Problem 1 : Cryptography

Alice is a cryptographer and uses a key to encrypt any important numbers (home address, phone no etc.). Basically he converts all the decimal numbers to a number system where the key is the base value. Bob, a great stalker has always followed Alice's activities. His final target is to find Alice's key. Now, Bob is in need of a program that converts any decimal number to a *key*-base number system given the value of the number in decimal and the value of *key*.
Write the program for Bob.

Sample Input	Sample Output
`233 (number in decimal)` `3 (value of key)`	22122

Problem 2 : Magic Square Problem

A magic square is a square matrix of distinct numbers (each number is used only once), where the numbers in each row, and the numbers in each column, and the numbers in each diagonal, all add up to the same number. For example, the following is a magic square where the numbers in each row, and in each column and, in each diagonal add up to 15.

6	1	8
7	5	3
2	9	4

Write a C program that takes a square matrix A with n rows as input and checks whether it is a magic square or not.

Problem 3: IPv4 Address

An IPv4 address is a 32 bit address formatted in the following way

a.b.c.d

where **a, b, c, d** are integers each ranging from **0 to 255**. Now you are given two IP addresses, first one in decimal form and second one in binary form, your task is to find if they are the same or not.

Input contains 2 lines. First line contains an IP address in decimal form, and second line contains an IP address in binary form. In binary form, each of the four parts contains 8 digits. Assume that the given addresses are valid.

Sample Input	Sample Output
`192.168.0.100` `11000000.10101000.00000000.11001000`	No
`65.254.63.122` `01000001.11111110.00111111.01111010`	Yes

Problem 4: Odd and Even

Gauss is a mathematician and loves to play with numbers. He loves the numbers that can be expressed as a product of one even and one odd number (except 1) . (e.g. 10 can be expressed as 2*5 where 2 is even, 5 is odd, so Gauss loves the number 10). Write a program that takes an array of integers as input and counts how many number Gauss loves.

[Hint: Write a function that takes an integer as an argument and returns 1 if it can be expressed as a product of an even and an odd number, otherwise returns 0. Use the function in the main program.]

Problem 5: Plagiarism

Your neighbor is a famous writer who suspects someone has plagiarized one of his books. He asked for your help to write a program that, given a paragraph from his book, and the sentence he suspects to be plagiarised, determines if the suspicious sentence occurs in his paragraph.

Sample Input	Sample Output
`The great hall of winterfell was hazy`	No

with smoke and heavy with the smell of roasted meat.Its grey stone walls were draped with banners. White,gold and crimson. The mother of dragons was not so kind.	
They crossed the desert for another two days in silence. The alchemist had become much more cautious. As they moved along, the boy tried to listen to his heart. The alchemist had become much more cautious.	Yes

Problem 6: Bob the Builder

Bob has bought some rods and he has to make a rod of **N** feet using them. He may merge two or more consecutive rods to make the **N** feet rod. However, he is not allowed to cut any rod (the original length of the rods won't be changed).

Write a C program that takes the number of rods and their lengths as input and checks whether there is a consecutive series of rods that may do the work of Bob.

[Hint: Check maximum subarray sum problem]

Sample Input	Sample Output
6(number of rods) 8 | 2 | 3 | 4 | 1 | 3 (Hence each element is the length of the rods.) 10 (value of **N)**	Yes. Can be done by merging 1st and 2nd rod. (8+2 = 10)

Problem 7 : Fermat number

In mathematics a Fermat number, named after Pierre de Fermat who first studied them, is a positive integer of the form

where n is a nonnegative integer. The first few Fermat numbers are:

3, 5, 17, 257, 65537, 4294967297, 18446744073709551617,...

Write down a program that will take an integer y as input and will determine whether the number is a Fermat number or not.

[Hint: Given two integers n and x as parameter where n > x and x> 1, write down a C function

int powerOfX (int n, int x)

that will check whether n = x^y , for some y >= 0, i.e. the number n is a power of x or not and return the value of y if so. If not, return -1. Use this function to solve fermat number problem.]

Sample Input	Sample Output
190	Not a fermat number
257	Fermat number

Problem 8 : Fake Tickets

A corrupted railway staff has copied some of the tickets of Intercity Subarna Express and sold them to some customers. The TTE of the train spotted the fact and listed the ticket numbers of all passengers. The duplicate ones are assumed to be bought illegally from the railway stuff.

Write a program that finds out the number of tickets bought from the stuff given the number of passengers and the ticket numbers of all passengers.

Sample Input	Sample Output
7 21 12 114 132 114 12 48	2
10 31 112 123 98 123 34 34 112 35 98	4

Problem 9 : Pokemon Lovers

Salman and ashiq are pokemon lovers. They like to collect Pokemon cards. Both collected a set of cards and like most boys of their age, they like to trade their cards. But while trading they don't trade the cards they already have. Besides, the cards are traded in a single operation: Alice gives Betty N distinct cards and receives back other N distinct cards. Also, they may have identical cards and they don't bother about it.

The boys want to know what is the maximum number of cards they can trade. For instance, if Alice has cards {1, 1, 2, 3, 5, 7, 8, 8, 9, 15} and Betty has cards {2, 2, 2, 3, 4, 6, 10, 11, 11}, they can trade at most four cards (5-4, 7-6, 8-10, 9-11).

Write a program that given the sets of cards owned by Alice and Betty, determines the maximum number of cards they can trade.

[Hint: Do A-B and B-A. If count(Array) is a function that counts the number of elements in Array, then find min(count(A-B), count(B-A)]

Problem 10 : Name Initials

Write a program that takes a person's name as input and prints the name initial as output. Name initial consists of the first letter of each word in his name. Suppose, each word is separated by exactly one space.

Sample Input	Sample Output
Md Kamrul Islam	MKI
`Momtaz Uddin`	MU

Problem 11: Potatoes produce Pringles

A sentence is called a *tautogram* if all of its words start with the same letter. Like :

1. Potatoes produce pringles
2. Roys ran rat race
3. Flowers flourish from florida

Write a program that takes a sentence as input and checks whether it is a tautogram or not.

Sample Input	Sample Output
Potatoes produce pringles	Tautogram
`I love to have cold coffees.`	Not Tautogram.

Problem 12: Lover Poet

Alef is a poet who likes to amaze his girlfriend with his poems. While writing poems, some words(strings) come to alef's mind randomly and then alef thinks whether these words can be rhymed or not.

The criteria for rhyming is that the last character of the previous string should be same as the first character of the next string. If such a pattern exists then the output should be YES else NO.

Sample Input	Sample Output
Alef sunshine faces	Yes. ['Alef faces sunshine']
Dew Drops	No.

Problem 13: Twin Primes

Two numbers are called twin primes if they are both prime and has a difference of 2. So, (5,7), (11,13) etc are twin primes. Write a program that takes n as input and prints all the twin primes from 1 to n.

Sample Input	Sample Output
5	3,5
11	3,5 5,7

Problem 14: Anagram

Two words are called anagrams of one another if their letters can be rearranged to form the other words. Like, “listen” and “silent” are anagrams of each other as they contain the same letters exactly the same number of times, thus can be rearranged to form each other.

Write a program that takes two strings as input and checks whether they are anagrams or not.

Sample Input	Sample Output
life file	They are anagrams
hill chill	They are not anagrams

Problem 15: Parentheses Balance

A set of parentheses are said to be balanced if there is a closing parentheses ‘)’ for every opening parentheses ‘(‘.

Write a program that given a set of parentheses as string and checks whether the parentheses is balanced or not.

Sample Input	Sample Output
(())()	Balanced
)(()	Not Balanced

Problem 16: Thief

A thief entered a house with an empty bag that can carry at most N kilograms of weights. There he found N items of weigh *w1, w2, w3, ... , wN* gradually. The price value of those items are *p1,p2,p3, ... , pN* gradually. The thief takes as much as he can in his bag (upto N kilograms). Being very greedy and knowing the prices of the items, he takes the item with more price first.

He may take fractional amount of an item. Find out how much price value in total he can take away with his bag.

[Hint:

```
Total_value = 0;
while N != 0 do:
        i  = index of maximum element in p array
        if(N < w[i]) : w = N- w[i] // Can take the remaining part
        else:  w = w[i] // Can take the full part
        N = N - w
        P[i] = -1
        Total_value = Total_value + p[i]*w[i]
```

]

Problem 17: Minimum Time interval

Given a list of 24-hour clock time points in "Hour:Minutes" format, find the minimum time interval among the adjacent clock times.

23.59 00.01 21:30	2 mins
20:00 21:30 21:45	15 mins

Problem 18: Maximum Time interval

Given a list of 24-hour clock time points in "Hour:Minutes" format, find the maximum time interval among the adjacent clock times.

23.59 00.01 01:30	89 mins
20:00 21:20 21:45	80mins

Problem 19: Big Integer Sum

Big integers that can't be stored in 4 byte space, can be stored in an array where each digit of the number represents one element of the array. If the number is of n digits, the most significant digit is stored in array[0] and the least significant is stored in array[n-1].

Write a program that takes two integers as input in this array form and print their summation. Be aware of the carries while doing the summation.

Sample Input	Sample Output
2000000000 2133250343	4 1 3 3 2 5 0 3 4 3
2003029302 1001020303	3 0 0 4 0 4 9 6 0 5

Problem 20: Buildings

Beside a narrow road in Dhaka, buildings are arranged in a row. Two buildings are said to be blockers if the height of the buildings between them in the row are less than them. Write a program that takes the number of buildings beside the road and their heights as inputs and finds the blockers with the maximum span or distance between them.

6 65 40 68 55 50 76	Index 2: 68 Index 5: 76
8 50 40 45 60 70 50 76 67	Index 0: 50 Index 3: 60

Problem 21: Rich kids of Dhaka

Samin and Zohayer are two rich kids of Dhaka each owning a porsche. One day, they went on a bet over whose porsche is faster. Samin told that he had driven a long way in only 45 minutes. Zohayer argued that he had driven a longer way at the same time. Then Samin provided a sequence of places he had been to. Zohayer also provided a sequence of places he had been to. Each place is denoted by a character. So, sequence of places is basically a sequence of characters or string.

Write a program that takes those sequence of places and checks whether they are same or not. Please note that sequences are circular that means the first character of the sequence again comes after the last character. For example, in sequence "GJIKCP" , G again comes after P. So, "GJIKCP" and "IKCPGJ" are the same sequences.

GJIKCP IKCPGJ	Same sequence
GJIKCP IKCPJG	Not Same sequence

Problem 22: Game of life

Given a board with m by n cells, each cell has an initial state live (1) or dead (0). Each cell interacts with its eight neighbors (horizontal, vertical, diagonal) using the following four rules (taken from the above Wikipedia article):

1. Any live cell with fewer than two live neighbors dies, as if caused by under-population.
2. Any live cell with two or three live neighbors lives on to the next generation.
3. Any live cell with more than three live neighbors dies, as if by overpopulation..

4. Any dead cell with exactly three live neighbors becomes a live cell, as if by reproduction.

Write a program that computes the next state (after one update) of the board given its current state. The next state is created by applying the above rules simultaneously to every cell in the current state, where births and deaths occur simultaneously.

Sample Input	Sample Output
[0,1,0] [0,0,1] [1,1,1] [0,0,0]	[0,0,0] [1,0,1] [0,1,1] [0,1,0]

Problem 23: Jump

A mouse has to overcome some stones to get to the house of his friend mouse. While overcoming the stones, for the stones that are higher than the height of their previous stone, the mouse needs to do a jump. In other cases, it doesn't have to give any jump and can simply walk.

Write a program that takes the number of stones and their heights as inputs and finds out how many jump the mouse needs to reach his friend.

Sample Input	Sample Output
5 (number of stones) 10 | 12 | 9 | 8 | 12	2 Jumps (1 from 10 to 12, another from 8 to 12)

Problem 24: Crazy Frog

In a shooting game called crazy frog, the gamer is a frog and he has to survive the shots by the opponent hunter. For each shot, the frog can either stand still or jump. If he stands still and the shot is at height 1 or 2, then he gets hit. If he jumps and the shot is at a height above 2, then he

is also hit. Otherwise, he is not hit. Given the height of each shot and a sequence of jumps, how many hits will the frog take?

Sample Input	Sample Output
9 (number of shots) 1 3 2 3 3 1 2 2 1 JJSSSJSSJ	4

Problem 25: How many deletes

You are given a string containing characters A and B only.Your task is to change it into a string such that there are no matching adjacent characters. To do this, you are allowed to delete zero or more characters in the string.

Your task is to find the minimum number of required deletions.

Sample Input	Sample Output
AABBA	2
ABBAAAB	3

Problem 26: Gemstone

John has collected various rocks. Each rock has various minerals embedded in it. Each type of mineral is designated by a lowercase letter in the range ascii[a-z]

There may be multiple occurrences of a mineral in a rock. A mineral is called a gemstone if it occurs at least once in each of the rocks in John's collection.

Given a list of minerals embedded in each of John's rocks, display the number of types of gemstones he has in his collection.

For example, the array of mineral composition strings arr=[abc,abc,bc]

The minerals b and c appear in each composite, so there are 2 gemstones.

Sample Input	Sample Output
3 abc abc bc	2 (The minerals b and c appear in each composite, so there are 2 gemstones.)

Problem 27: Sherlock Homes

Watson gives Sherlock an array of integers. His challenge is to find an element of the array such that the sum of all elements to the left is equal to the sum of all elements to the right. For instance, given the array ,

arr=[5, 6, 8, 11], 8 is between two subarrays that sum to 11. You will be given arrays of integers and must determine whether there is an element that meets the criterion.

Sample Input	Sample Output
4 5 | 6 | 8 | 11	8
5 5 | 5 | 10 | 4 | 6	10

Problem 28: Ice Cream

Sunny and Johnny like to pool their money and go to the ice cream parlor. Johnny never buys the same flavor that Sunny does. The only other rule they have is that they spend all of their money.

Given a list of prices for the flavors of ice cream, select the two that will cost all of the money they have.

For example, they have m=6 to spend and there are flavors costing cost=[1,3,4,5,6]. The two flavors costing 1 and 5 meet meet the criteria. Using 1-based indexing, they are at indices

1 and 4.

Sample Input	Sample Output
5 (number of ice creams) 1 3 4 5 6	1 and 4