Lab#11

Implementation of Queue

Objective

- To understand the basic concepts of the implementation of queue and its basic operations.

Theory

Queue

The Queue is an abstract data structure, somewhat similar to Stacks. Unlike stacks, a queue is open at both its ends. One end is always used to insert data (enqueue) and the other is used to remove data (dequeue). Queue follows First-In-First-Out methodology, i.e., the data item stored first will be accessed first.
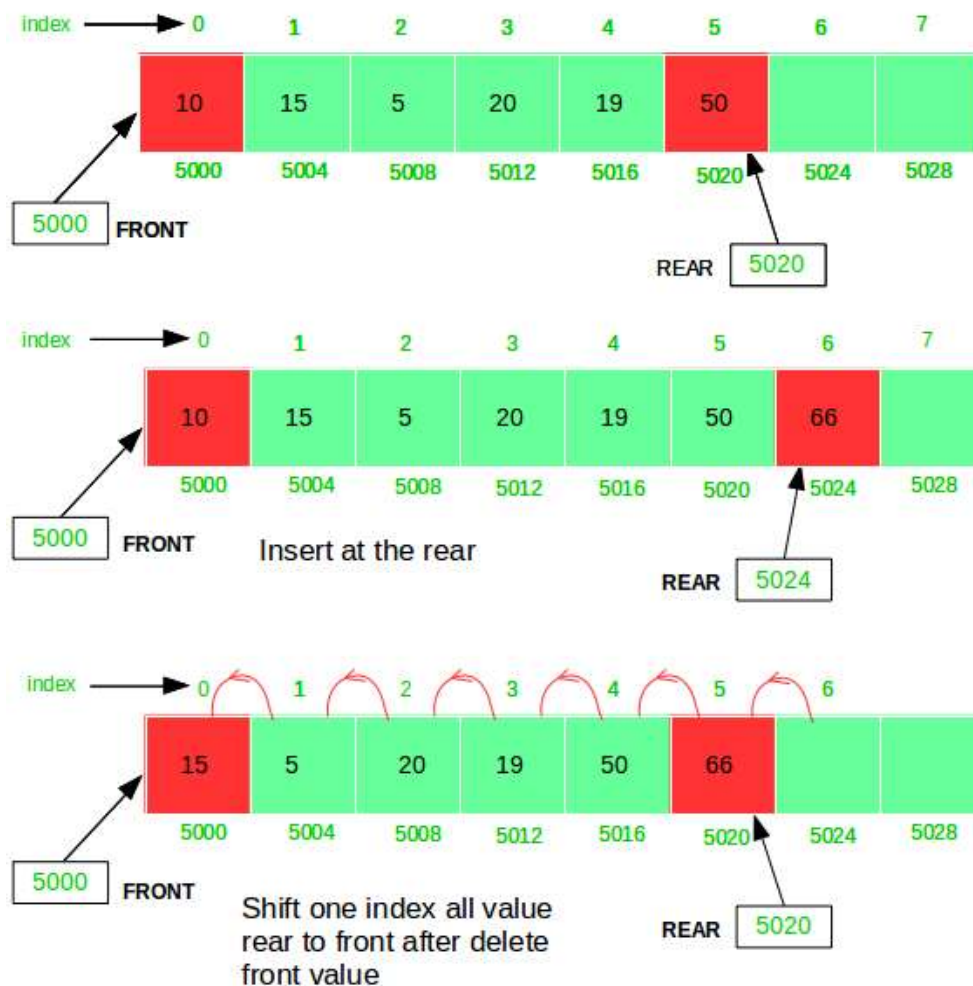

Figure 1 Queue

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Basic Operations

Queue operations may involve initializing or defining the queue, utilizing it, and then completely erasing it from the memory. Here we shall try to understand the basic operations associated with queues.

- enqueue() – add (store) an item to the queue.

- dequeue() – remove (access) an item from the queue.

Example of Queue (Array)

Queue with Array in Java: https://medium.com/@rafia.shaikh61/java-queue-a824d531c426

Queue with Linked List in Java: https://medium.com/@rafia.shaikh61/java-queue-stack-171c1fc6ac4c

Exercise

Tasks

Task Scheduling: Queues can be used to schedule tasks that need to be executed in a specific order. For example, in a web server application, incoming requests can be stored in a queue and processed in the order they were received.
1. Implement using array.
2. Implement using linked list.

[Optional]Bonus Question for Champs😊

Holiday decoration

Recently, the first model of decoration was assembled from multi-colored glowing light bulbs at the holiday jewelry factory. The prototype of the decoration was assembled as follows:

- First, two light bulbs were taken and connected with a wire.
- Then, a light bulb was taken **N-2** times and it was connected with a wire to one of the previously added to the garland light bulbs.

The result was a decoration of **N** colored light bulbs. The factory has **K** bulbs of different colors. When the prototype was ready, it was handed over to the Beauty Department. In this department, it was decided to consider the beauty of jewelry the number of pairs of light bulbs of the same color, connected by a wire.

Employees of the Beauty Department **M** repaint some of the light bulbs in one of the **K** colors for some reason known only to them. All they need to produce the perfect jewelry is to quickly determine the beauty of the product, after repainting the next light bulb. The staff of the beauty department asks you, the **best programmer**, to write a program that will determine the beauty of jewelry according to the given prototype of jewelry and the sequence of repainting light bulbs.

Input format

- The first line contains three integers N, K, M denoting the number of bulbs in the product prototype, the number of repaints, and the number of different colors of bulbs available at the factory.
- The second line contains N positive integers A_i denoting the colors of the bulbs in the order of addition to the product.
- The third line contains N−2 positive integers P_j denoting the number of the light bulb to which the (j+2) light bulb was connected.
- The next M lines contain two integers X and Y denoting the number of the repainted lamp and the color in which it is repainted, respectively. The numbers in the lines are separated by single spaces.

Output format

Print M_j lines. The ith line should contain a single integer denoting the number of pairs of light bulbs of the same color, connected by a wire, after execution and repainting.

Constraints

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$2 \leq N \leq 3 * 10^5$

$1 \leq M \leq 3 * 10^5$

$1 \leq K \leq 10^9$

$1 \leq A_i \leq K$

$1 \leq P_j \leq j+1$

$1 \leq X \leq N$

$1 \leq Y \leq K$

Sample Input	Sample Output
3 3 3 1 2 3 2 2 1 3 1 2 2	1 2 0

Explanation

In the first case, all bulbs are connected in a chain (first-second-third) and have different colors. Then they are repainted in the same color. First, a pair of light bulbs 1 2 becomes a single color (the second light bulb is repainted in color 1), and then 2 3 (the third light bulb is repainted in color 1). After repainting the second bulb in the color of 2 single-color pairs of bulbs connected by a wire, does not remain.

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