**Infosys Coding Assessment Questions**

1. **Make Palindromes**

You are given a Palindromic String **S**.It is given that a **Valid palindrome** is a Palindrome that has the same first Character as **S**.

Find the Total Number of distinct Valid Palindromes you can form by re-arranging the characters of S.(including S).Since the answer can be very large return it modula 10^9 +7.

**Function Description**

Complete the CountPal function in the editor below.It has the Following Parameters (S):

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| s | STRING | The given String s |

Return-The Function must return an INTEGER denoting the total numbers of distinct valid palindromes possible modulo 10^9+7.

**Constraints-**

1≤len(s)≤10^5

Input Format for debugging

The First line Contains a string s.denoting the given string s.

**Sample Test cases-**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| aba | 1 | We can form only one Pallindrome : “aba” |
| abccba | 2 | We can form two Pallindromes: “abccba” And “acbbca” |

**2.Chair Game**

You are Playing a game With n Players.In this game a chair is assigned to each player.

All the players make a circle With the Chairs assigned to them.the game is make all Players Closer there eyes and sit in one of the Chairs if the chair is empty.

Find the total number of ways seating players such that all players are seated in a chair that is not assigned to them.Since the answer can be very large return it modulo 10^9 +7.

**Notes-**

It is given that you are also a Participant of the game.Hence,the total number of players in the game n+1.

**Function Description**

Complete the Count function in the editor below.It has the following parametes(s):

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| n | INTEGER | The number of players that are playing the game along with you. |

Return-

The Function must return an INTEGER denoting the total number of ways of seating players such that all players are seated in a chair that is not assigned to them modulo 10^9+7.

**Constraints-**

1≤n≤10^5

**Input format for debugging-**

The first line contains an integer,n,denoting the number of players that you are playing the game with.

**Sample Testcases-**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output description |
| 1 | 1 | In this you play with one player so we have 2 chairs you can sit in his chair and he sit in your chair. |
| 2 | 2 | In this we have chairs number 1,2,3  We have only 2 cases  1:  (Player 1 has chair 3 ,player 2 has chair 1 and player 3 has chair 2)  2:  (player 1 has chair 2,player 2 has chair 3 and player 3 has chair 2) |
| 3 | 0 | We have only 0 Cases to 4 players. |

**3.****Equal Sum Pairs**

You are given an array A having N integers.You need to choose some pairs of indices.Such that they meet the following Constraints.

-Each index goes to at most one pair.

-Sum of elements at both the indices in each pair is Same.

Find the maximum number of pairs which can be chosen.

**Function Description**

Complete the Solve Function in the editor below.it has the following parameters(S):

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The number of Elements in A. |
| A | INTEGER ARRAY | The given array. |

Return-

The function must return an INTEGER denoting the maximum number of pairs which can be chosen.

**Constraints-**

1≤N≤1000

1≤A[i]≤N

**Input format for debugging**

The first line contains an integer,N,denoting the number of elements in A.

Each line of I of the N Subsequent lines (Where 0≤i<N) Contains an integer describing A[i].

**Sample TestCases-**

|  |  |  |
| --- | --- | --- |
| input | Output | Output Description |
| 2 2 2 | 1 | Only one Pair {2,2} |
| 7 6 4 4 7 7 7 3 | 2 | Two pairs {4,7},{4,7} |
| 8 4 1 7 6 7 6 5 8 | 3 | {4,8},{7,5},{6,6} |

**4.**

**5.Construnt and Count**

Find the total number of distinct ambitious array possible since the answer may be large return it modulo 10^9+7.

Note-Two arrays are said to be distinct if there exists at least one index I (1≤i≤n) such that elements at index I are not equal.

**Function Description**

Complete the Count function in the editor below .It has the following parameters(s);

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| n | INTEGER | The maximum size of an ambitious arrays. |
| I | INTEGER | Lower bound values for the ambitious array [r-I+1≤30] |
| r | INTEGER | Upper bound values for the ambitious array [r-I+1≤30] |
| b | INTEGER | The desired beauty of an ambitious array. |

Return- The function must return an INTEGER denoting the total number of distinct ambitious arrays possible modulo 10^9+7.

**Constraints**

--------------------------------------------------------

**Input Format for debugging**

The first line Contains an integer, n , denoting the maximum size of an ambitious arrays.

The next line contains an integer,I,denoting the lower bound values for the ambitious array.

The next line contains an integer,r,denoting the upper bound values for the ambitious array.

The next line contains an integer,b,denoting the desired beauty of an ambitious array.

**Sample Test Cases**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| 3  5  6  2 | 8 | The following arrays satisfy the conditions:  {5,6}  {6,5}  {5,5,6}  {5,6,5}  {5,6,6}  {6,5,5}  {6,5,6}  {6,6,5} |
| 1  1  10  1 | 10 | The following arrays satisfys the Conditions:  {1}  {2}  {3}  {4]  {5}  {6}  {7}  {8}  {9}  {10} |
| 2  542  546  2 | 12 | The following arrays satisfy the Conditions:  {542,543}  {542,545}  {543,542}  {543,544}  {543,545}  {544,543}  {544,545} |

**6. Big Chance To Win**

You and your friends can play N football Matches.It is given that x[i]/y[i] in the probability of winning the nth match.

Additationally ,you are given two types of queries .There are Q questions of each type as described below:

1.First Type of query is described by three integers idx,p,q.you have to replace the probability in the index idx[I]by the fraction p[I]/q[I].The result of this type of query is always zero.

2.Second type of query is of the form (left[I],right[I]).This query denotesthat you should find the value R representing the square of the number of wins in the range from left [I] to right [I].The result of this query type is R.

You are needed to perform the queries alternately I.e.first type query then 2nd type query then 1st type and so on.

Output the sum of the result of all the queries modulo 10^9+7.

**Function Description**

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The number of Matches. |
| Q | INTEGER | The number of Queries. |
| X | INTEGER ARRAY | Array of x values.The ith element denotes the x value of winning the ith match. |
| y | INTEGER ARRAY | Array of y values.The ith element denotes the x value of winning the ith match. |
| idx | INTEGER ARRAY | Array of idx values.The ith element denotes the value of idx for the ith query of the first type. |
| P | INTEGER ARRAY | Array of P values.The ith element denotes the value of P for the ith query of the first type. |
| q | INTEGER ARRAY | Array of q values.The ith element denotes the value of q for the ith query of the first type. |

**Constraints**

1≤N≤10^5

1≤Q≤10^5

1≤x[I]≤10^5

X[I]≤y[I]≤10^5

1≤idx[I]≤N

1≤p[I]≤10^5

**7.Removing Caractor**

You are given a string s of length n and an array of string t containing m strings eatch of length n-1 . You need to remove one caracter from s Such that s becomes equal to any of the m string s.

Find the total number of strings from the m given strings which can be obtained by removing one caracer from s.

**8.Happy Hour**

Hadis gets n dollars of money as his Salary.

Hadi dicides to distribute this money to as many people as he can . He will disribute the money he has such that no 2 people get the same amount of dollars.

Find the maximum number of people Hadi can give money to.

**9. Remove the Balls**

You have N balls to be placed on a shelf on the top of each other. The balls have a number written on them represented by array A.

However when K balls have an integer k written on them and are on top of each other then you remove these k balls.

Find the total number of Balls on the shelf after inserting the 1st ball for each I where 0 ≤i <N and store it in array result [j].

Output the array result.

**Sample Test Cases**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| 3  2  2  3 | 1  6  1 | N=3  A=[2,2,3]  We insert A[0] first hence there is 1 ball on shelf  Then we insert A[1] and the shelf has 2 balls written 2 on them in a row hence we remove both the balls,  Hence there are 0 balls on the shelf  Then we insert A[2] and the shell has 1 ball on it. |

**10. GCD Maximization**

You are given an array A of N integers.

You can replace exactly one element of the array A.Then you complete the GCD (Greater Common divisor) of all the elements of A.

Find the maximum possible GCD you can get.

**Function Description**

Complete the GCD Maximization function in the editor below .it has the following parameters (S);

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The size of A. |
| A | INTEGER ARRAY | The Given Array. |

Return- The function must return an INTEGER Containing the Maximum Possible GCD you can get.

**Constraints-**

1≤N≤10^5

1≤A[I]≤10^5

**Input Format for Debugging**

The first line Contains an integer, N, denoting the number of elements A.

Each line I of the N subsequent lines (Where 0≤i<N) Contains an integer describing A[I]

**Sample Test Cases**

|  |  |  |
| --- | --- | --- |
| Input | Output | Description |
| 2  6  12 | 12 | N=2  A=[6,12] |
| 3  1  4  8 | 4 | N=3  A=[1,4,8] |
| 4  2  4  6  8 | 2 | N=4  A=[2,4,6,8] |

**11.Another Xor Problem**

You are given three integers N,L,R.

An integer x is called beautiful if

L<=X<=R.

N@X<N

Fin the total number of beautiful integers.

Note- The @ symbol is used to denote a XOR Operation.

**Function Description**

Complete the another Xor problem function in the editor below. It has the following parameters (s):

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The value of integer N Described in the Problem. |
| L | INTEGER | The value of integer L Described in the Problem. |
| R | INTEGER | The value of integer R Described in the Problem. |

Return- The Function must return an INTEGER denoting the total number of beautiful integers.

**Constraints-**

1≤N≤10^9

1≤L≤10^9

1≤R≤10^9

**Input Format for debugging**

The first line Contains an integer N, denoting the integer as described in the Problem.

The next line Contains an integer L, denoting the integer as described in the Problem.

The next line Contains an integer R, denoting the integer as described in the Problem.

**Sample Test Cases**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| 5  2  7 | 4 | N=5  L=2  R=7  Integer 4,5,6,7 are beautiful. |
| 2  1  2 | 1 | N=2  L=1  R=2  Integer 2 is beautiful. |

**12.Subsequence & Distance**

You are given an array A of Size N . Additionaly it is given that 1<=A[I]<=K.

Lets build another array B of size N\*K Such that B equals to the Concentration of Copies of array A.This means that if N=3,K=2, And A={1,2,1} then B={1,2,1,1,2,1}

Lets choose K indices p1.......px from B, Such that:

O<=p1<p2<…......<Pk<N\*K.

B[p1]=1,B[p2]=2,…...B[pk]=K.

Find the minimum distance between two valid indices of p1 and px.

Note-It is given that array A is Zero indexed.

**Function Description-**

Complete the Solve function in the editor below.It has the following parameters(s);

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The number of elements in array A. |
| K | INTEGER | The upper bound of elements in array. |
| A | INTEGER ARRAY | The given array. |

**Constraints-**

1≤N≤10^5

1≤N≤(min N,10^4)

1≤A[I]≤K

**Input format for Debugging-**

The first line Contains an integer ,N,denoting the number of elements in A.

The next line Contains an integer K.

Each line I of the N Subsequent lines (where 0≤i<N) Contains an integer describing A[I].

**Sample Test Cases-**

|  |  |  |
| --- | --- | --- |
| Input | Output | Description |
| 6  4  3  1  2  1  4  2 | 7 | N=6,K=4  A=[3,1,2,1,4,2]  B=[3,1,2,1,4,2,3,1,2,1,4,2,3,1,2,1,4,2,3,1,2,1,4,2]  We can choose P[1]=3,P[2]=5,P[3]=6 and P[4]=10  The answer is P[4]-P[1]=10-3=7  It can be shown that 7 is the minimal possible answer. |
| 4  3  1  3  1  2 | 3 | N=4,K=3  A=[1,3,1,2]  B=[1,3,1,2,1,3,1,2,1,3,1,2]  We can choose P[1]=2,P[2]=3 and P[3]=5.  The answer is P[3]-P[1]=5-2=3.  It can be shown that 3 is the minimal possible answer. |

**13. Xor Operations**

You are given an array A of N integers on which the follwing operations can be Performed.

Pick an index I,0<=I<N.

Choose any integer P.

Replace A[I] with A[I] xor 2p.

Find the minimum number of operations required to make all elements of array A equal.

**Function Description-**

Complete the Xor Operations Function in the editor below. It has the following Parameters(s);

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The size of the array A. |
| A | INTEGER ARRAY | The array A. |

The function must return an INTEGER denoting the minimum number of operations required to make all elements of array A equal.

**Constraints-**

1≤N≤10^5

1≤A[I]≤10^9

**Input Format for Debugging-**

The first line Contains an integer ,N,denoting the number of elements in A.

Each line of the N subsequent lines (where o≤i≤N)Contains an integer describing A[I].

**Sample Test Cases**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| 2  5  5 | 0 | N=2  A=[5,5]  Since the array already has all elements equal,no operations are required. |
| 2  1  2 | 2 | N=2  A=[1,2]  Choose I=0 and p=1  Choose I=1 and p=0  Hence 2 operations are needed. |
| 4  7  6  10  11 | 6 | N=4  A=[7,6,10,11]  Choose I=0 and p=0  Choose I=0 and p=2  Choose I=3 and p=0  Choose I=1 and p=2  Choose I=0 and p=3  Choose I=1 and p=3  The array after applying the above operations becomes [10,10,10,10] |

**14.Max Expertise**

You are given the hierarchy of a company represented by a directed tree of N nodes,where N is the number of employees.Each has only one direct manager and possibly many indirect managers.Each employee can manage many employees directly and indirectly.

Each employee has a Skill level A[x] and an expertise level.

The expertise level of an employee equals the count of employees y such that:

A[y]>A[x].In other words,skill level of employee y is strictly greater than the skill level of Employee X.

The employee x manages the employee y (directly or indirectly)

A Set of employees is a beautiful set if,none of the employees in the set manages the others directly or indirectly.The expertise of the set equals ,the sum of the expertise levels for all the employees in the set.

Find the maximum expertise of a beautiful set with size at most K.

Notes-

A tree is an undirected graph in which any two verticles are connected by exactly one path.A directed tree is directed acyclic graph (DAG) Whose underlying Undirected graph is a tree.

The size of a set is the number of employees in the set.

**Function Description-**

Complete the CalculateMaxSetExpertise function in the editor below.It has the following Parameters(s):

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The number of Employees. |
| K | INTEGER | The Maximum size of Set. |
| A | INTEGER ARRAY | The Skill of the Employees. |
| Parent | INTEGER ARRAY | The parent array,Which represents the directed tree.  It is guranteed that parent[1]equals –1 since it is the root of the tree and should have no parent. |

The function must return an INTEGER denoting the maximum expertise of a beautiful set with size at most K.

**Constraints-**

1≤N≤10^5

1≤K≤100

1≤A[I]≤10^5

-1≤Parent[I]≤N.

**Sample Test Cases-**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| 3  1  1  2  3  -1  1  2 | 2 | N=3  K=1  A=[1,2,3]  Parent=[-1,1,2]  We can choose a set that Contains only the first employee.  His expertise is 2 since he manages both the employees 2 and 3 and their skills is strictly greater than his skills. |
| 3  1  1  1  3  -1  1  2 | 1 | N=3  K=1  A=[1,1,3]  Parent=[-1,1,2]  We can choose a set that contains only the first employee His expertise is 1 since the manages employee 3 indirectly and A[3]>A[1] |
| 7  10  7  1  2  3  4  5  6  -1  1  1  2  3  4  5 | 4 | N=7  K=10  A=[7,1,2,3,4,5,6]  Parent=[-1,1,1,2,3,4,5]  We can choose the set {2,3}.The expertise of each of them is 2.and none of them manages the other. |

**15.** **Prime With Square**   
  
n = 5;n>3  
n<=10^7   
1) 5 = 1^2 + 2^2 = 1 + 4 = 5 only one pair => answer is 1.  
2) 3 = 0 ;   
3) 13 = 2^2 + 3^3 = 4 + 9 = 13   
 (2+3)5 = 1^2 + 2^2 = 1 + 4 = 5 => two pairs => answer is 2.

**16. A big chance to win**   
  
Question is too theoritcal so i cant remind.  
  
but there 9 variables.  
  
6 Arraylist => p,q,left,right,x,y  
  
3 variables =>n,q,I

**17. Fibbnocci String :**   
  
int n = 5   
String s = "ba";  
  
1) 5   
 ba => answer = 2 =>f(5) = babba  
  
2) 7  
 bab => answer = 4 => f(7)=babbababbabba  
  
3) 40  
 bb => answer = 15744 =>10^6+3 equals 157744

**18. Selling Items-**

You have an array A of size n Where A[I] denotes the number of Customers Coming to the shop on the 1st day .You also have an array B of size n where B[I] denotes the number of items available for sale on 1st day.

On first day each of the A[I] customers present can buy one of the B[I] items available on that day.

Additionaly you can double your inventory for k.days out of the n days.

Determine the Maximum number of items that can sold.

**19.Amazing Sequence-**

We call a sequence of M integers a[1],a[2],….....a[m] as an amazing sequence holds the following condition:

Min(a[1],a[2]<=min(a[2],a[3]<=…....<=min(a[m-1],a[m])

You are given an array a of n integers.Determine the length of the longest amazing subsequence of a.

**Function Description-**

Complete the Solve function in the editor below.It has the following Parameters (s):

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| n | INTEGER | The size of the array a. |
| a | INTEGER ARRAY | The given array. |

**Return-**The function must return an INTEGER denoting the length of the longest amazing subsequent of a.

**20. String Update**

You are given a binary string S.

Each passing minute the following happens:

if S[i] = 1,then s[i+1]becomes s[i] for i,0<=i<lens(S)-1

Find the first moment when the string S does not change

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| S | STRING | The given String |

**Return:** The function must return an INTEGER denoting the first moment when the String has all characters only 1’s

**Constraints:**

**Input format for debugging**

**Sample Testcases:**

|  |  |  |
| --- | --- | --- |
| Input | Output | Output Description |
| 1001 | 2 | At 1 minute ,S[1] becomes 1.  At 2 minutes[2] becomes 1.  The String does not change after that. |
| 1110 | 1 | In the first minute , S[3] becomes 1, The string does not …................................................................................................................................. |

**21. Company Hierarchy –2**

You are given the hierarchy of a company, represented by a directed tree of N nodes, where N is the number of employees. Each employee has only one direct manager and possibly many indirect managers. Each employee can manage many employees directly and indirectly.

Each employee has a skill level A[x] and an expertise level. The expertise level of employee x equals the max of all values A[y] for all employees y such that x manages y[directly or indirectly].

A Set of employees is a beautiful set if,none of the employees in the set manages the others directly or indirectly. The expertise of the set equals, the sum of the expertise levels for all the employees in the set.

Find the maximum expertise of a beautiful set with size at most k.

Notes:

* The max of a set of values is the smallest non-negative integer that does not belong to the set
* A tree is an undirected graph in which any two vertices are connected by exactly one path. A directed tree is a directed acyclic graph(DAG) whose underlying undirected graph is a tree.
* The size of a set is equal to the number of employees in the set .

**Function Description:**

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | The number of Employees. |
| K | INTEGER | The Maximum size of Set. |
| A | INTEGER ARRAY | The Skill of the Employees. |
| Parent | INTEGER ARRAY | The parent array,Which represents the directed tree.  It is guranteed that parent[1]equals –1 since it is the root of the tree and should have no parent. |

**22. Sort the Array**

You are given an array of N integers A.

You can do the following operation on the array any number of times.

* Choose a subarray of A of length k where 1<=k<=N and sort it.
* The cost of doing this operation is k^3

Find the minimum cost required to sort the array A. Since the answer can be very large output it modulo 10^9 + 7.

**Function Description:**

|  |  |  |
| --- | --- | --- |
| Name | Type | Description |
| N | INTEGER | An integer description size of array A. |
| A | INTEGER ARRAY | The given array. |

Return : The function must return an INTEGER denoting the minimum cost required to sort the array A modulo 10^9+7