ACM-ICPC AFGHANISTAN

ACM-ICPC First Training BootCamp

Hosted by NetLinks

Sixth Session

Dynamic Programming

Location: NetLinks Plaza

Date:8/16/2018

Time: 01:00pm – 04:30pm

1. Smart Sister

Lina has a string S and its starting index is 1. The string S consists of characters from $1-9$. As she is very intelligent, she wants to test his brother Qurban. She asked her brother Qurban to count the number of even numbered characters (i.e $2,4,6,8$) for every index i ($1\leq i\leq|S|$). For an index i, the result should be calculated from i to the end of the string. As Vinay doesn't know about programming, he wants you to help him find the solution.

Input Format:
First line contains a string S.

Output Format:
Print $|S|$ space-separated integers, the result of every index.

Constraints:
$1 \leq |S| \leq 10^4$

Input:

574674546476

Output

7 7 7 6 5 5 4 4 3 2 1 1

2. Find the Winner

Two friends Kazim and Ali are playing an interesting game. They take turns drawing a ball from a bag which initially contains R red balls and G green balls. Each player draws a ball alternatively and never put it back. The person who is the first to draw a red balls wins. Ali always draws first. If there are no more balls in the bag and nobody has drawn a red ball, the Ali wins.

What is the probability of the Ali winning?

Input Format:
The first line will contain the number of test cases T.
The first line of each test case will contain a number R (number of red balls) and G(number of green balls)

Output Format:
For each test case, print the desired probability.
Constraints:
1<=T<=10
0<=R,G<=10^3

Input

4

2 1

1 1

10 0

3 4

Output

0.666667

0.500000

1.000000

0.6

3. Subset Sum

Give a set of non-negative integers, and a value sum, determine if there is a subset of the given set with sum equal to given sum.

Examples: set[] = {3,34,4,12,5,2}, sum = 9

Output: True //there is a subset (4,5) with sum 9

Input format:

In first line you give the sum value and the second line the values of set.

Output format:

Output True if there is a subset sum to sum else False.

Input:

9

3 34 4 12 5 2

Output:

True

4. Gym

The government of China believes that the health of its citizens is the highest priority. It has devised an **N**-day health plan. During these **N** days, the citizens are encouraged to go to the gym for workouts.

A person may or may not go to the gym on any day. The people of China are a lazy lot, and they don't want to go to the gym for more than one consecutive day. Given the number of days **N**, print the number of ways the **N**-day plan can be completed.

Note that it is possible to not go to the gym on any day at all and still complete the plan.

Input Format:

The first line contains **T**, the number of test cases.

Each test case contains a number **N** denoting the number of days.

Output Format:

Each test case contains a single number denoting the number of ways by which the **N**-day plan may be completed.

Output your answer modulo 10^9+7.

Constraints

$1 <= T <= 60000$

$1 <= N <= 10^{18}$

input:

2

2

3

Output:

3

5

Explanation:

In the first test case the plan can be completed by going only on the first day, only on the second day or on no day at all.

In the second test case, the plan can be completed by any of the following combinations.

{}, {1}, {2}, {3}, {1,3}

5. Cutting the Iron:

Given an Iron of length n inches and an array of prices that contains prices of all pieces of size smaller than n. Determine the maximum value obtainable by cutting up the Iron and selling the pieces. For example, if the length of the Iron is 8 and the values of different pieces are given as follow then the maximum obtainable value is 22 (by cutting in two pieces of lengths 2 and 6)

Length	1	2	3	4	5	6	7	8
Price	1	5	8	9	10	17	17	20

Input format:

The first line is the test case, the second line is the length of the Iron, the next line is the length and price of the Iron, each length and price of Iron is separated by comma (,) and the length and price of Iron is separated by colon (:).

Output Format:

Print the maximum price.

Input:

2

8

1:1,2:5,3:8,4:9,5:10,6:17,7:17,8:20

8

1:3,2:5,3:8,4:9,5:10,6:17,7:17,8:20

Output:

22

24

6. Reading Competition

In a book reading competition, there are N books that should be read. For answering questions for every book, it is
necessary to read the whole book. A high number of books have been introduced and it is not possible to read all of
them. So, every contestant should select and read a few number of books according to the time he or she has.

Your job is to write a program to find maximum number of questions that can be answered by the contestant using
following information:

- Amount of time that contestant can put on reading the book
- Average reading speed ratio (number of page per hour) of every contestant
- List of books and their page counts
- Maximum possible speed (number of page per hour) for reading every book
- Number of question that is selected from each book

Input Format:

The first line of input contains an integer T denoting the number of test cases. Then T test cases follow. Each test case
consists of six lines. The first line consists N the number of books. The second line consists D, the maximum time which contestant can spend for reading. In the next line of input will be P, denoting the average speed of contestant in reading based on pages per hours. The next line contains W space separated positive integers denoting the number of each book's questions in contest and in the fifth line are V space separated positive integers denoting the number of each book's pages. Finally, the sixth line are Y space separated positive integers denoting possible speed for reading each book.

Constraints:
$1 \leq N \leq 100$
$1 \leq D \leq 100$
$1 \leq W[i] \leq 100$
$1 \leq V[i] \leq 100$

Output Format:
Print the maximum possible questions that can be solved within given conditions that you can obtain for each test case
in a new line.

Input:

2

3
40
2
1 2 3
40 50 10
2 2 2
4
50
4
5 8 3 5
100 120 90 100
4 3 2 5

Output:

5
10