Virtusa Placement Training

SET - 4

CONNECT
Training Solutions

1.Analytical Ability & Problem Solving

1. Find the missing term in the series:
2, 12, 36, 80, 150, ?

A) 252
B) 270
C) 216
D) 240

2. If GO = 32 and SHE = 49, then SOME will be equal to?

A) 56
B) 58
C) 62
D) 64

3. A man is standing facing South. He turns 135° in the anti-clockwise direction and walks 10m. Then he turns 90° in the clockwise direction and walks 10m. Finally, he turns 45° in the anti-clockwise direction and walks 5m. In which direction is he now from his starting point?

A) North
B) North-West
C) East
D) North-East

4. In a tournament, six teams (T1 to T6) participate. Each team plays every other team exactly once.

- T1 lost to T3 and T5.
- T6 won against T2 and T4.
- T3 won against every team except T4 and T6.
- T2 won against only one team.
- No match ended in a draw.
  Which team won the tournament (i.e., had the most wins)?

A) T3
B) T4
C) T5
D) T6

5.
Conclusions:
I. Some phones are definitely not remotes.
II. All chargers being phones is a possibility.
Which set of statements could lead to these conclusions?

A) All chargers are phones. Some phones are remotes.
B) No charger is a phone. All phones are remotes.
C) Some chargers are phones. No phone is a remote.
D) All remotes are chargers. Some phones are not chargers.

6. Find the odd one out:
(8, 25), (27, 64), (125, 216), (343, 512)

A) (8, 25)
B) (27, 64)
C) (125, 216)
D) (343, 512)

7. Pointing to a man in a photograph, a woman said, "His brother's father is the only son of my grandfather." How is the woman related to the man in the photograph?

A) Mother
B) Aunt
C) Sister
D) Daughter

8. A, B, and C have a total of 120 marbles. What is the number of marbles with B?
I. B has 30 more marbles than C, and C has 30 fewer marbles than A.
II. The number of marbles with B is the average of the number of marbles with A and C.

A) Statement I alone is sufficient.
B) Statement II alone is sufficient.
C) Both statements are needed together.
D) Either statement alone is sufficient.

9. Eight scientists are sitting around a circular table. Four are from Project A and four from Project B. No two from the same project are immediate neighbors. P (Project B) is second to the left of Q. R (Project A) is third to the right of P. S and T are immediate neighbors, and neither is from the same project as R. V is not a neighbor of R. Who is sitting opposite to P?

A) S
B) T
C) R
D) V

10. If all Bloops are Rax, and all Rax are Quags, which of the following must be true?
I. All Bloops are Quags.
II. Some Quags are Bloops.
III. No Quag is a Bloop.

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

2.Numerical Ability

1. A can do a work in 16 days and B in 24 days. They start working on alternate days, with A beginning the work. In how many days will the work be finished?

A) 19 days
B) 19.5 days
C) 19.33 days
D) 20 days

2. The marked price of an article is 50% above the cost price. A discount of x% is given on the marked price, and the dealer still makes a profit of 20%. Find the value of x.

A) 20%
B) 25%
C) 16.67%
D) 30%

3. In how many ways can 7 Indians and 5 Americans be seated around a round table so that no two Americans sit together?

A) $6! * {}^{7}P_{5}$
B) $7! * {}^{6}P_{5}$
C) $6! * 5!$
D) $7! * 5!$

4. From a cask of wine, containing 64 litres, 8 litres are drawn out and the cask is filled with water. If the same process is repeated a second, then a third time, what will be the proportion of wine to water in the resulting mixture?

A) 343 : 169
B) 343 : 512
C) 169 : 343
D) 512 : 343

5. Box A contains 4 red and 5 black balls. Box B contains 3 red and 7 black balls. A ball is transferred from Box A to Box B, and then a ball is drawn from Box B. What is the probability that the drawn ball is red?

A) 27/90
B) 32/99
C) 31/99
D) 29/90

6. Two pipes A and B can fill a tank in 15 hrs and 20 hrs. A third pipe C can empty it in 25 hrs. All three are opened. After 10 hours, C is closed. In how much time will the tank be full?

A) 12 hrs
B) 13 hrs
C) 16 hrs
D) 14.16 hrs

7. A solid metallic cone of height 10 cm and radius of base 20 cm is melted to make spherical balls of radius 1 cm. Find the number of balls.

A) 1000
B) 1200
C) 900
D) 1500

8. In a game of 100 points, A can give B 20 points and C 28 points. How many points can B give C in a game of 100 points?

A) 8
B) 10
C) 12
D) 15

9. The difference between the CI and SI on an amount of ₹15,000 for 2 years is ₹96. The rate of interest per annum is:

A) 6%
B) 7%
C) 8%
D) 9%

10. A number when divided by a divisor leaves a remainder of 24. When twice the original number is divided by the same divisor, the remainder is 11. What is the value of the divisor?

A) 13
B) 35
C) 37
D) 45

3.Grammar & Vocabulary

1. Spot the Error:
Hardly had he left the stadium (A)/ than the storm broke out, (B)/ drenching everyone completely. (C)/ No Error (D)

A) A
B) B
C) C
D) D

2. Sentence Improvement:

The accountant, along with the cashier, <u>are responsible for</u> the discrepancy.

A) is responsible for
B) are responsible to
C) is responsible to
D) No improvement

3. Fill in the blank:
The politician's speech was filled with _____, using grand and impressive words but saying very little of substance.

A) platitudes
B) brevity
C) bombast
D) clarity

4. Synonym: Choose the word most similar in meaning to **Pernicious**.

A) Beneficial
B) Harmless
C) Malicious
D) Temporary

5. Antonym: Choose the word most opposite in meaning to **Quiescent**.

A) Dormant
B) Inactive
C) Latent
D) Frenetic

6. Idiom/Phrase Meaning: What is the meaning of "To be at daggers drawn"?

A) To be very close friends.
B) To be in a state of extreme enmity or hostility.
C) To be ready for a celebration.
D) To be confused and lost.

7. Appropriate Word:
The CEO's _____ decision to sell the company was met with shock and disbelief from the employees.

A) prudent
B) calculated
C) precipitous
D) deliberate

8. Spot the Error:
The data received from the survey (A)/ indicate that the market trends (B)/ are shifting rapidly. (C)/ No Error (D)

A) A
B) B
C) C
D) D

9. Sentence Improvement:

<u>Not only the students but also the teacher were responsible</u> for the chaos.

A) but also the teacher was
B) but the teacher also was
C) but also the teacher is
D) No improvement

10. One Word Substitution:

A style in which a writer makes a display of his knowledge.

A) Ornate
B) Pedantic
C) Verbose
D) Artificial

3.Technical MCQs

1. What is the primary difference between Stream.map() and Stream.flatMap()?

A) map() is an intermediate operation, flatMap() is a terminal operation.
B) map() transforms each element into another object, flatMap() transforms each element into a stream of other objects and then flattens these streams into a single stream.
C) map() can only be used on maps, flatMap() on lists.
D) flatMap() is a deprecated version of map().

2. A Fenwick Tree (or Binary Indexed Tree) is a data structure primarily used for which operation?

A) Sorting an array in O(n log n) time.
B) Storing a prefix tree for string matching.
C) Efficiently calculating prefix sums of an array while allowing point updates.
D) Implementing a priority queue.

3. What is a "materialized view" in a database?

A) A temporary table used for sorting.
B) A view whose results are physically stored in a table and periodically updated from the source tables.
C) A view that cannot be indexed.
D) An alias for a standard view.

4.Which scheduling algorithm can lead to "convoy effect," where a short process gets stuck behind a long process?

A) Round Robin
B) Shortest Job First (SJF)
C) First-Come, First-Served (FCFS)
D) Priority Scheduling

5. Which of the following is NOT a type of SQL injection attack?

A) Error-based SQLi
B) Union-based SQLi
C) Blind SQLi
D) Buffer Overflow SQLi

6. What is the output of this code?

```
public class Main {
    public static void main(String[] args) {
        try {
            System.out.print("A");
            int value = 10 / 0;
            System.out.print("B");
        } catch (Exception e) {
            System.out.print("C");
        } finally {
            System.out.print("D");
        }
        System.out.print("E");
    }
}
```

A) ABDE
B) ACE
C) ACDE
D) ADE

7. The ability of an object to be treated as an instance of its parent class is known as:

A) Encapsulation
B) Polymorphism
C) Inheritance
D) Abstraction

8. You are given a directed acyclic graph (DAG). Which algorithm would you use to find a linear ordering of its vertices such that for every directed edge from vertex u to vertex v, u comes before v in the ordering?

A) Dijkstra's Algorithm
B) Breadth-First Search (BFS)
C) Topological Sort
D) Prim's Algorithm

9. What does the ON DELETE CASCADE constraint do in a foreign key relationship?

A) It prevents the deletion of a parent row if child rows exist.
B) It automatically deletes all corresponding child rows when a parent row is deleted.
C) It sets the foreign key in child rows to NULL when a parent row is deleted.
D) It sends a cascade of warning messages before deletion.

10. What is the role of a ClassLoader in the JVM?

A) To compile .java files into .class files.
B) To dynamically load Java classes into the JVM at runtime.
C) To manage the lifecycle of threads.
D) To enforce security policies on classes.

11. What is the difference between UNION and UNION ALL?

A) UNION combines rows from two queries and removes duplicates; UNION ALL includes all rows, including duplicates.
B) UNION ALL is faster but requires the tables to have the same number of columns.
C) UNION is a DML command, UNION ALL is a DDL command.
D) There is no difference in their output.

12. The "Banker's Algorithm" is used for:

A) CPU scheduling
B) Memory management
C) Deadlock avoidance
D) File system caching

13. In C++, what is the purpose of the explicit keyword when used with a single-argument constructor?

A) To make the constructor public.
B) To prevent the compiler from performing implicit type conversions using that constructor.
C) To mark the constructor for inlining.
D) To declare that the constructor can throw exceptions.

14. Which of the following is NOT an application of a graph data structure?

A) Social networks
B) GPS navigation systems
C) Implementing a First-In, First-Out (FIFO) queue.
D) Computer network topology.

15. You want to find the second highest salary from an Employees table. Which query is the most robust way to do this?

A) SELECT MAX(Salary) FROM Employees WHERE Salary < (SELECT MAX(Salary) FROM Employees);
B) SELECT Salary FROM Employees ORDER BY Salary DESC LIMIT 1, 1;
C) SELECT Salary FROM (SELECT Salary, DENSE_RANK() OVER (ORDER BY Salary DESC) as r FROM Employees) WHERE r = 2;
D) SELECT Salary FROM Employees WHERE Salary = (SELECT Salary FROM Employees GROUP BY Salary ORDER BY Salary DESC LIMIT 1,1);

16. What is a "Phantom Reference" used for in Java?

A) To refer to objects that have already been finalized but not yet reclaimed by the garbage collector.
B) To create a weak reference that does not prevent garbage collection.
C) To ensure an object is never garbage collected.
D) It is an outdated concept replaced by weak references.

17. The "Decorator Pattern" is a design pattern that allows behavior to be added to an individual object, dynamically, without affecting other objects from the same class. This pattern adheres most closely to which SOLID principle?

A) Single Responsibility Principle
B) Open/Closed Principle
C) Liskov Substitution Principle
D) Interface Segregation Principle

18. If you need a data structure that supports finding the minimum, maximum, median, and allows efficient insertion/deletion, what is the most suitable choice?

A) A standard Binary Search Tree.
B) A Hash Map.
C) A Min-Heap and a Max-Heap.
D) A sorted array.

19. In the context of process scheduling, what is "aging"?

A) The process of increasing the priority of processes that have been waiting for a long time to prevent starvation.
B) The process of moving older processes to a slower memory tier.
C) A technique to estimate the age of a process for memory management.
D) The degradation of performance as an operating system runs for a long time.

20. What does a FULL OUTER JOIN between Table A and Table B on A.id = B.id produce?

A) All rows from Table A and only matching rows from Table B.
B) All rows from Table B and only matching rows from Table A.
C) All rows from both Table A and Table B, with NULLs in place where a match does not exist.
D) Only the rows that exist in both Table A and Table B.

4.Pseudo Code

1. **What is the return value of find_median([3, 1, 7, 5, 2, 6]) using this algorithm?**

```
Function find_median(A)
    // quickselect is an algorithm to find the k-th smallest element
    n = length(A)
    if n is odd
        return quickselect(A, n/2)
    else
        return (quickselect(A, n/2 - 1) + quickselect(A, n/2)) / 2.0
    end if
End Function
```

A) 3.5
B) 4
C) 4.5
D) 5

2. **This algorithm finds the maximum area of a histogram represented by an array of heights. What is the overall time complexity of this stack-based approach?**

```
Function max_histogram_area(heights)
    stack S
    max_area = 0, i = 0
    while i < length(heights)
        if S is empty OR heights[S.top()] <= heights[i]
            S.push(i), i++
        else
            top_of_stack = S.pop()
            area = heights[top_of_stack] * (S.is_empty() ? i : i - S.top() - 1)
            max_area = max(max_area, area)
    end while
    while S is not empty    end while
    return max_area
End Function
```

A) $O(n^2)$
B) $O(n \log n)$
C) $O(n)$
D) $O(\log n)$

3. **This function calculates the 'inversion count' of an array. What does an 'inversion' signify?**

```
Function merge_and_count(A, temp, left, mid, right)
    // ... standard merge logic ...
    inv_count = 0
    // ... inside the merge loop ...
    if A[i] <= A[j]
        // ... merge ...
    else
        // ... merge ...
        inv_count = inv_count + (mid - i + 1)
    end if
    return inv_count


Function count_inversions(A, temp, left, right)
    // ... recursive calls for left and right halves ...
    // return left_inversions + right_inversions + merge_and_count(...)
End Function
```

A) A pair of indices i and j such that i < j and A[i] > A[j].
B) Any element that is not in its sorted position.
C) The number of swaps required by Bubble Sort.
D) A pair of adjacent elements A[i] and A[i+1] such that A[i] > A[i+1].

- 4. **This represents the Aho-Corasick algorithm's core logic after building a Trie and failure links. What problem does it solve efficiently?**

```
Procedure search(text, trie_root)
    currentState = trie_root
    for i from 0 to length(text)-1
        char = text[i]
        while currentState has no transition for char AND currentState != trie_root
            currentState = currentState.failure_link
        end while        if currentState has transition for char
            currentState = currentState.next_state[char]
        end if
        // if currentState is an output node, report matches
    end for
End Procedure
```

A) Finding the longest common substring between two strings.
B) Finding the shortest edit distance between two strings.
C) Finding all occurrences of a set of keywords in a given text in a single pass.
D) Compressing a text using a dictionary-based approach.

5. **This pseudocode describes an algorithm for finding the convex hull of a set of points. Which algorithm is it**

```
Procedure solve(Points)
    Find the point with the lowest y-coordinate (p0).
    Sort all other points based on the polar angle they make with p0. Stack S
    S.push(p0), S.push(Points[1]), S.push(Points[2])
    for i from 3 to n-1
        while cross_product(S.second_to_top(), S.top(), Points[i]) is not counter-clockwise
            S.pop()
        end while
        S.push(Points[i])
    end for
    return S
End Procedure
```

A) Jarvis March (Gift Wrapping)
B) Graham Scan
C) Quickhull
D) Chan's Algorithm

6. **What problem is solved by this dynamic programming algorithm on a string s?**

```
Function solve(String s)
    n = length(s)
    dp = 2D boolean array of size n x n, initialized to false
    maxLength = 1
    // Base cases for length 1 and 2
    for k from 3 to n // k is the substring length
        for i from 0 to n-k
            j = i + k - 1
            if dp[i+1][j-1] == true AND s[i] == s[j]
                dp[i][j] = true
                maxLength = max(maxLength, k)
            end if
        end for
    end for
    return maxLength
End Function
```

A) Length of the longest common subsequence with itself.
B) Length of the longest palindromic substring.
C) Length of the longest repeated substring.
D) Length of the longest non-palindromic substring

7. **This algorithm operates on a flow network. What does the path found by BFS represent, and what does the overall while loop calculate?**

```
Procedure edmonds_karp(Graph G, source s, sink t)
    max_flow = 0
    while path = BFS(G, s, t) // BFS finds a path in the residual graph
        path_flow = find_bottleneck_capacity(path)
        max_flow = max_flow + path_flow
        // Update residual graph capacities along the path
    end while
    return max_flow
End Procedure
```

A) A path represents an edge; the loop calculates the minimum cut.
B) A path represents an augmenting path; the loop calculates the maximum flow.
C) A path represents the shortest path; the loop finds the cheapest path.
D) A path represents a cycle; the loop detects negative cycles.

8. **What is the time complexity of this algorithm that checks for primality?**

```
Function isPrime(n)
    if n <= 1 return false
    if n <= 3 return true
    if n % 2 == 0 OR n % 3 == 0 return false
    i = 5
    while i * i <= n
        if n % i == 0 OR n % (i + 2) == 0
            return false
        end if
        i = i + 6
    end for
    return true
End Function
```

A) O(n)
B) O(log n)
C) O(√n)
D) O(1)

5. Coding

Problem 1: Find All Duplicates in an Array

Given an integer array nums of length n where all the integers of nums are in the range [1, n] and each integer appears **once or twice**, return *an array of all the integers that appear **twice***.

You must write an algorithm that runs in **O(n)** time and uses only **constant extra space**.

Input:
nums = [4,3,2,7,8,2,3,1]

Output:
[2,3]

Constraints:

n == nums.length

1 <= n <= 10^5

1 <= nums[i] <= n

Each element in nums appears **once or twice**.

Problem 2: Word Search II

Given an m x n board of characters and a list of strings words, return *all words on the board*.

Each word must be constructed from letters of sequentially adjacent cells, where "adjacent" cells are horizontally or vertically neighboring. The same letter cell may not be used more than once in a word.

Input:
board = [["o","a","a","n"],["e","t","a","e"],["i","h","k","r"],["i","f","l","v"]]
words = ["oath","pea","eat","rain"]
Output: ["eat","oath"]

Constraints:

m == board.length

n == board[i].length

1 <= m, n <= 12

board[i][j] is a lowercase English letter.

1 <= words.length <= 3 * 10^4

1 <= words[i].length <= 10

words[i] consists of lowercase English letters.

All the strings of words are unique.

6.Essay Writing

Question:

Write a well-structured essay of approximately 250-300 words evaluating the relevance and risks of the "move fast and break things" ethos, famously associated with early Silicon Valley startups.

The "Move Fast and Break Things" Philosophy: Is it a Viable Innovation Strategy or a Recipe for Ethical Failure in the Age of AI and Big Data?

7.Passage Comprehension

- The principle of Net Neutrality, a cornerstone of the open internet, posits that Internet Service Providers (ISPs) must treat all data on the internet equally, without discriminating or charging differently based on user, content, website, platform, application, type of attached equipment, or method of communication. For decades, this framework ensured a level playing field, preventing ISPs from becoming gatekeepers of online content by blocking, throttling, or creating "fast lanes" for preferred partners who could afford to pay more. Proponents argue that this egalitarian approach fosters innovation, as startups can compete with established giants without needing to pay a premium for bandwidth, and it protects free speech by preventing ISPs from censoring or slowing down disfavored viewpoints.
- However, opponents of stringent net neutrality regulations, primarily the ISPs themselves, contend that such rules stifle investment and innovation from their end. They argue that the immense capital expenditure required to build and maintain modern broadband infrastructure necessitates variable pricing models. By being able to charge high-bandwidth content providers (such as streaming services) more, they could subsidize the network's expansion and offer lower-cost basic plans to consumers. Furthermore, they posit that prioritizing critical data, such as for telemedicine or emergency services, over less time-sensitive traffic is a legitimate form of network management that net neutrality regulations can inhibit.

- The debate, therefore, is not merely a technical squabble but a profound ideological conflict over the internet's future. It pits a vision of the internet as a common carrier, a public utility with open and equal access, against a vision of it as a private market, where service tiers and differentiated pricing are standard business practices. The trajectory of this debate will fundamentally determine whether the internet evolves as a democratized space for permissionless innovation or as a curated, commercially stratified ecosystem.

1. Which of the following best encapsulates the central conflict described in the passage?
A) A technical debate between different types of network infrastructure.
B) A legal dispute over international data privacy laws.
C) A conflict between free speech advocates and large tech companies.
D) An ideological and economic struggle between viewing the internet as a public utility versus a private market.

2. According to the opponents of net neutrality, what is the primary justification for creating "fast lanes"?
A) To censor content that they deem inappropriate for the public.
B) To generate revenue from content providers to fund network infrastructure investment and maintenance.
C) To make the internet less accessible to startups and smaller companies.
D) To comply with international cybersecurity standards.

3. The author uses the term "permissionless innovation" in the final sentence. What does this most likely mean?
A) An environment where all new applications must receive a permit from ISPs.
B) An environment where innovators must pay a fee to access the network.
C) An environment where anyone can create and launch a new service or application without needing prior approval from network owners.
D) An environment where innovation is strictly controlled and regulated by the government.

4. What can be inferred about the author's own stance on net neutrality?
A) The author is strongly and explicitly in favor of a completely unregulated internet market.
B) The author is strongly and explicitly in favor of strict net neutrality regulations.
C) The author presents the arguments from both sides in a neutral, analytical manner without explicitly stating a personal preference.
D) The author believes the debate is irrelevant to the average internet user.

5. Which of the following scenarios would be a direct violation of the principle of Net Neutrality as described in the passage?

A) An ISP offering different internet speeds (e.g., 100 Mbps, 500 Mbps) to consumers for different prices.

B) An ISP slowing down the connection speed to a specific video streaming service that has not paid a special fee.

C) An ISP blocking a website known for distributing malware.

D) A user choosing to pay for a premium, ad-free version of a music streaming app.