 2. 'CURTIME()' returns only the current time in 'HH:MM:SS' format. 3. 'NOW()' is the standard SQL function that returns both the current date and the current time as a single value (Timestamp). 4. 'DATE()' is usually used to extract the date part from a datetime expression, rather than fetching the current system time.

Final Answer: NOW().

Answer: (C)

Q42.

Solution

Concept:

Python file modes determine the "pointer" behavior and how existing data is treated. The 'w' (write) mode is one of the most commonly used but also one of the most destructive modes.

Solution:

1. When a file is opened using 'open(filename, 'w')', the Python interpreter checks if the file exists. 2. If the file exists, the 'w' mode "truncates" the file. Truncation means it completely deletes all existing data, effectively making it an empty file. 3. If the file does not exist, it creates a new one. 4. To add data without deleting what is already there, one must use the 'a' (append) mode.

Final Answer: It overwrites the existing content.

Answer: (C)

Q43.

Solution

Concept:

Network resilience refers to how well a network survives the failure of one of its components. Different layouts (topologies) have different "Single Points of Failure."

Solution:

1. In a **Star Topology**, every node (computer/printer) is connected to a central hub or switch. 2. All communication between nodes must pass through this central device. 3. If a single cable to a computer breaks, only that computer goes offline. 4. However, if the central hub or switch itself fails, the entire network becomes non-functional because no node can communicate with any other. 5. In contrast, Mesh topology is highly resilient, and Bus topology fails only if the main backbone cable is cut.

Final Answer: Star.

Answer: (B)

Q44.

Solution

Concept:

Postfix notation (Reverse Polish Notation) follows the order of operations (BODMAS/PEMDAS) but places the operator after the operands.

Solution:

1. Expression: $A + B * C$ 2. According to operator precedence, Multiplication ($*$) is higher than Addition ($+$). 3. First, convert $B * C$ to postfix: $BC*$ 4. Now the expression is $A + [BC*]$. 5. Treating $[BC*]$ as a single operand, convert the addition: $A[BC*]+$ 6. Removing the brackets gives the final postfix expression: $ABC*+$

Final Answer: $ABC*+$.

Answer: (C)

Q45.

Solution

Concept:

Constraints are rules enforced on data columns on a table. They are used to limit the type of data that can go into a table to ensure accuracy and reliability.

Solution:

1. 'UNIQUE' ensures all values in a column are different but allows NULL values. 2. 'PRIMARY KEY' ensures uniqueness AND that the value is not null, but only one can exist per table. 3. 'NOT NULL' is the specific constraint that forces a column to always contain a value. You cannot insert a new record or update a record without providing a value for this column. 4. 'DEFAULT' provides a fallback value if none is supplied but does not strictly prevent empty inputs if NULL is allowed.

Final Answer: NOT NULL.

Answer: (C)

Q46.

Solution

Concept:

Merge Sort is a classic example of the "Divide and Conquer" algorithmic paradigm. It works by recursively breaking down a problem into two or more sub-problems of the same or related type, until these become simple enough to be solved directly.

Solution:

1. The algorithm first divides the unsorted list into n sublists, each containing one element (a list of one element is considered sorted). 2. It then repeatedly merges sublists to produce new sorted sublists until there is only one sublist remaining. 3. This "divide" (splitting the array in half) and "merge" (combining two sorted halves) process ensures a consistent time complexity of $O(n \log n)$ across all cases (best, average, and worst). 4. Unlike Quick Sort, it does not use a pivot and is generally more predictable in its performance.

Final Answer: Merge Sort.

Answer: (B)

Q47.

Solution

Concept:

Python is a strongly typed language, which means it does not perform implicit type conversions (coercion) that could lead to data loss or logical ambiguity.

Solution:

1. ‘TypeError‘ is raised when an operation or function is applied to an object of an inappropriate type. 2. A common example is trying to concatenate a string and an integer (e.g., ‘”Age: ” + 25‘). Python requires you to explicitly convert the integer to a string first. 3. ‘ValueError‘ occurs when the type is correct but the content is invalid (e.g., ‘int(”abc”)‘). 4. ‘AttributeError‘ occurs when you try to access a method or property that does not exist for that specific object type.

Final Answer: TypeError.

Answer: (B)

Q48.

Solution

Concept:

In SQL, the ‘GROUP BY‘ clause is used to arrange identical data into groups. This is only useful if we intend to perform a mathematical summary of each group.

Solution:

1. ‘GROUP BY‘ is almost always used with **Aggregate Functions** like ‘COUNT()‘, ‘MAX()‘, ‘MIN()‘, ‘SUM()‘, and ‘AVG()‘. 2. These functions take multiple rows as input and return a single value for each group. 3. For example, ‘SELECT Dept, COUNT(*) FROM EMPLOYEE GROUP BY Dept;‘ groups employees by their department and then applies the aggregate function ‘COUNT‘ to each group. 4. Using ‘GROUP BY‘ without an aggregate function usually results in the same output as using ‘DISTINCT‘.

Final Answer: Aggregate Functions.

Answer: (C)

Q49.

Solution

Concept:

Managing IP addresses manually in a large network is prone to errors and difficult to maintain. Network protocols exist to automate the configuration of network interfaces.

Solution:

1. **DHCP** (Dynamic Host Configuration Protocol) is a network management protocol used on UDP/IP networks. 2. A DHCP server dynamically assigns an IP address and other network configuration parameters (like subnet mask and default gateway) to each device on a network so they can communicate with other IP networks. 3. **DNS** (Domain Name System) translates domain names to IP addresses but does not assign the addresses themselves. 4. **SMTP** is for email, and **HTTP** is for web traffic.

Final Answer: DHCP.

Answer: (B)

Q50.

Solution

Concept:

Linear data structures are defined by how elements are added and removed. A Queue follows the ”First-In, First-Out” (FIFO) principle, mimicking a real-world waiting line.

Solution:

1. A **Queue** uses two distinct pointers to manage data. 2. The **Rear** (or Tail) is where new elements are added to the structure (Insertion/Enqueue). 3. The **Front** (or Head) is where elements are removed from the structure (Deletion/Dequeue). 4. This ensures that the element that has been in the queue the longest is the first one to be processed. 5. In contrast, a **Stack** uses only one end (Top) for both insertion and deletion.

Final Answer: Queue.

Answer: (B)

Answer Key

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