

# Goldman Sachs Cracker Sheet

- By Sunyul Hossen

Note: [To Use this sheet optimally go and watch the "Cracking the Goldman Sachs coding interview 🔥: The definitive prep guide" video on Debug Buzz Channel.

Link - <https://youtu.be/ncR47GRTnUg> ]

## Q) 25th August 2022

Given a palindrome, you must change 1 character in it such that the string is not a palindrome and is lexicographically smallest.

Output the string if you are able to do so, otherwise return "IMPOSSIBLE"

Sampe Testcase:

- "aaabbaaa" -> "aaaabaaa"
- "aa" -> "IMPOSSIBLE"

Constraint:

- $1 \leq N \leq 1000$
- the palindrome consists of only lowercase English letter

## Q) 3rd August 2022

<https://leetcode.com/problems/sort-integers-by-the-number-of-1-bits/>

## Q) 3rd August 2022

Given an array of *words* and an array of *sentences*, determine which words are anagrams of each other. Calculate *how many* sentences can be created by replacing any word with one of the anagrams. Return a *list* containing number of sentences possible for each sentence.

Example

wordSet = ['listen', 'silent', 'it', 'is']

sentence = 'listen it is silent'

Determine that listen is an anagram of silent. Those two words can be replaced with their anagrams.

The four sentences that can be created are:

- listen it is silent
- listen it is listen
- silent it is silent
- silent it is listen

## Q) 2nd August 2022

Find the second smallest element in the array (use  $O(n)$  time)

## Q) 2nd August 2022

Given a 2-D String array of student-marks find the student with the highest average and output his average score. If the average is in decimals, floor it down to the nearest integer.

Example 1:

Input: [{"Bob", "87"}, {"Mike", "35"}, {"Bob", "52"}, {"Jason", "35"}, {"Mike", "55"}, {"Jessica", "99"}]

Output: 99

Explanation: Since Jessica's average is greater than Bob's, Mike's and Jason's average.

Follow-up:

Questions: What is the time complexity? What is the space complexity? Can you solve it in  $O(n)$  time?

## Q) 29th July 2022

The School of Language and Science teaches five subjects: Physics, Chemistry, Math, Botany, and Zoology. each student is skilled in one subject. The skills of the students are described by string of a=named skills that consists of the letters p,c,m,b, abd z only. Each character describes the skill of a student.

Given a list of students' skills, determine the total number of different teams satisfying the following constrains:

- A team consists of a group of exactly five students.
- Each student is skilled in a different subject.
- A student may only be on one team.

#### Example 1

skills = pcmbzpcmbz

There are 2 possible teams that can be formed at one time: skills[0-4] = pcmbz and skills[5-9] = pcmbz, for example.

#### Example 2

skills = mppzombpzcmpmzz

The sorted string is bbbbccmmmmppppzzzz. All of the skills are represented, but there are only 3 students skilled in Chemistry. Only 3 teams can be created.

#### Function Description

Complete the function `differentTeams` in the editor below. The function must return an integer value representing the number of teams that can be formed given the constraints. `differentTeams` has the following parameter(s): `string skills`: a string of length `n` where each position represents the Skill of a student.

## Q) 27th July 2022

Given a vector of distinct strings, we have to find the maximum number of strings which we can take such that we can arrange them consecutively only with following rules-  
Two strings are `a` and `b`, then  $\max(\text{len}(a), \text{len}(b)) = N + 1$ , where `N` is the longest common suffix of `a` and `b`.

Example- {rgy, bgy, ash, y, gy}

Output- 4

Explanation- rgy->bgy->gy->y is one of the possible outcome

## Q) 25th July 2022

encode input string "aaaabbcccd" -> "a4b2c3d1"

## Q) 25th July 2022

<https://leetcode.com/problems/median-of-two-sorted-arrays/>

## Q) 24th July 2022

28m left

**BETA** Can't read the text? [Switch](#) theme

### 1. GoodArray

For a number  $N$ , a *goodArray* is the smallest possible array that consists of only powers of two ( $2^0, 2^1 \dots 2^k$ ) such that the sum of all the numbers in the array is equal to  $N$ .

For each query that consists of three integers  $l, r$ , and  $m$ , find out the product of elements  $goodArray[l]$  through  $goodArray[r]$  modulo  $m$  when  $goodArray$  is sorted in non-decreasing order.

**Example**  
For  $N = 26$ , queries =  $[[1, 2, 1009], [3, 3, 5]]$

$goodArray$  when sorted is  $[2, 8, 16]$ .

For query  $l = 1, r = 2, m = 1009$ ,  $ans = goodArray[1] * goodArray[2] = (2 * 8) \text{ modulo } 1009 = 16$ .  
For query  $l = 3, r = 3, m = 5$ ,  $ans = goodArray_3 = (16) \text{ modulo } 5 = 1$ .

The answer is  $[16, 1]$ .

**Function Description**  
Complete the function `getQueryResults` in the editor below.

`getQueryResults` has the following parameters:

## Q) 24th July 2022

27m left

## 2. Football Scores

The number of goals achieved by two football teams in matches in a league is given in the form of two lists. For each match of team B, compute the total number of matches of team A where team A has scored *less than or equal to* the number of goals scored by team B in that match.

**Example**  
 $teamA = [1, 2, 3]$   
 $teamB = [2, 4]$

Team A has played three matches and has scored  $teamA = [1, 2, 3]$  goals in each match respectively. Team B has played two matches and has scored  $teamB = [2, 4]$  goals in each match respectively. For 2 goals scored by team B in its first match, team A has 2 matches with scores 1 and 2. For 4 goals scored by team B in its second match, team A has 3 matches with scores 1, 2 and 3. Hence, the answer is  $[2, 3]$ .

**Function Description**

Complete the function `counts` in the editor below.

`counts` has the following parameter(s):

- `int teamA[n]`: first array of positive integers
- `int teamB[m]`: second array of positive integers

**Return**

`int[m]`: an array of  $m$  positive integers, one for each  $teamB[i]$  representing the total number of elements from  $teamA[j]$  satisfying  $teamA[j] \leq teamB[i]$  where  $0 \leq j < n$  and  $0 \leq i < m$ , in the given order.

**Constraints**

## Q) 30th June 2022

Given a jumbled collection of segments, each of which is represented as a Pair(startPoint, endPoint), this function sorts the segments to make a continuous path.

A few assumptions you can make:

Each particular segment goes in one direction only, i.e.: if you see (1, 2), you will not see (2, 1).

Each starting point only have one way to the end point, i.e.: if you see (6, 5), you will not see (6, 10), (6, 3), etc.

For example, if you've passed a list containing the following int arrays:

$[(4, 5), (9, 4), (5, 1), (11, 9)]$

Then your implementation should sort it such:

$[(11, 9), (9, 4), (4, 5), (5, 1)]$

@param segments collection of segments, each represented by a Pair(startPoint, endPoint).

@return The sorted segments such that they form a continuous path.

@throws Exception if there is no way to create one continuous path from

all the segments passed into this function. Feel free to change the Exception type as you think appropriate.

## Q) 30th June 2022

File contains list of Ip Address. Get the IP address/s with highest frequency. If multiple Ip address available with highest freq, return sorted comma separated.

## Q) 30th June 2022

<https://leetcode.com/problems/trapping-rain-water/>

## Q) 26th June 2022

Given size (N) of a group of student and teacher will pick k-th student and remove it from the group, after that teacher will start to count again from the next student and remove k-th student.

If the counting reach the end of group then it will keep counting from the beginning of the group. You need to write a function which take N and K as input and return the index of remaining student.

e.g. N = 5, K = 3

1, 2, [3], 4, 5 -> remove 3 from group, start to count from 4

[1], 2, 4, 5 -> reach 5 (the end of group) and continue to count from beginning, remove 1

2, 4, [5] -> remove 5 from group, start to count from 2

[2], 4 -> remove 2 from the group, 4 is the remaining student

## Q) 22nd June 2022

Find the final position of the robot starting from {0, 0}. The robot moves based on the characters in a string of the form 'ULRD'

## Q) 22nd June 2022

Find max rock collectible in a 2D grid where user starts from  $\{n-1, 0\}$  and ends at  $\{0, m-1\}$

## Q) 20th June 2022

[https://github.com/Java-aid/Interview-Preparations/blob/master/ProblemStatements/Goldman%20Sachs/GS%20Online%20Assessment%201\\_2017.pdf](https://github.com/Java-aid/Interview-Preparations/blob/master/ProblemStatements/Goldman%20Sachs/GS%20Online%20Assessment%201_2017.pdf)

## Q) 20th June 2022

<https://stackoverflow.com/questions/52652675/counting-connections-in-a-mn-matrix>

## Q) 8th May 2022

The Game of Book Cricket is played by 2 players. Each player randomly opens the book and as you open the pages you score runs. The last digit of the even numbered page corresponds to your score.

So if you opened page number 236, your score is 6. Hence possible scores are either 0,2,4,6 or 8. However if the number ends with a 0 or 8, you are out and you lose your turn. Every time you open the book, note the score and keep on adding. So if you opened pages 124, 56, 22 your score is  $4 + 6 + 2 = 12$ .

Given that player 1 has scored  $N(\text{totalScore})$  runs and the number of pages in the book is only 10, your task is to identify the number of ways you can match the score and remain not out?

Input:

totalScore(N): Total score of the first player

Example:

Sample

Input: 6

Output: 4

Explanation:

6 can be reached by the following combinations

[2,2,2]

[2,4] [4,2]

[6]

## Q) 8th May 2022

Given a Pattern containing only Ns and M's . N represents ascending and M represents descending , Each character (M or N) needs to display sequence of numbers(2 numbers) explaining the ascending or descending order (for ex: 21 ->represents descending -> M) . The second character in the pattern takes the last digit from first character and builds the sequence and so on..Please look at example section below.

There could be multiple numbers satisfying the pattern. The goal is to find out the lowest numeric value following the pattern.

Constraints:

Input can have maximum 8 characters

Output can have Digits from 1-9 and Digits can't repeat.

In case of no possible output or incorrect input value (like blank /null /NON M or N character) please return -1.

Example Section:

Input : M

Output: 21 (2 -> 1 shows descending and possible smallest numeric value. Even 65 or 74 can qualify, but 21 being the smallest numeric value is the correct answer)

Input : MNM

Output:2143 (M represents descending 2->1 , N represents ascending 1->4 (1 is coming from last character) , M represents descending 4->3(4 is coming from last character sequence) — There would be many number qualifying the pattern like 3142 ,8796,6241 etc.. 2143 is the lowest numeric value for this pattern sequence.)

## Q) 29th April 2022



Return the start index and length of the longest substring having identical characters in a given String.

i/p : S = "aabbbbbbccddb"

o/p: [2,5]

explanation : As longest substring is 'bbbb' of length 5 and start index as 2

i/p: S = "aabb22rrrr34571111111"

o/p: [17,7]

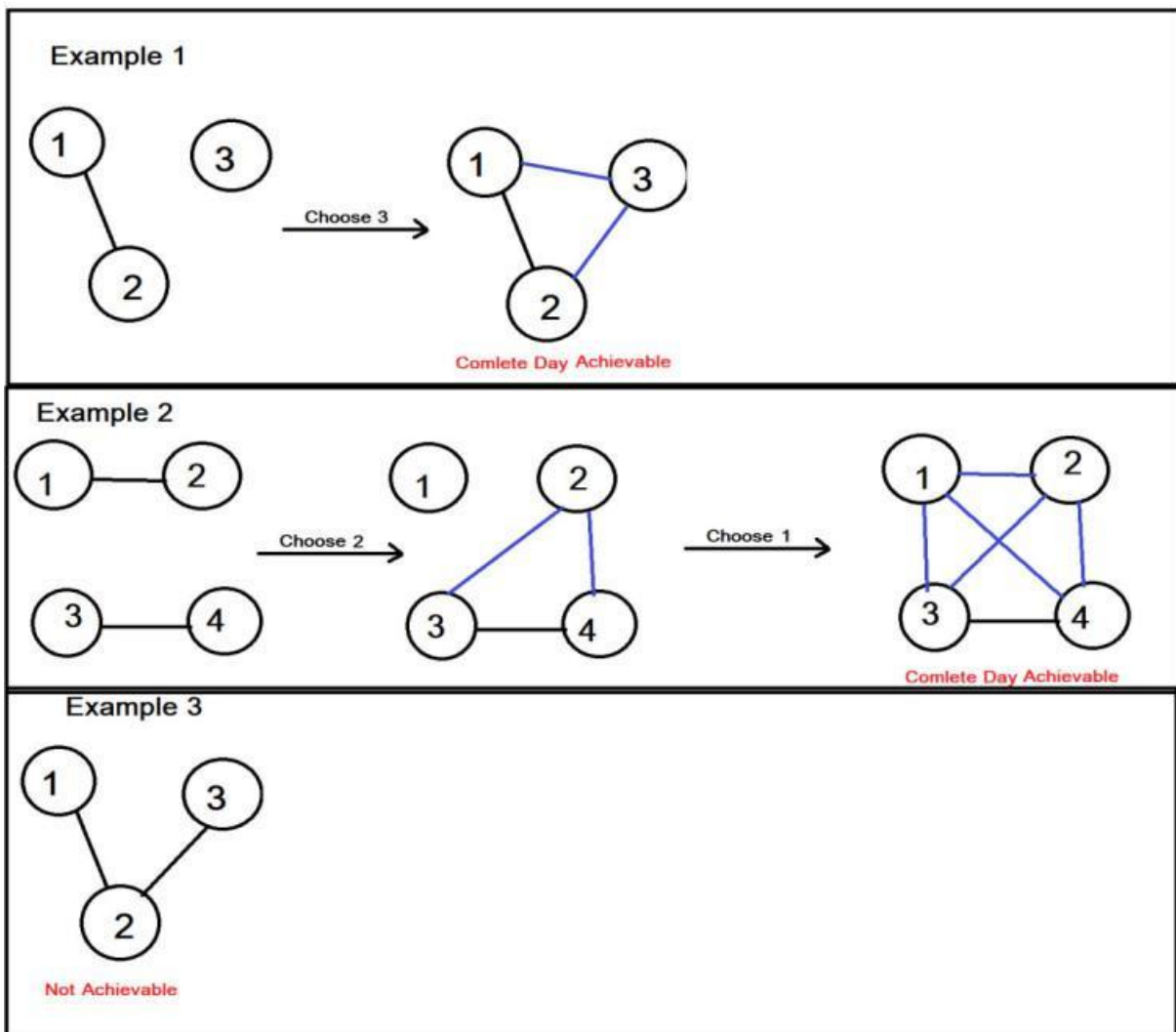
explanation : As '111111' is the longest substring of length 7 and start index =17

## Q) 12th March 2022

There are n places in a city, we need to connect each place to every other place in the city by roads (called complete day condition). The way we update edges(roads) is by selecting a node(place), upon which every pre-existing edge from that node will vanish and every possible edge that wasn't there in pre-existing edges (which just vanished) will appear.

We can select any number of nodes, in any order. There were some pre-existing edges provided for every city. Task is to figure out if complete day condition will be met by some order of selection of nodes.

number of nodes :  $n \leq 1000$ .



**Q) 11th March 2022**

<https://leetcode.com/discuss/interview-question/1837422/Goldman-Sachs-or-Company-or-First-non-repeating-character>

**Q) 11th March 2022**

<https://leetcode.com/discuss/interview-question/1837465/Goldman-Sachs-or-Company-or-Find-the-maximum-gold-that-can-be-collected>

## Q) 11th March 2022

The tree with the highest number of nodes, is the largest one. The edges are directed from parent to child.

Input:

{{1 -> 2}, {3 -> 4}}

Output:

2

## Q) 10th March 2022

<https://leetcode.com/discuss/interview-question/1837422/Goldman-Sachs-or-Coderpad-or-First-non-repeating-character>

## Q) 10th March 2022

<https://leetcode.com/problems/minimum-path-sum/>

## Q) 10th March 2022

<https://leetcode.com/discuss/interview-question/1837497/Goldman-Sachs-or-Coderpad-or-Find-the-largest-tree>

## Q) 10th March 2022

<https://leetcode.com/problems/robot-bounded-in-circle/>

## Goldman Sachs Tech Interview Questions on Data Structures and Algorithms

1. You have a sorted array `arr[]` of distinct integers. Arrange the elements into a sequence such that  $arr[1] \geq arr[2] \leq arr[3] \geq arr[4] \leq arr[5]$ .

2. Find the contiguous subarray within an array, A of length N, which has the largest sum.
3. What is a linked list, and what are its types?
4. Can doubly-linked be implemented using a single pointer variable in every node?
5. Given a list of nonnegative integers, arrange them such that they form the largest number. For example: Given [3, 30, 34, 5, 9], the largest formed number is 9534330.
6. How will you implement a queue using a stack?
7. Can you check if a given Binary Tree is BST or not?
8. Given a positive integer n and a string s consisting only of letters D or I, you have to find any permutation of the first n positive integer that satisfies the given input string. D means the next number is smaller, while I means the next number is greater. Note that the length of given string s will always equal to n - 1, and the solution should be in linear time and space.
9. Which data structures are used for the BFS and DFS of a graph?
10. What are Infix, prefix, Postfix notations?
11. Given an array, find the pivot/position where the left sum of the array is equal to the right sum.
12. Given an array, find the minimum length sub-array with a given sum.

## **Goldman Sachs Tech Interview Questions on Systems Design**

1. Explain load balancing and why is it important to system design?
2. Explain the steps of designing a search engine?
3. Take us through the steps of incorporating microservices into an e-commerce platform?
4. Can you explain the process of creating a global file-sharing or storage system?
5. Can you explain the process for creating a chat or messaging system?
6. Tell me about the type of algorithm you would use to create a newsfeed for a social media website?
7. What, according to you, are the critical components for designing an e-commerce website?
8. What are parking lot systems, and how are they designed?
9. How will you determine the goal and scale of a system?

10. Can you name some techniques used to stream large amounts of data on or off of a server?

## Behavioral Interview Questions in Goldman Sachs Tech Interview

1. Describe a conflict you had with a colleague in the past. How did you solve the conflict?
2. Describe a time when you went above and beyond with your customer service.
3. What does integrity mean to you?
4. Tell us about an obstacle you overcame.
5. What are the things that you value the most in a job?
6. What's the biggest misconception that your co-workers have about you. And why?
7. Why would you choose to work at Goldman Sachs?
8. Tell us about a time when you had to work under very close supervision?
9. Describe the best manager under which you had to work. What did you learn?
10. How do you decide how much time is needed for a particular task?

## Goldman Sach Tech Interview Questions on Data Analysis

1. Given  $N$  noodles in a bowl and randomly attaching ends. What is the expected number of loops you will have in the end?
2. How to remove duplicates without distinct from a database table?
3. When is the value at risk inappropriate?
4. What is the Wiener process?
5.  $A = \begin{bmatrix} -2 & -1 \\ 9 & 4 \end{bmatrix}$ . What is  $A^{1000}$ ?
6. Write an algorithm for a tree traversal.
7. Write a program for Levenshtein Distance calculation.
8. Count the total number of trees in the states.
9. Define "Data Cleansing."
10. Name the best tools used for data analysis.

# Goldman Sachs Technical Interview Questions Based on Job Profiles

Here are some of the frequently asked questions when you interview for different job profiles at Goldman Sachs:

**Software engineer:**

1. What are verification and validation?
2. Name two tools that are used for keeping track of software requirements?
3. What language do you like to write programming algorithms?
4. What is mean by software scope?
5. How can you measure project execution?
6. What is cohesion?
7. What are the various phases of SDLC?
8. How can we derive the size of the software product?
9. What is SRS?
10. What actions are taken during a feasibility study?

**Product Manager:**

1. Tell us about your favorite product and what you will change in it.
2. How do you know if a product is well-designed?
3. What has made product Y successful?
4. How do you define success for the products you launched?
5. Have you worked on system integrations like CRM platforms?
6. What cross-functional skills do you possess?
7. Explain and walk me through Design to Engineering of a product.
8. When you were doing A/B Testing, what specific things would you evaluate?
9. Have you worked in an agile environment?
10. What are your release cycles?

**Program Manager:**

1. What's your experience with program charters?
2. Do you create a code of ethics to be a better manager?

3. If two stakeholders provide you with conflicting requirements, how do you determine how to proceed?
4. How do you properly define and control the goals for each program that you manage?
5. What's your tested formula to keep up with industry trends?
6. Why do projects fail?
7. Tell me about your risk analysis process.
8. Talk about your biggest project success and biggest project failure.
9. Have you ever had to negotiate with a difficult stakeholder? Tell me about the experience.
10. What is your management style?

#### **Algorithm Engineer:**

1. What is a Hash Table, and what are the average case and worst-case times for each of its operations? Tell me about the way one can use this structure to find all anagrams in a dictionary?
2. Write the algorithm to reverse a string.
3. What are Red-Black Trees and B-Trees? What is the best use case for each of them?
4. Is it possible to implement a Binary search Algorithm without recursion?
5. You have a set of data intervals represented by StartDate and EndDate. How would you efficiently calculate the longest timespan covered by them? Explain the time complexity.
6. What is A\*, and what are its implementation details?
7. Explain how divide-and-conquer algorithms work. Discuss a few examples where this approach can be used.
8. Suppose you need to design a scheduler that to schedule a set of tasks. There are several tasks that need to wait, and other tasks have to be completed before that. What algorithm will you use to design the schedule, and how would you implement it?
9. What are Divide and Conquer algorithms? Describe how they work.
10. Explain how insertion sort, quicksort, heap sort, and merge sort work.

#### **Senior Software Engineer:**

1. What type of approach do you prefer — a microservice approach or a monolithic approach?

2. What is your approach for doing Unit Testing for your peer's code?
3. What is your process to test and find the bugs in the application that you've developed?
4. What factors do you consider when designing inventory management systems?
5. How do you improve maintainability problems related to legacy code projects?
6. What would you do to develop and enforce database confidentiality policies?
7. How will you carry out debugging an entire system of applications?
8. What kind of instrumentation do you apply to ensure high-performance architecture design?
9. When would you consider a NoSQL design over an SQL design?
10. How would you create an SQL database with sharding capabilities for geographical and time-series information?

#### **Front-end Developer:**

1. How do you make the structure of CSS and JavaScript easier to understand for other developers?
2. What is CSS Rule?
3. What are HTML meta tags?
4. What is ReactJS?
5. Explain the principles of SOLID.
6. What is meant by user-centered design?
7. Why should you use jQuery?
8. Explain how variables differ in CoffeeScript from JavaScript?
9. How will you optimize the page through front-end technology or code?
10. Explain the differences between Block, Inline, Box-sizing, and Inline-block?

#### **Backend Developer:**

1. What is the difference between PATCH and PUT?
2. Explain the difference between design and architecture?
3. What will you do to find the most expensive queries in an application?
4. How do you deal with failures in a distributed system?



5. When would you apply asynchronous communication between two systems?
6. What is an MVC framework?
7. How would you manage Web Services API versioning?
8. Write a program to filter out only the alphabets from the provided Email Address and sort the alphabets. Also, put the sorted alphabets back to the Email Address without changing the positions of other characters.
9. What is your preferred programming language?
10. What is your experience with GoTo, and do you prefer structured programming?

#### **Engineering Manager:**

1. Explain the difference between leadership and management.
2. How do you structure your one-on-ones?
3. What is your process of developing the tech leads in your team?
4. Should code ownership be individual?
5. What behaviors do successful team members have in common?
6. What behaviors have you noticed from team members who struggle the most?
7. According to you, what are the best ways to keep an engineering team motivated?
8. How do you measure success for your team members?

## **Goldman Sachs Interview Questions for Freshers**

1. What is Garbage Collection in Java?
2. Explain hashCode() and equals() in Java.
3. Differentiate between StringBuffer and StringBuilder classes in the context of Java.
4. Explain the difference between an interface and an abstract class in Java?
5. What are the differences between pointers and reference variables in C++?
6. Tell us the difference between an interface and an abstract class in Java?
7. What is a final keyword in Java?

# Goldman Sachs Interview Questions for Experienced Professionals

1. What are different testing concepts? Define unit testing, integration testing, regression testing and explain the need for each one of them.
2. What is the need for multiple environments for the same application?
3. If you need to add a particular feature to an application, how will you do it? How will you document it, test it and take it through different environments of the application?
4. Write the algorithm for a given list of transactions between friends who have to give or take some amount of money from one another. They have to settle up with a minimum number of transactions, and you have to return a list of all the transactions. If B owes A Rs. 200 :  $B \rightarrow A = 200$ . Similarly, if C owes B Rs. 200 :  $C \rightarrow B = 200$ . So the minimum number of transactions is 1, and that should be:  $C \rightarrow A = \text{Rs. } 200$ .

## Most Unusual Goldman Sachs Technical Interview Questions

Goldman Sachs is notorious for throwing brain teasers your way. Check out some of the common ones that candidates have had to encounter:

1. What is the angle between the hour and minute hand of a clock at 3.15?
2. How would you get out if you were shrunk to the size of a pencil and put in a blender?
3. What's the sum of all the numbers between 1 and 100?