# INFORMATICS OLYMPIAD-PROBLEM LIST

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1) You are given an array of N integers which is a permutation of the first N natural numbers. You can swap any two elements of the array. You can make at most K swaps. What is the largest permutation, in numerical order, you can make?

**Input Format**
The first line of the input contains two integers, N and K, the size of the input array and the maximum swaps you can make, respectively. The second line of the input contains a permutation of the first N natural numbers.

**Output Format**
Print the lexicographically largest permutation you can make with **at most** K swaps.

**Sample Input**
5 1

4 2 3 5 1

**Sample Output**

5 2 3 4 1

2) You are given two arrays, A and B, both containing integers.
A pair of indices (i,j) is *beautiful* if the i'th element of array is equal to the j'th element of array . In other words, pair is *beautiful* if and only if A[i]=B[j].
Given A and B, there are k pairs of beautiful indices . A pair of indices in this set is *pairwise disjoint* if and only if for each 0<=x<y<=k-1 it holds that i(x) != i(y) and j(x)!=j(y) .
Change exactly 1 element in B so that the resulting number of *pairwise disjoint beautiful* pairs is maximal, and print this maximal number to stdout.

**Input Format**

The first line contains a single integer,N (the number of elements in A and B ).
The second line contains N space-separated integers describing array A .
The third line contains N space-separated integers describing array B .

**Output Format**

Determine and print the maximum possible number of pairwise disjoint beautiful pairs.

Note: You must first change 1 element in B , and your choice of element must be optimal.

3) Given a list of N integers, your task is to select K integers from the list such that its *unfairness* is minimized.

If (x1,x2,x3⋯x4) are numbers selected from the list , the unfairness is defined as :

max(x1,x2,x3,⋯xk) - min(x1,x2,x3,x4⋯xk)

where *max* denotes the largest integer among the elements of K , and *min* denotes the smallest integer among the elements of K.

**Note**: Integers in the list may not be unique.

**Input Format**
The first line contains an integer N .
The second line contains an integer K .
N lines follow. Each line contains an integer that belongs to the list N.

**Output Format**
An integer that denotes the minimum possible value of *unfairness*.

4) Given a positive integer, print the next smallest and the next largest number that have the same number of '1's in their binary representation.

5) A child is running up a staircase with n steps and can hop either 1 step, 2 steps or 3 steps at a time. Implement a method to count how many possible ways the child can run up the stairs.

6) Imagine a robot sitting on the upper left corner of grid with r rows and c columns. The robot can move in two directions, right and down, but certain cells are "off limits" such that

the robot cannot step on them. Design an algorithm to find a path for the robot from the top left to the bottom right.

7) Given an array of integers, find the length of the longest arithmetic progression in the array.

( Try finding the sum of the integers involved in the AP as a bonus-hard problem ).

8) Write a recursive function to multiply two positive integers without using the "*" operator. You can use addition, subtraction, and bit-shifting, but you should minimize the number of those operations.

9) Write a function to determine the number of bits you would need to flip to convert integer A to integer B.
( Use binary representation. )

10) There is a building of N floors. If an egg drops from the K-th floor or above, it will break. If it's dropped from any floor below K, it will not break. You're given two eggs. Find N, while minimizing the number of drops for the worst case

11) Given a string, write a code to check if it is a permutation of a palindrome.

12) Implement a method to perform basic string compression using the counts of repeated characters. Fr example, the string aabcccccaaa would become a2b1c5a3. If the "compressed" string would not become any smaller than the original string, your method should return the original string. You can assume the string has only uppercase and lowercase letters of the English alphabet. (a-z).

13) You are given a binary tree in which each node contains an integer value ( which might be positive or negative). Design an algorithm to count the number of paths that sum to a given value. The path does not need to start or end at the root of a leaf, but it must go downwards ( travelling only from parent nodes to child nodes ).

14) Write an algorithm that outputs the power set of a given set of integers.

15) Jack is a greedy boy and in front of him there are **n** islands and on every island he visits he either have to pay some amount of gold or will earn some amount of gold.

You are given the information on which island he gets how much profit or loss.

**$A_1$, $A_2$, ..., $A_n$** are the profit or loss in the respective islands.

But he has few restrictions

1. He have to start from island number 1 and must end on island number **n**.

2.He also has a jumping capacity **L** in the beginning. Suppose he is on the island **m** and has jumping capacity **k** on that instance then he can jump from island **m** to island **m + d**where **d** divides **k** and after this jump his jumping capacity will change to **d**.

As Jack is a greedy boy he will always have the maximum profit.
Can you figure out the maximum profit he can collect?

**Input**

The first line contains **N, L** the number of islands and the jumping capacity in island number 1.

The following line contains N space separated integers **$A_1$, $A_2$, ..., $A_n$** these are the respective profit or loss in the respective islands.

**Output**

Print one integer, the maximum profit Jack can collect.

Tips:

**Constraints**

- **2 ≤ N ≤ 50000**
- **2 ≤ L ≤ 50000**
- **-10^9 ≤ L ≤ 10^9**

**Example**

**Input:**

5 4

8

-1

3

-1

3

**Output:**

14

**Explanation**

**Example case 1.** When you start you have jump capacity of 4 and he starts with a profit of 8. Next he jumps two times and he is on island number 3 with a total profit of 11 and jump capacity of 2, the he jumps two times and he is on island number 5 with total profit 14. This is the maximum he can get. Any other sequence of jumps cannot get him more profit than 14

16) N people live in Sequence Land. Instead of a name, each person is identified by a sequence of integers, called his or her id. Each id is a sequence with no duplicate elements. Two people are said to be each other's relatives if their ids have at least K elements in common. The extended family of a resident of Sequence Land includes herself or himself, all relatives, relatives of relatives, relatives of relatives of relatives, and so on without any limit.

Given the ids of all residents of Sequence Land, including its President, and the number K, find the number of people in the extended family of the President of Sequence Land.

For example, suppose N = 4 and K = 2. Suppose the President has id (4, 6, 7, 8) and the other three residents have ids (8, 3, 0, 4), (0, 10), and (1, 2, 3, 0, 5, 8). Here, the President is directly related to (8, 3, 0, 4), who in turn is directly related to (1, 2, 3, 0, 5, 8). Thus, the President's extended family consists of everyone other than (0, 10) and so has size 3.

**Input format**

- Line 1: Two space-separated integers, N followed by K.

- Lines 2 to N + 1: Each line describes an id of one of the residents of Sequence Land, beginning with the President on line 2. Each line consists of an integer p, followed by p distinct integers, the id.

**Output format**

The output consists of a single integer, the number of people in the extended family of the President.

### Test Data

The testdata is grouped into two subtasks. In both subtasks, $1 \le N \le 300$ and $1 \le K \le 300$. Each number in each id is between 0 and 109 inclusive.

- **Subtask 1** [30 points]: The number of elements in each id is between 1 and 10 inclusive.
- **Subtask 2** [70 points]: The number of elements in each id is between 1 and 300 inclusive.

### Example

Here is the sample input and output corresponding to the example above.

### Sample input

4 2

4 4 6 7 8
4 8 3 0 4
2 0 10
6 1 2 3 0 5 8

### Sample output

3

**Note**: Your program should not print anything other than what is specified in the output format. Please remove all diagnostic print statements before making your final submission.

17) Find the smallest number such that the sum of it's digits is **N** and it is divisible by $\mathbf{10^N}$.If no such number exists, print -1.

18) Chef recently learned about concept of periodicity of strings. A string is said to have a period **P**, if **P** divides **N** and for each i, the i-th of character of the string is same as **i-P**$^{th}$character (provided it exists), e.g. "abab" has a period **P = 2**, It also has a period of **P = 4**, but it doesn't have a period of 1 or 3.

Chef wants to construct a string of length **N** that is a palindrome and has a period **P**. It's guaranteed that **N** is divisible by **P**. This string can only contain character 'a' or 'b'. Chef doesn't like the strings that contain all a's or all b's.

Given the values of **N, P**, can you construct one such palindromic string that Chef likes? If it's impossible to do so, output "impossible" (without quotes)

### Input

The first line of the input contains an integer **T** denoting the number of test cases.

The only line of each test case contains two space separated integers **N, P**.

### Output

For each test case, output a single line containing the answer of the problem, i.e. the valid string if it exists otherwise "impossible" (without quotes). If there are more than possible answers, you can output any.

### Constraints

- **1 ≤ T ≤ 20**
- **1 ≤ P, N ≤ $10^5$**

### Subtasks

- **Subtask #1** (25 points) : **P = N**
- **Subtask #2** (75 points) : No additional constraints

### Example

### Input

5

3 1

2 2

3 3

4 4

6 3

### Output

impossible

impossible

aba

abba

abaaba

**Explanation**

**Example 1**: The only strings possible are either aaa or bbb, which Chef doesn't like. So, the answer is impossible.

**Example 2**: There are four possible strings, aa, ab, ba, bb. Only aa and bb are palindromic, but Chef doesn't like these strings. Hence, the answer is impossible.

**Example 4**: The string abba is a palindrome and has a period of 4.

**Example 5**: The string abaaba is a palindrome and has a period of length 3.

19) Uncle Shiva is an avid collector of books. In his study he has two long shelves with *N* books in each of them. He has invited the artist Lavanya to decorate his study. Lavanya feels that the arrangement of books in the two shelves is not aesthetic. She has come up with a measure for the elegance of the two shelves called *Skew*. The *Skew* of the two bookshelves is defined to be the sum of the heights of the tallest books in each of the two shelves.

Lavanya recommends rearranging the books between the two shelves so that the *Skew* is as small as possible. On the other hand, Uncle Shiva prides himself as a balanced personality and always wants the two shelves to have an equal number of books, *N* in each.

Lavanya is an artist, she merely recommends what needs to be done, leaving the actual rearranging to Uncle Shiva. Uncle Shiva on the other hand is lazy and would like to do very little work. As a compromise, Uncle Shiva is willing to exchange books between the two shelves *K* times and would like to do these exchanges cleverly so as to make the *Skew* as small as possible (via *K* swaps).

For example, suppose each shelf contained 5 books, where the heights of the books on the first shelf are 3, 5, 2, 7 and 1, and the heights of the books on the second shelf are 14, 2, 3,

10 and 4. The *Skew* of this arrangement is 7 + 14 = 21. If $K = 1$, i.e., Uncle Shiva is willing to exchange only one book between the two, he can swap the book with height 2 in shelf 1 with the book with height 14 in shelf 2 and this will increase the *Skew* to 24! On the other hand if he swaps the book with height 7 in the first shelf with the book with height 3 in the second shelf then the resulting arrangement has a *Skew* of 5 + 14 = 19. You can verify that if $K = 1$ then this is the smallest *Skew* that can be achieved. So for this case the answer is 19.

Your task is to write a program that takes as input, $N$ – the number of books in each shelf, $K$ – the number of swaps that Uncle Shiva is willing to do, and the heights of the books on the two shelves, and computes the smallest *Skew* value that can be achieved through at most $K$ swaps of books between the two shelves.

### Input format

- There is only one line, which contains $((2 \times N) + 2)$ space separated integers.
- The first two integers are $N$ and $K$.
- The next $N$ integers, give the heights of the $N$ books in the first book shelf.
- The last $N$ integers, give the heights of the $N$ books in the second book shelf.

### Output format

A single line with a single integer giving the minimum *Skew* that can be achieved via at most $K$ swaps between the two bookshelves

### Test data

You may assume that the heights of all the books lie in the range between 0 and $10^8$, both inclusive and that $1 \leq N \leq 10^5$. Note that there may be more than one book with the same height on a bookshelf.

**Subtask 1 (30 Marks)** You may assume that $K = 1$.
**Subtask 2 (70 Marks)** $0 \leq K \leq N$.

### Sample Input

5 1 3 5 2 7 1 14 2 3 10 4

### Sample Output

19

### Explanation

$N = 5,\ K = 1$
The first book shelf contains books with heights {3, 5, 2, 7, 1}.
The second book shelf contains books with heights {14, 2, 3, 10, 4}
This is same as the example explained above, and so the answer is 19.

20) You have a five-quart jug, a three-quart jug, and an unlimited supply of water ( but no measuring cups ). How would you come up with exactly four quarts of water ? Note that the jugs are oddly shaped, such that filling up exactly “half” of the jug would be impossible.

21) Given an even number E, print the two smallest odd numbers that sum to E.