Quiz 3: ECS 342/442/642 Competitive Programming

3 pm to 3:55 pm on 20th Feb, 2025

Instructions

- Please show your code to the invigilator and make sure he makes a note of it.

- Suppose your enrollment number is `20001`.

    - Open Linux and create folder `quiz-03-20001`.
    - The folder should contain files `quiz-31-20001.cpp`, `quiz-32-20001.cpp`, and `quiz-33-20001.cpp` corresponding to the following three questions.
    - Zip the folder and upload it at http://172.28.153.65:5000

- Your output should use the following line of code.

```cpp
int main()
{
    int final_output; // or other relevant declaration
    cout << ``20001\t'' << ``Donald Knuth\t'' << final_output << endl;
    //Replace `20001' by your roll number and `Donald Knuth' by your name.
}
```

Questions

1. (10 pts) **Dice Combinations**

   Your task is to count the number of ways to construct sum n by throwing a dice one or more times. Each throw produces an outcome between 1 and 6.

   For example, if $n = 3$, there are 4 ways: (i) $1 + 1 + 1$, (ii) $1 + 2$, (iii) $2 + 1$, and (iv) 3.

   Input: An integer n.

   Output: Print the number of ways modulo $10^9 + 7$.

2. (10 pts) **Removal Game**

   There is a list of n numbers and two players who move alternately. On each move, a player removes either the first or last number from the list, and their score increases by that number. Both players try to maximize their scores. What is the maximum possible score for the first player when both players play optimally?

   Input: The first input line contains an integer n: the size of the list. The next line has n integers $x_1, x_2, \ldots, x_n$: the contents of the list.

   Output: Print the maximum possible score for the first player.

3. (10 pts) **Minimizing Coins**

   Consider a money system consisting of n coins. Each coin has a positive integer value. Your task is to produce a sum of money x using the available coins in such a way that

the number of coins is minimal. For example, if the coins are $\{1, 5, 7\}$ and the desired sum is 11, an optimal solution is $5 + 5 + 1$ which requires 3 coins.

Input: The first input line has two integers n and x: the number of coins and the desired sum of money. The second line has n distinct integers $c_1, c_2, \ldots, c_n$: the value of each coin.

Output The minimum number of coins. If it is not possible to produce the desired sum, print -1.