CUET UG Computer Science Sample Paper -3

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 stack S is used to convert an infix expression to a postfix expression. Given the infix expression $A + B * (C - D)/E$, what is the status of the stack (from bottom to top) after the character 'D' has been processed?

(A) $+, *, (, -$

(B) $+, (, -$

(C) $+, *, -$

(D) $+, *, (, -$

Q2. Which of the following SQL queries will return the names of students who have 'a' as the second character and 'e' as the fourth character in their names from a table 'STUDENT'?

(A) SELECT Name FROM STUDENT WHERE Name LIKE '$_a\,e$

(A) SELECT Name FROM STUDENT WHERE Name LIKE '

(B) SELECT Name FROM STUDENT WHERE Name LIKE 'a$_e$

(B) SELECT Name FROM STUDENT WHERE Name LIKE '$_a$

Q3. A linear list contains the following elements: 10, 20, 30, 40, 50. If we perform a Binary Search for the element 45, how many comparisons are required to determine that the element is not present?

(A) 2

(B) 3

(C) 4

(D) 5

Q4. In Python, while reading a binary file using the `pickle` module, which exception is specifically raised when the end of the file is reached unexpectedly during a `load()` operation?

(A) FileNotFoundError

(B) IOError

(C) EOFError

(D) StopIteration

Q5. Consider a Relational Schema $R(A, B, C, D)$. If the functional dependencies are $A \rightarrow B$ and $B \rightarrow C$, which of the following is definitely a candidate key for this relation if D is also an attribute with no dependencies?

(A) A

(B) B

(C) $\{A, D\}$

(D) $\{A, B, C, D\}$

Q6. What will be the output of the following SQL command?

```
SELECT ROUND(157.48, -2), TRUNCATE(157.48, -1);
```

(A) 200, 150

(B) 160, 150

(C) 100, 150

(D) 200, 160

Q7. A circular queue is implemented using an array of size 6. If the current values of `Front` and `Rear` are 2 and 5 respectively (using 0-based indexing), what will be the new values of `Front` and `Rear` after inserting one element and deleting two elements?

(A) Front = 4, Rear = 0

(B) Front = 0, Rear = 4

(C) Front = 3, Rear = 0

(D) Front = 4, Rear = 1

Q8. Which protocol is responsible for resolving a known IP address into its corresponding physical MAC address in a Local Area Network?

(A) DNS

(B) ARP

(C) DHCP

(D) RARP

Q9. A programmer is using the following code snippet:

```
f = open("data.txt", "r+")
f.write("CUET")
```

If the file originally contained ”EXAMINATION”, what will be the content of the file after the write operation?

(A) CUET

(B) CUETINATION

(C) EXAMINATIONCUET

(D) CUETAMINATION

Q10. In the context of network security, what is the term used for a script or program that monitors and logs every keystroke made on a computer to steal passwords?

(A) Ransomware

(B) Keylogger

(C) Worm

(D) Trojan Horse

Q11. How many passes are required to sort an array of n elements using the Selection Sort algorithm in the worst case?

(A) n

(B) $n \log n$

(C) $n - 1$

(D) n^2

Q12. Which SQL function is used to return the position of the first occurrence of a substring within a string?

(A) SUBSTR()

(B) LOCATE()

(C) POSITION()

(D) INSTR()

Q13. In Python's exception handling, which block is executed regardless of whether an exception was raised or not?

(A) try

(B) except

(C) finally

(D) else

Q14. In a relational database, the 'Selection' (σ) operator in Relational Algebra is equivalent to which SQL clause?

(A) SELECT

(B) WHERE

(C) FROM

(D) GROUP BY

Q15. Which network topology uses a central controller or hub to which all other nodes are connected?

(A) Bus

(B) Ring

(C) Star

(D) Mesh

Q16. Which of the following sorting algorithms has the best-case time complexity of $O(n)$ when the input array is already sorted?

(A) Selection Sort

(B) Quick Sort

(C) Insertion Sort

(D) Merge Sort

Q17. What is the correct SQL command to delete all rows from a table named 'LOGS' without removing the table structure itself, and ensuring the operation is logged?

(A) DROP TABLE LOGS;

(B) TRUNCATE TABLE LOGS;

(C) DELETE FROM LOGS;

(D) REMOVE FROM LOGS;

Q18. In a Python program, if you need to ensure that a file object 'f' is automatically closed even if an exception occurs, which statement is most Pythonic to use?

(A) try...except...finally

(B) open(file, 'w').close()

(C) with open(file, 'w') as f:

(D) f.flush()

Q19. Which of the following is an example of a 'many-to-many' relationship in a database design?

(A) Citizen and Passport

(B) Department and Manager

(C) Student and Course

(D) Customer and Order

Q20. What is the result of the following postfix expression evaluation?
$5, 3, +, 2, *, 4, -$

(A) 12

(B) 16

(C) 10

(D) 8

Q21. Which layer of the OSI model is responsible for logical addressing and determining the best path for data packets (Routing)?

(A) Data Link Layer

(B) Transport Layer

(C) Network Layer

(D) Physical Layer

Q22. A text file 'story.txt' contains: "The sky is blue." What will be the output of `print(len(f.readlines()))` if the file has only that single line?

(A) 15

(B) 4

(C) 1

(D) 16

Q23. In SQL, which group function excludes NULL values while performing the calculation?

(A) COUNT(*)

(B) COUNT(column_name)

(C) MAX()

(D) Both (B) and (C)

Q24. What is the time complexity of searching for an element in a balanced Binary Search Tree (BST) in the average case?

(A) $O(n)$

(B) $O(n^2)$

(C) $O(\log n)$

(D) $O(1)$

Q25. Which of the following is a physical address permanently assigned to a Network Interface Card (NIC)?

(A) IP Address

(B) MAC Address

(C) Port Address

(D) URL

Q26. Which sorting technique is based on the 'Divide and Conquer' strategy and uses a pivot element?

(A) Bubble Sort

(B) Quick Sort

(C) Insertion Sort

(D) Selection Sort

Q27. The SQL `HAVING` clause is used in conjunction with which other clause to filter results after aggregation?

(A) WHERE

(B) ORDER BY

(C) GROUP BY

(D) SELECT

Q28. What is the primary difference between a Stack and a Queue?

(A) Stack is LIFO, Queue is FIFO

(B) Stack is FIFO, Queue is LIFO

(C) Stack uses two ends, Queue uses one

(D) No difference

Q29. Which protocol is used to transfer files between a client and a server on a computer network?

(A) HTTP

(B) SMTP

(C) FTP

(D) POP3

Q30. In Python, what is the output of `bool(0), bool(1), bool([])`?

(A) True, True, True

(B) False, True, False

(C) False, True, True

(D) True, False, False

Q31. Which SQL function is used to convert a string to all uppercase letters?

(A) UPPER()

(B) UCASE()

(C) Both (A) and (B)

(D) CAPITALIZE()

Q32. What is the purpose of the 'Primary Key' in a database table?

(A) To allow duplicate values

(B) To uniquely identify each record

(C) To link two tables together

(D) To index the table

Q33. Which of the following is NOT a type of network topology?

(A) Ring

(B) Bus

(C) Circle

(D) Mesh

Q34. In Python, which mode is used to open a file for both reading and writing in binary format?

(A) rw

(B) rb+

(C) r+b

(D) Both (B) and (C)

Q35. Which command is used to add a new column to an existing table in SQL?

(A) UPDATE TABLE

(B) ALTER TABLE

(C) INSERT INTO

(D) CHANGE TABLE

Q36. What is the prefix notation for the infix expression $(A + B) * C$?

(A) $+AB * C$

(B) $* + ABC$

(C) $AB + C*$

(D) $*A + BC$

Q37. Which transmission media uses light pulses to transmit data at very high speeds?

(A) Coaxial Cable

(B) Twisted Pair Cable

(C) Fiber Optic Cable

(D) Ethernet Cable

Q38. In Python, which keyword is used to raise a custom exception manually?

(A) throw

(B) raise

(C) except

(D) try

Q39. Which SQL keyword is used to return only different (unique) values?

(A) UNIQUE

(B) DISTINCT

(C) DIFFERENT

(D) SELECT

Q40. Which sorting algorithm works by building a sorted list one element at a time by comparing the current element with the previous ones?

(A) Bubble Sort

(B) Selection Sort

(C) Insertion Sort

(D) Merge Sort

Q41. Which SQL aggregate function is used to calculate the total number of records in a table, including those with NULL values?

(A) COUNT(column$_name$)

(A) COUNT(*)

(B) SUM(*)

(C) TOTAL()

Q42. In Python, if you use the `seek(5, 0)` method on a file object, where will the file pointer be positioned?

(A) 5 bytes from the current position

(B) 5 bytes from the end of the file

(C) 5 bytes from the beginning of the file

(D) At the 5th line of the file

Q43. Which of the following is a 'DML' (Data Manipulation Language) command in SQL?

(A) ALTER

(B) UPDATE

(C) DROP

(D) CREATE

Q44. In a stack implemented using a list in Python, which method is most commonly used to perform the 'Pop' operation?

(A) remove()

(B) delete()

(C) pop()

(D) discard()

Q45. Which networking device operates at the Data Link Layer and uses MAC addresses to forward data only to the specific intended port?

(A) Hub

(B) Repeater

(C) Switch

(D) Gateway

Q46. What is the correct way to handle multiple exceptions in a single Python `except` block?

(A) except ValueError, TypeError:

(B) except (ValueError, TypeError):

(C) except ValueError | TypeError:

(D) except ValueError and TypeError:

Q47. Which SQL clause is used to sort the result-set in descending order?

(A) SORT BY

(B) ORDER BY ... DESC

(C) ORDER BY ... ASC

(D) GROUP BY ... DESC

Q48. 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) $O(1)$

Q49. Which protocol is used to fetch emails from a remote server to a local client, usually deleting them from the server after download?

(A) SMTP

(B) POP3

(C) IMAP

(D) HTTP

Q50. In Relational Algebra, which operator is used to select specific columns from a relation?

(A) Selection (σ)

(B) Projection (π)

(C) Union ($\cup$)

(D) Join ($\bowtie$)

Detailed Solutions

Q1.

Solution

Concept:

The conversion from Infix to Postfix uses a stack to hold operators and parentheses. The precedence rules are: Parentheses > Power > Multiply/Divide > Add/Subtract. When an operand is encountered, it goes to the output. When an operator is encountered, it is pushed onto the stack after popping operators of higher or equal precedence. An opening parenthesis is always pushed, and a closing parenthesis pops everything until the opening parenthesis.

Solution:

1. Expression: $A + B * (C - D)/E$ 2. Initial Step: 'A' is an operand $\rightarrow$ Output: A, Stack: empty. 3. '+' is an operator $\rightarrow$ Push to Stack. Stack: [+]. 4. 'B' is an operand $\rightarrow$ Output: AB, Stack: [+]. 5. '*' is an operator (higher precedence than '+') $\rightarrow$ Push to Stack. Stack: [+, *]. 6. '(' is pushed to the stack. Stack: [+, *, (]. 7. 'C' is an operand $\rightarrow$ Output: ABC, Stack: [+, *, (]. 8. '-' is an operator $\rightarrow$ Push to Stack (since it follows an opening bracket). Stack: [+, *, (, -]. 9. 'D' is an operand $\rightarrow$ Output: ABCD. 10. At this exact point, after processing 'D', the stack contains the operators that have been deferred due to precedence or parentheses.

Final Answer: The stack contains $+, *, (, -$.

Answer: (A)

Q2.

Solution

Concept: Pattern matching in SQL is performed using the `LIKE` operator with two specific wildcards:

- _ (Underscore): Represents exactly **one** character at a specific position.
- % (Percent): Represents **zero, one, or multiple** characters.

Solution: To find names where 'a' is the 2nd character and 'e' is the 4th character, we must map out the string positions:

- **1st position:** Any character → _
- **2nd position:** Must be 'a' → `a`
- **3rd position:** Any character → _
- **4th position:** Must be 'e' → `e`
- **Rest of the string:** Any characters (zero or more) → %

Combining these, the pattern is `'_a_e%'`.
The resulting query is:

```
SELECT Name FROM STUDENT WHERE Name LIKE '_a_e%'
```

Answer: (C)

Q3.

Solution

Concept:
Binary Search works on a sorted list by repeatedly dividing the search interval in half. The number of comparisons is determined by the number of times the list is split until the element is found or the range becomes empty.
Solution:
1. List: [10, 20, 30, 40, 50]. Size $n = 5$. Target = 45. 2. **Comparison 1**: Mid index = $(0 + 4)//2 = 2$. Element at index 2 is 30. - $45 > 30$, so search in the right half: [40, 50]. 3. **Comparison 2**: Mid index = $(3 + 4)//2 = 3$. Element at index 3 is 40. - $45 > 40$, so search in the right half: [50]. 4. **Comparison 3**: Mid index = $(4 + 4)//2 = 4$. Element at index 4 is 50. - $45 < 50$. The search range now becomes empty (no elements between index 4 and 4). 5. The process terminates after 3 comparisons to conclude 45 is not in the list.
Final Answer: 3 comparisons are required.

Answer: (B)

Q4.

Solution

Concept:

The ‘pickle‘ module in Python is used for serializing and de-serializing Python objects. When reading from a file using ‘pickle.load()‘, the function expects to find a valid pickled object.

Solution:

1. If the file is empty or the pointer reaches the end of the file while the ‘load()‘ function is still expecting data to reconstruct an object, it cannot proceed. 2. In standard file I/O, ‘read()‘ might just return an empty string, but ‘pickle.load()‘ raises a specific built-in exception. 3. This exception is ‘EOFError‘ (End Of File Error). 4. ‘FileNotFoundError‘ occurs during the ‘open()‘ call if the file doesn’t exist. ‘StopIteration‘ is related to iterators, not specifically the pickle module’s file reading.

Final Answer: The exception is EOFError.

Answer: (C)

Q5.

Solution

Concept:

A Candidate Key is a minimal set of attributes that can uniquely identify a tuple in a relation. If an attribute does not appear on the right-hand side of any functional dependency, it **must** be part of any candidate key because it cannot be derived from any other attribute.

Solution:

1. Given dependencies: $A \rightarrow B$ and $B \rightarrow C$. 2. Attributes in the relation: $\{A, B, C, D\}$. 3. Analysis of Right-Hand Sides: B and C are determined by other attributes. 4. Analysis of Left-Hand Sides: A determines B, and B determines C. So A can determine $\{A, B, C\}$ via transitivity. 5. Attribute D: D does not appear in any dependency. It is an isolated attribute. 6. To uniquely identify a row, we need A (to get B and C) and we absolutely need D (because nothing else determines D). 7. Therefore, the minimal set to identify all attributes $\{A, B, C, D\}$ is $\{A, D\}$.

Final Answer: The candidate key is $\{A, D\}$.

Answer: (C)

Q6.

Solution

Concept:

The 'ROUND(n, d)' function rounds a number n to d decimal places. If d is negative, it rounds to the left of the decimal point (tens, hundreds, etc.). The 'TRUNCATE(n, d)' function simply chops off the number at the specified position d without rounding.

Solution:

1. For 'ROUND(157.48, -2)': - The value -2 indicates rounding to the nearest hundred. - The digit at the tens place is 5. Since it is 5 or greater, the hundreds digit (1) is rounded up to 2. - Result: 200. 2. For 'TRUNCATE(157.48, -1)': - The value -1 indicates truncating at the tens place. - Truncation simply sets all digits to the right of the specified position to zero. - The digit 7 (units place) becomes 0. - Result: 150. 3. Combining both results gives (200, 150).

Final Answer: 200, 150.

Answer: (A)

Q7.

Solution

Concept:

In a circular queue of size N, index arithmetic is performed using the modulo operator to wrap around. - Insertion: $Rear = (Rear + 1) \pmod N$ - Deletion: $Front = (Front + 1) \pmod N$

Solution:

1. Initial State: $Front = 2$, $Rear = 5$, Size $N = 6$. 2. Step 1 (Insertion): - New $Rear = (5 + 1) \pmod 6 = 6 \pmod 6 = 0$. - $Front$ remains 2. 3. Step 2 (First Deletion): - New $Front = (2+1) \pmod 6 = 3$. - $Rear$ remains 0. 4. Step 3 (Second Deletion): - New $Front = (3+1) \pmod 6 = 4$. - $Rear$ remains 0. 5. Final state: $Front = 4$, $Rear = 0$.

Final Answer: Front = 4, Rear = 0.

Answer: (A)

Q8.

Solution

Concept:

Address Resolution Protocol (ARP) is used to map a dynamic IP address to a physical machine address (MAC address) that is recognized in the local network. This is essential for data link layer communication.

Solution:

1. When a packet needs to be sent to an IP address on a local network, the sender first checks its ARP cache. 2. If the MAC address is not found, an ARP request is broadcasted to all nodes in the network asking ”Who has this IP address?”. 3. The node with that specific IP address responds with its MAC address. 4. DNS is used for name-to-IP resolution. DHCP is for assigning IP addresses. RARP is the reverse of ARP (MAC to IP).

Final Answer: The protocol is ARP.

Answer: (B)

Q9.

Solution

Concept:

When a file is opened in ‘r+‘ mode in Python, the file pointer is placed at the beginning of the file. Unlike ‘w‘ mode, it does not truncate (delete) the existing content. However, as you write, it overwrites the characters at the current pointer position one by one.

Solution:

1. Original File Content: ”EXAMINATION” (Length: 11) 2. File mode ‘r+‘ places pointer at index 0. 3. Writing ”CUET”: - ’C’ replaces ’E’ (index 0) - ’U’ replaces ’X’ (index 1) - ’E’ replaces ’A’ (index 2) - ’T’ replaces ’M’ (index 3) 4. The characters from index 4 onwards (”INATION”) remain untouched. 5. Resulting content: ”CUET” + ”INATION” = ”CUETINATION”.

Final Answer: CUETINATION.

Answer: (B)

Q10.

Solution

Concept:

Cyber threats come in various forms. Spyware is a type of malware designed to gather information about a person or organization without their knowledge. A specific type of spyware focuses on input monitoring.

Solution:

1. A **Keylogger** (short for keystroke logger) is software or hardware that records every key pressed by the user. 2. This is primarily used to capture sensitive data like login credentials, credit card numbers, and private messages. 3. Ransomware encrypts files and demands payment. A Worm is a self-replicating program. A Trojan Horse is a malicious program disguised as legitimate software.

Final Answer: The term is Keylogger.

Answer: (B)

Q11.

Solution

Concept:

Selection Sort is a comparison-based sorting algorithm. It works by repeatedly finding the minimum element from the unsorted part of the array and putting it at the beginning. This process is divided into several passes.

Solution:

1. In Selection Sort, to sort an array of size n, the algorithm searches for the smallest element in the range $[0, n-1]$ and swaps it with the element at index 0. 2. In the next pass, it searches for the smallest element in the range $[1, n-1]$ and swaps it with the element at index 1. 3. This continue until it reaches the $(n-1)^{th}$ element. By the time $n-1$ elements are placed in their correct positions, the last element (n^{th}) is automatically in its correct place. 4. Therefore, the total number of passes required to ensure the entire array is sorted is exactly $n-1$. 5. Note that while the number of comparisons is $O(n^2)$, the number of passes is linear relative to the number of elements.

Final Answer: $n-1$ passes are required.

Answer: (C)

Q12.

Solution

Concept:

SQL provides various string functions to manipulate and search within text data. Finding the starting position of a specific pattern or substring is a common requirement in data retrieval.

Solution:

1. 'SUBSTR()' is used to extract a portion of a string, not to find a position. 2. 'LOCATE()' and 'POSITION()' are valid in some SQL dialects (like MySQL and PostgreSQL) to find a substring. 3. However, 'INSTR(string, substring)' is the standard function used to return the position of the first occurrence of a substring within a string. 4. If the substring is not found, 'INSTR()' returns 0. If it is found, it returns the 1-based index of the first character of the match.

Final Answer: The function is INSTR().

Answer: (D)

Q13.

Solution

Concept:

Python's 'try...except...finally' block is used for exception handling. Each block has a specific role in managing errors and ensuring program stability.

Solution:

1. The 'try' block contains the code that might raise an exception. 2. The 'except' block code runs only if an exception occurs in the 'try' block. 3. The 'else' block runs only if no exception occurred in the 'try' block. 4. The 'finally' block is the "cleanup" block. It executes no matter what happens—whether an exception was raised and caught, raised and not caught, or if no exception occurred at all. 5. This is typically used for closing files or releasing network resources.

Final Answer: The block is finally.

Answer: (C)

Q14.

Solution

Concept:

Relational Algebra is a theoretical language for managing relational databases. Its operators have direct counterparts in SQL (Structured Query Language).

Solution:

1. The 'Selection' operator (σ) is used to filter rows (tuples) based on a specific condition. 2. In an SQL query, the 'SELECT' clause is actually equivalent to the 'Projection' (π) operator because it chooses columns. 3. The 'FROM' clause identifies the relation (table). 4. The 'WHERE' clause is the component that applies a condition to filter rows, which matches the definition of the 'Selection' operator in Relational Algebra.

Final Answer: The WHERE clause.

Answer: (B)

Q15.

Solution

Concept:

Network topology defines the physical or logical layout of a network. Different topologies offer different levels of redundancy, cost, and ease of installation.

Solution:

1. In a **Bus** topology, all nodes are connected to a single backbone cable. 2. In a **Ring** topology, each node connects to exactly two other nodes, forming a continuous path. 3. In a **Star** topology, all computers and devices are connected to a central hub or switch. All data transfers pass through this central controller. 4. In a **Mesh** topology, every node is connected to every other node. 5. The description of a central controller/hub specifically identifies the Star topology.

Final Answer: Star topology.

Answer: (C)

Q16.

Solution

Concept:

Best-case time complexity refers to the minimum number of steps an algorithm takes when the input is already in the desired order. For sorting, this usually means the array is already sorted.

Solution:

1. **Selection Sort**: Always $O(n^2)$ because it always scans the entire unsorted part to find the minimum, regardless of initial order. 2. **Merge Sort**: Always $O(n \log n)$ because it always divides the array and merges it back. 3. **Quick Sort**: Best case is $O(n \log n)$ with a good pivot. 4. **Insertion Sort**: In the best case (already sorted), it compares each element with its predecessor once and moves to the next. This results in $n - 1$ comparisons and zero swaps. 5. Therefore, the complexity is linear, $O(n)$.

Final Answer: Insertion Sort.

Answer: (C)

Q17.

Solution

Concept:

There are different ways to remove data in SQL. 'DROP' removes the table entirely. 'TRUNCATE' and 'DELETE' remove rows. However, they differ in how they handle logs and transaction overhead.

Solution:

1. 'DROP TABLE' deletes the data and the definition. This is incorrect here. 2. 'TRUNCATE' is a DDL command. It is faster but it does not log individual row deletions; it deallocates pages. 3. 'DELETE FROM' is a DML command. It removes rows one by one and records each deletion in the transaction log. 4. Since the requirement specifies the operation must be "logged" (implying a standard DML log for recovery/auditing) and the structure must remain, 'DELETE' is the correct choice.

Final Answer: DELETE FROM LOGS;

Answer: (C)

Q18.

Solution

Concept: In Python, managing external resources like files requires ensuring they are closed to prevent memory leaks or file corruption.

- **Context Managers:** The `with` statement simplifies resource management by using the Context Management protocol.
- **Automatic Cleanup:** It guarantees that the `__exit__()` method is called (which closes the file) as soon as the execution leaves the `with` block, even if an exception is raised.

Solution: While a `try...finally` block (Option A) can achieve the same result, it is more verbose and less readable. The `with` statement (Option C) is the "Pythonic" way to handle file I/O because it is concise and inherently safe.

- (A) `try...finally`: Functional, but not the most Pythonic.
- (B) `open(...).close()`: Incorrect; doesn't allow for operations on the file before closing.
- (C) `with open(...) as f`: Correct; automatically handles closing.
- (D) `f.flush()`: Only clears the internal buffer; it does not close the file.

Answer: (C)

Q19.

Solution

Concept:
Relationship cardinality defines how many instances of one entity can be associated with instances of another. - One-to-One (1:1) - One-to-Many (1:N) - Many-to-Many (M:N)
Solution:
1. **Citizen and Passport**: One citizen has one passport (usually). (1:1). 2. **Department and Manager**: One department has one manager. (1:1). 3. **Customer and Order**: One customer can place many orders, but an order belongs to one customer. (1:N). 4. **Student and Course**: One student can enroll in many courses, and one course can have many students. This is a classic Many-to-Many relationship.
Final Answer: Student and Course.

Answer: (C)

Q20.

Solution

Concept:

Postfix expressions (Reverse Polish Notation) are evaluated using a stack. - If an operand is encountered, push it to the stack. - If an operator is encountered, pop the top two operands, apply the operator, and push the result back.

Solution:

1. Expression: $5, 3, +, 2, *, 4, -$ 2. Push 5: Stack [5] 3. Push 3: Stack $[5, 3]$ 4. Encounter '+': Pop 3, 5. Calc $5 + 3 = 8$. Push 8. Stack [8] 5. Push 2: Stack $[8, 2]$ 6. Encounter '*': Pop 2, 8. Calc $8 * 2 = 16$. Push 16. Stack [16] 7. Push 4: Stack $[16, 4]$ 8. Encounter '-': Pop 4, 16. Calc $16 - 4 = 12$. Push 12. Stack [12] 9. Result is 12.

Final Answer: 12.

Answer: (A)

Q21.

Solution

Concept:

The Open Systems Interconnection (OSI) model consists of seven layers. The Network Layer (Layer 3) is primarily concerned with getting packets from the source host to the destination host, potentially through multiple intermediate networks.

Solution:

1. The Physical Layer deals with bitstreams and hardware. 2. The Data Link Layer manages node-to-node data transfer (MAC addresses) and error correction on the physical link. 3. The **Network Layer** handles logical addressing (IP addresses). It is the layer where routers operate to determine the optimal path for data to travel across interconnected networks. 4. The Transport Layer ensures end-to-end communication and error recovery (TCP/UDP).

Final Answer: Network Layer.

Answer: (C)

Q22.

Solution

Concept:

In Python, the ‘readlines()‘ method reads all the lines in a file and returns them as a list of strings, where each string represents a single line including the newline character “.

Solution:

1. The file ’story.txt’ contains one single line of text: ”The sky is blue.” 2. When ‘f.readlines()‘ is called, it returns a list: ‘[”The sky is blue.”]‘. 3. The ‘len()‘ function, when applied to a list, returns the number of elements (items) in that list. 4. Since there is only one line in the file, the list contains only one element. 5. Therefore, ‘len(f.readlines())‘ evaluates to 1. Note: ‘len(f.read())‘ would have returned the character count (15), but ‘readlines()‘ counts the number of lines.

Final Answer: 1.

Answer: (C)

Q23.

Solution

Concept: In SQL, aggregate (group) functions handle `NULL` values differently depending on the syntax used:

- `COUNT(*)`: Counts every row in the result set, including rows that contain `NULL` values.
- `COUNT(column`$_{n}ame$`)` : $Countsonlytherowswherethespecifiedcolumnis NOT$ `NULL`.
- `MAX(), MIN(), SUM(), AVG(): These functions ignore NULL values by default and perform the calculation only on non-null data.`

Solution: Analyzing the given options:

- (A) `COUNT(*)` includes all records, so it does not exclude `NULL`s.
- (B) `COUNT(column`$_{n}ame$`)`$explicitlyexcludes$`NULL`$values in that column.$
- `(C) MAX() ignores NULL values to find the maximum value among existing data.`

Since both (B) and (C) exclude `NULL` values during calculation, the correct option is (D).

Answer: (D)

Q24.

Solution

Concept:

A balanced Binary Search Tree (BST) is a tree where the height of the left and right subtrees of every node differs by no more than one. Examples include AVL trees or Red-Black trees.

Solution:

1. In a standard BST, the search time depends on the height of the tree. 2. In the worst case (a skewed tree), the height is n, leading to $O(n)$. 3. However, in a **balanced** BST, the height is maintained at approximately $\log_2(n)$. 4. Since each comparison allows the search to discard half of the remaining nodes (similar to Binary Search on an array), the time complexity is logarithmic. 5. Therefore, the average (and worst-case for balanced trees) time complexity is $O(\log n)$.

Final Answer: $O(\log n)$.

Answer: (C)

Q25.

Solution

Concept:

Each device on a network has different types of addresses. Logical addresses can change based on the network, while physical addresses are burned into the hardware.

Solution:

1. An **IP Address** is a logical address assigned by software or a network administrator; it changes if the device moves to a different network. 2. A **MAC Address** (Media Access Control) is a 48-bit unique identifier assigned by the manufacturer to the Network Interface Card (NIC). 3. It is often referred to as the ”burned-in address” or physical address because it is permanent and globally unique to that specific piece of hardware. 4. Port addresses identify specific processes on a host, and URLs identify resources on the web.

Final Answer: MAC Address.

Answer: (B)

Q26.

Solution

Concept:

The 'Divide and Conquer' strategy involves breaking a problem into smaller sub-problems, solving them independently, and combining their results. In sorting, this usually involves partitioning the array.

Solution:

1. **Bubble Sort**, **Insertion Sort**, and **Selection Sort** are simple $O(n^2)$ algorithms that process elements linearly. 2. **Quick Sort** selects a 'pivot' element from the array and partitions the other elements into two sub-arrays, according to whether they are less than or greater than the pivot. 3. The sub-arrays are then sorted recursively. 4. This "partitioning" based on a pivot is the defining characteristic of Quick Sort. Merge Sort also uses Divide and Conquer but does not use a pivot; it divides the array exactly in half.

Final Answer: Quick Sort.

Answer: (B)

Q27.

Solution

Concept:

Filtering in SQL can happen at two stages: before grouping (using 'WHERE') and after grouping (using 'HAVING').

Solution:

1. The 'WHERE' clause is used to filter rows from the base table before any groupings are formed. 2. The 'GROUP BY' clause is used to collect data into groups based on one or more columns. 3. Once the groups are formed and aggregate functions (like 'SUM' or 'COUNT') are applied, the 'HAVING' clause is used to filter those resulting groups. 4. Therefore, 'HAVING' is logically and syntactically tied to the 'GROUP BY' clause.

Final Answer: GROUP BY.

Answer: (C)

Q28.

Solution

Concept:

Stacks and Queues are linear data structures that differ in the order in which elements are accessed and removed.

Solution:

1. A **Stack** follows the **LIFO** (Last-In, First-Out) principle. The last element added is the first one to be removed (like a stack of plates). 2. A **Queue** follows the **FIFO** (First-In, First-Out) principle. The first element added is the first one to be removed (like a line at a ticket counter). 3. Stacks usually use a single end (Top) for both insertion and deletion, while Queues use two ends (Rear for insertion, Front for deletion). 4. The fundamental primary difference is the LIFO vs FIFO ordering logic.

Final Answer: Stack is LIFO, Queue is FIFO.

Answer: (A)

Q29.

Solution

Concept:

Application layer protocols are designed for specific tasks like web browsing, email, or file transfer.

Solution:

1. **HTTP** (Hypertext Transfer Protocol) is for transferring web pages and related data. 2. **SMTP** (Simple Mail Transfer Protocol) is for sending emails. 3. **FTP** (File Transfer Protocol) is a standard network protocol used specifically for the transfer of computer files between a client and server on a computer network. 4. **POP3** (Post Office Protocol) is used by email clients to retrieve messages from a mail server.

Final Answer: FTP.

Answer: (C)

Q30.

Solution

Concept:

In Python, the ‘bool()‘ function returns the truth value of an object. Most objects are ‘True‘ unless they are ”empty” or represent ”zero.”

Solution:

1. ‘bool(0)‘: The integer zero is considered ”Falsy” in Python. Result: ‘False‘. 2. ‘bool(1)‘: Any non-zero numeric value is considered ”Truthy.” Result: ‘True‘. 3. ‘bool([])‘: An empty list is considered ”Falsy.” Result: ‘False‘. 4. Therefore, the sequence is ‘False, True, False‘.

Final Answer: False, True, False.

Answer: (B)

Q31.

Solution

Concept:

In SQL, string manipulation functions are used to modify the appearance of text data. Case conversion is a common requirement for standardizing output or performing case-insensitive comparisons.

Solution:

1. 'UPPER(string)' is a standard SQL function that converts all characters in the provided string to uppercase. 2. 'UCASE(string)' is a synonym for 'UPPER()' used in many database systems like MySQL to perform the exact same operation. 3. Both functions will take an input like 'cuet' and return 'CUET'. 4. 'CAPITALIZE()' is not a standard SQL function for this purpose (it is often used in Python or other programming languages to uppercase only the first letter). 5. Since both (A) and (B) are valid, option (C) is the correct choice.

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

Answer: (C)

Q32.

Solution

Concept:

Constraints are rules applied to table columns to ensure data integrity. The Primary Key is the most fundamental constraint in a relational database management system (RDBMS).

Solution:

1. A **Primary Key** must contain unique values; no two rows can have the same primary key value. 2. It cannot contain 'NULL' values, ensuring that every record can be reached. 3. Its primary purpose is to act as a unique identifier for each record (row) in a table, allowing for efficient data retrieval and establishing relationships with other tables (as Foreign Keys). 4. While it does create an index, its logical purpose is identification, not just indexing.

Final Answer: To uniquely identify each record.

Answer: (B)

Q33.

Solution

Concept:

Network topologies describe the layout of connections between nodes. Standard topologies have specific names and geometric configurations recognized in networking theory.

Solution:

1. **Ring**: Nodes are connected in a closed loop. 2. **Bus**: Nodes are connected to a single central cable. 3. **Mesh**: Every node is connected to every other node. 4. **Star**: Nodes are connected to a central hub. 5. "Circle" is not a technical term for a network topology; though a Ring looks like a circle, the formal networking term is 'Ring'.

Final Answer: Circle is NOT a type of network topology.

Answer: (C)

Q34.

Solution

Concept:

Python file modes define how a file is accessed. The letter 'b' indicates binary mode, and the '+' sign indicates that the file is open for both reading and writing (updating).

Solution:

1. 'rb' is for reading binary only. 'wb' is for writing binary only. 2. 'rb+' opens a binary file for both reading and writing. 3. 'r+b' is also a valid syntax in Python to represent the same "read/write binary" mode. 4. Both notations are functionally identical and accepted by the 'open()' function.

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

Answer: (D)

Q35.

Solution

Concept:

Data Definition Language (DDL) commands are used to change the structure of a database, such as creating, deleting, or modifying tables.

Solution:

1. 'UPDATE' is a DML command used to change data *inside* existing rows. 2. 'INSERT' is a DML command used to add new rows. 3. 'ALTER TABLE' is the DDL command used to modify the table's structure, including adding, deleting, or modifying columns. 4. To add a column, the syntax is typically: 'ALTER TABLE table$_n ameADDcolumn_n amedatatype$; '.

Final Answer: ALTER TABLE.

Answer: (B)

Q36.

Solution

Concept:

Prefix notation (also known as Polish Notation) places the operator before its operands. To convert from infix to prefix, one common method is to determine the order of operations and move the operator to the left of the operands it affects.

Solution:

1. Expression: $(A + B) * C$. 2. First, evaluate the expression inside the parentheses: $(A + B)$. 3. The prefix form of $(A + B)$ is $+AB$. 4. Now the expression is effectively $[+AB] * C$. 5. The operator '*' is applied to the operands $[+AB]$ and C. 6. Move '*' to the front of the two operands: $*[+AB]C$. 7. Removing brackets gives: $* + ABC$.

Final Answer: $* + ABC$.

Answer: (B)

Q37.

Solution

Concept:

Guided transmission media use physical cables to direct signals. Different cables use different physical properties (electricity vs. light) to carry data.

Solution:

1. **Coaxial Cable** and **Twisted Pair Cable** (like Ethernet/UTP) use copper wires to transmit data as electrical signals. 2. **Fiber Optic Cable** consists of thin strands of glass or plastic. 3. It transmits data using Total Internal Reflection of light pulses. 4. Because light travels faster and is not susceptible to electromagnetic interference (EMI), Fiber Optic provides much higher speeds and bandwidth compared to copper-based media.

Final Answer: Fiber Optic Cable.

Answer: (C)

Q38.

Solution

Concept:

Python allows developers to handle built-in errors and also trigger their own errors when specific logical conditions are met in a program.

Solution:

1. The 'try' keyword starts a block to monitor for errors. 2. The 'except' keyword catches an error that has occurred. 3. The 'throw' keyword is used in languages like C++ or Java, but not in Python. 4. In Python, the 'raise' keyword is used to force a specific exception to occur. For example: 'raise ValueError("Invalid Input")'.

Final Answer: raise.

Answer: (B)

Q39.

Solution

Concept:

SQL queries often return duplicate rows if a column contains the same value for multiple records. To clean up the output and see only the unique entries, a specific keyword is used.

Solution:

1. The ‘SELECT‘ statement by default returns all rows that match the criteria. 2. The ‘UNIQUE‘ keyword is a constraint used during table creation (DDL) to ensure a column doesn’t have duplicates. 3. The ‘DISTINCT‘ keyword is used within a ‘SELECT‘ statement to suppress duplicate values in the result set. 4. For example, ‘SELECT DISTINCT City FROM Students;‘ will list each city name only once, even if 100 students live there.

Final Answer: DISTINCT.

Answer: (B)

Q40.

Solution

Concept:

Insertion Sort is a simple sorting algorithm that works similarly to the way you sort playing cards in your hands. It conceptually splits the array into a ”sorted” and an ”unsorted” part.

Solution:

1. The algorithm starts with the first element (already considered sorted). 2. It takes the next element from the unsorted part and compares it with the elements in the sorted part (from right to left). 3. It ”inserts” the element into its correct position by shifting the larger elements to the right. 4. This process repeats until the entire array is processed. Unlike Selection Sort (which finds the minimum), Insertion Sort focuses on placing the current element in its relative correct spot.

Final Answer: Insertion Sort.

Answer: (C)

Q41.

Solution

Concept: In SQL, aggregate functions perform calculations on a set of values.

- `COUNT(column_name)` : $Counts only then on-NULL values in the specified column.$
- `COUNT(*): Counts every row in the table, including rows that contain NULL values or duplicate data.`
- `SUM(): Calculates the total sum of a numeric column.`

Solution: To retrieve the total number of records in a table without excluding any rows based on their content (including those with NULLs), the asterisk wildcard is used within the count function.

$$\text{Total Records} = \text{COUNT}(*)$$

The other options provided are either incorrect syntax (`TOTAL()`) or perform different mathematical operations (`SUM()`).

Answer: (A)

Q42.

Solution

Concept:

The 'seek()' method in Python is used to change the position of the file handle (pointer). It takes two arguments: 'offset' and 'whence'.

Solution:

1. The first argument '5' is the offset (number of bytes to move). 2. The second argument '0' defines the reference point. 3. Reference points are: - '0': Beginning of the file (absolute positioning). - '1': Current position. - '2': End of the file. 4. Since 'whence' is 0, the pointer moves 5 bytes relative to the very start of the file. 5. This is used to skip headers or move to a specific known byte location.

Final Answer: 5 bytes from the beginning of the file.

Answer: (C)

Q43.

Solution

Concept:

SQL commands are categorized into sub-languages. DDL (Data Definition Language) defines structure, while DML (Data Manipulation Language) manages the data within that structure.

Solution:

1. 'CREATE', 'ALTER', and 'DROP' are all DDL commands because they create, modify, or delete the actual table or database objects. 2. 'UPDATE' is used to modify existing records (data) within a table. 3. Because 'UPDATE' deals with the manipulation of the data values themselves rather than the table structure, it is a DML command. 4. Other DML commands include 'INSERT', 'DELETE', and 'SELECT' (though some categorize SELECT as DQL).

Final Answer: UPDATE.

Answer: (B)

Q44.

Solution

Concept:

A stack is a Last-In-First-Out (LIFO) structure. In Python, lists are versatile and can be used as stacks using specific built-in methods that operate on the end of the list.

Solution:

1. To 'Push' an item onto a stack, we use 'list.append()', which adds an item to the end. 2. To 'Pop' an item (remove the most recently added item), we need to remove the last element of the list. 3. The 'list.pop()' method removes the item at the given index and returns it. If no index is specified, it removes and returns the last item in the list. 4. This behavior perfectly matches the requirements of a stack's Pop operation. 'remove()' searches for a specific value, which is not how a stack operates.

Final Answer: pop()

Answer: (C)

Q45.

Solution

Concept:

Networking hardware operates at different layers of the OSI model. Intelligent devices can inspect frames to make better forwarding decisions than simple broadcast devices.

Solution:

1. A **Hub** is a Layer 1 (Physical) device. It broadcasts data to all ports, leading to collisions and security issues. 2. A **Repeater** is also Layer 1; it simply regenerates the signal. 3. A **Switch** is a Layer 2 (Data Link) device. It maintains a MAC address table. When a frame arrives, the switch checks the destination MAC and sends the frame only to the port where that MAC is located. 4. A **Gateway** usually operates at the higher layers to connect different network protocols.

Final Answer: Switch.

Answer: (C)

Q46.

Solution

Concept:

When handling exceptions in Python, you may want to execute the same error-handling logic for multiple different types of errors. Python allows you to catch multiple exceptions by grouping them.

Solution:

1. To catch multiple exceptions in a single ‘except‘ block, the exception types must be passed as a parenthesized tuple. 2. The syntax ‘except (ValueError, TypeError):‘ tells Python to execute the block if either a ‘ValueError‘ OR a ‘TypeError‘ occurs. 3. Using a comma without parentheses (Option A) was valid in Python 2 but is a syntax error or behaves differently in Python 3. 4. Using logical operators like ‘and‘ or ‘|‘ (Options C and D) is syntactically incorrect for the ‘except‘ statement in this context.

Final Answer: except (ValueError, TypeError):

Answer: (B)

Q47.

Solution

Concept:

The 'ORDER BY' clause is used to sort the result-set of a query. By default, it sorts in ascending order, but this can be modified with specific keywords.

Solution:

1. 'ORDER BY' is the standard clause for sorting. 2. To specify the direction of the sort, we use 'ASC' for ascending (lowest to highest) and 'DESC' for descending (highest to lowest). 3. 'SORT BY' is not standard SQL syntax for most RDBMS (though used in Hive/Hadoop). 4. Since the requirement is for descending order, the keyword 'DESC' must be appended after the column name in the 'ORDER BY' clause.

Final Answer: ORDER BY ... DESC

Answer: (B)

Q48.

Solution

Concept:

Bubble Sort is a simple 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 Bubble Sort, for a list of n elements, there are $n-1$ passes. 2. In each pass, the algorithm performs comparisons and potentially swaps. 3. In the average case, the number of comparisons is approximately:

$$\frac{n(n-1)}{2}$$

4. In Big O notation, we ignore lower-order terms and constants. Therefore, $n(n-1)/2$ simplifies to $O(n^2)$. 5. While some versions of Bubble Sort can achieve $O(n)$ in the best case with a flag, the average and worst-case scenarios remain quadratic.

Final Answer: $O(n^2)$.

Answer: (C)

Q49.

Solution

Concept:

Email retrieval protocols define how an email client interacts with a mail server to access messages. The two primary protocols are POP3 and IMAP.

Solution:

1. **SMTP** is used for sending emails, not receiving them. 2. **POP3** (Post Office Protocol version 3) was designed with the assumption that a user checks mail from one device. It downloads the emails and, by default, deletes them from the server. 3. **IMAP** (Internet Message Access Protocol) leaves the emails on the server and synchronizes changes across multiple devices. 4. Because the question specifies "usually deleting them from the server after download," it refers to the traditional behavior of POP3.

Final Answer: POP3.

Answer: (B)

Q50.

Solution

Concept:

Relational Algebra uses specific operators to manipulate relations. These operators form the theoretical basis for SQL commands.

Solution:

1. The **Selection** (σ) operator filters rows based on a condition (equivalent to SQL 'WHERE'). 2. The **Projection** (π) operator is used to select specific columns (attributes) from a relation, discarding the others (equivalent to SQL 'SELECT column$_{n}ame$').3.$The * *Union * *(\cup)$ operator combines rows from two compatible relations. 4. The **Join** ($\bowtie$) operator combines related tuples from different relations based on common attributes. 5. Therefore, selecting specific columns is the function of the Projection operator.

Final Answer: Projection (π).

Answer: (B)

Answer Key

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