CSE 4304-Data Structures Lab. Winter 2021

Lab-07

Date: August 22, 2021 (Sunday)

Target Group: All Lab groups

Topic: Segment Tree basics, Lazy Propagation

Instructions:

- Task naming format: fullID_T01L07_1A.c/cpp
- If you find any issues in problem description/test cases, comment in the google classroom.
- If you find any tricky test cases which I didn't include and others might forget to handle, please comment! I'll be happy to add.
- I'll mark the modified portions in BLUE color.

Task-1:

Given an array with **N** elements (indexed from 1 to N) and a Query within range (i,j), your task is to find the minimum value of that range.

Input:
Each test case will have two values (N, Q) in the first line, denoting the total number of elements N and the total number of queries Q.
The following line will take N numbers (A segment tree will be built using these values).
Each of the following Q lines will have two values indicating i & j for each range.

Output:
For each Query, you have to print the minimum value of range (i,j).

Sample Input	**Sample Output**
5 3 78 1 22 12 3 1 2 3 5 4 4	 1 3 12
1 1 10 1 1	 10
6 6 20 50 10 40 90 30 1 6 3 3 5 5 5 6 4 6 3 6	 10 10 90 30 30 10

Note: Maximum complexity of each query should be in O(logN).

Task 2:

Robin Hood likes to loot rich people and help poor people with this money. Instead of mixing the money, he keeps *n* sacks to keep money from different sources separately. The sacks are numbered as 1 to N. With these sacks, he usually performs three types of tasks:

1. Give all the money of i^{th} sack to the poor, leaving it empty.
2. Add a new component (given in input) into j^{th} sack.
3. Find the total amount of money from i^{th} sack to j^{th} sack.

Since he is not a programmer, he seeks your help.

Input:
Each test case will have two values N, Q in the first line denoting the total number of elements (N) and the total number of queries(Q).
The following line will take N numbers.
Each of the following Q lines can have values as:

- 1 i (Give all money from ith sack to the poor and show current status.)
- 2 i v (Add v amount of money to ith sack.)
- 3 i j (Find the total amount of money from ith to jth sack.)

Output:

- Type-1: Print the amount of money that the poor will receive.
- Type-2: Show the current status of the sacks after the update.
- Type-3: Print the total amount from i to j.

Sample Input	**Sample Output**
5 6 3 2 1 4 5 1 5 2 4 4 3 1 4 1 3 3 3 5 1 2	 5 (3 2 1 4 0) 3 2 1 8 0 14 1 (3 2 0 8 0) 8 2 (3 0 0 8 0)

Task 3:

Implement the Query and Update operation for a segment tree maintaining the ‘Lazy-propagation’ property. Test the system for different cases and make sure everything is implemented correctly.

Prepare to explain the whole process clearly in the viva. You are highly recommended to draw the recursion trees for better understanding.