Quiz 5: ECS 342/442/642 Competitive Programming

2 pm to 2:55 pm on 28^{th} March, 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-05-20001`.
  - The folder should contain files `quiz-51-20001.cpp`, `quiz-52-20001.cpp`, and `quiz-53-20001.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.

```
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) **Dynamic Range Minimum Queries**

   Given an array of n integers, your task is to process q queries of the following types:

   (1) update the value at position k to u

   (2) what is the minimum value in range [a,b]?

   Input: The first input line has two integers n and q: the number of values and queries. The second line has n integers $x_1, x_2, \ldots, x_n$: the array values. Finally, there are q lines describing the queries. Each line has three integers: either "1 k u" or "2 a b".

   Output: Print an integer which is sum of the result of each query of type 2.

   Constraints: The problem has a time limit of 2 seconds.

2. (10 pts) **Distance Queries**

   You are given a tree consisting of n nodes. Your task is to process q queries of the form: what is the distance between nodes a and b?

   Input: The first input line contains two integers n and q: the number of nodes and queries. The nodes are numbered $1, 2, \ldots, n$. Then there are $n-1$ lines describing the edges. Each line contains two integers a and b: there is an edge between nodes a and b. Finally, there are q lines describing the queries. Each line contains two integer a and b: what is the distance between nodes a and b?

   Output: Print sum of q integers which are the answers to above queries.

   Constraints: The problem has a time limit of 2 seconds.

3. (10 pts) **Static Range Sum Queries**

Given an array of n integers, your task is to process q queries of the form: what is the sum of values in range $[a, b]$?

Input: The first input line has two integers n and q: the number of values and queries. The second line has n integers $x_1, x_2, \ldots, x_n$: the array values. Finally, there are q lines describing the queries. Each line has two integers a and b: what is the sum of values in range $[a, b]$?

Output: Print the sum of results of all queries.

Constraints: The problem has a time limit of 1 second.