

Data Structures And Practices

Assignment 2

Instructions

- Any programming language supported by ideone.com is allowed.
- Use only one programming language to solve both the problems.
- **Submit only a single `txt` file which should contain your code** which will be directly executed on ideone.com with the given input formats for each problem. Anything else won't be accepted as a submission. Especially, refrain from submitting handwritten codes in `pdf` files or URLs to your code.
- **Focus more on correctness of your code.**
- The problems are kept unambiguous and clear. However, if you still have any doubts, first make a public comment on Google classroom and if you don't receive any response for 24 hours then email the TAs.
- Do not post hints/solutions to any of the problems on any public platform.
- **Plagiarism will result in strict penalisation.**
- Please see [sample submission 1.txt](#) and [sample submission 2.txt](#) for the submission format. Note that the code in these sample submissions is just representative of the submission format and is not associated with the solutions of any of the problems below.

Rotate & Sort The List

15 (5+5+5) points

Problem Statement

In this problem, you have to first implement a singly linked list whose each node should have the following attributes,

- `key` - a positive integer
- `next` - address/pointer/reference to the next node in the linked list

You will receive Q_1 queries of following types,

- 1 x - Append a node to the linked list whose `key` should be x . After appending, print, in a new line, the `key` of each node in the linked list separated by a single space.
- 2 x - Delete the node in the linked list whose `key` is x . If such a node is not present in the linked list, no changes should be made. After this, print, in a new line, the `key` of each node in the linked list separated by a single space. The deleted node, if any, should be added in another linked list.

Then you will receive Q_2 queries of the following type,

- k - The linked list should be rotated towards right by $|k|$ steps if $k > 0$, otherwise the linked list should be rotated towards left by $|k|$ steps. k will always be an integer.

Once all of the above Q_2 queries are done, print, in a new line, the `key` of each node in the linked list separated by a single space.

Then you have to merge the two linked lists together after sorting (by `key`), each of them using the merge sort algorithm. Once done, print in a new line, the `key` of each node in the linked list separated by a single space. Note that the linked list in the end should also be sorted by `key`.

Input Format

The first line will contain a positive integer, Q_1 , following which there will be Q_1 lines containing queries as described above. Then the very next line will contain a positive integer Q_2 following which will be Q_2 lines containing queries as described above.

Output Format

$Q_1 + 2$ lines with space separated values of the key of each node in the linked list as explained above.

Constraints

- $0 < Q_1 < 1000$
- $0 < Q_2 < 10000$
- $0 < \text{key}, x < 1000$
- $-100 < k < 100$

Example

Input

For this problem, your program should accept the input as shown in the box below.

```
5
1 2
1 4
1 6
1 7
2 4
3
1
-1
2
```

Output

For this problem, your program should produce the output as shown in the box below.

```
2
2 4
2 4 6
2 4 6 7
2 6 7
6 7 2
2 4 6 7
```

Explanation

Firstly, there are 5 queries which will be modifying the linked list.

1 2 appends the key 2 to the empty list and the new list is [2], therefore the first line in the output is 2.

1 4 appends the key 4 to the above list and the new list is [2, 4], therefore the second line in the output is 2 4.

1 6 appends the key 6 to the above list and the new list is [2, 4, 6], therefore the third line in the output is 2 4 6.

1 7 appends the key 7 to the above list and the new list is [2, 4, 6, 7], therefore the fourth line in the output is 2 4 6 7.

2 4 deletes the key 4 from the above linked list and the new list is [2, 6, 7], therefore the fifth line in the output is 2 6 7.

Now there are 3 queries for rotating the linked list.

1 rotates the linked list to the right by 1 step and the new list is [7, 2, 6].

-1 rotates the above linked list to left by 1 step and the new list is [2, 6, 7].

2 rotates the above linked list to right by 2 steps and the new list is [6, 7, 2].

Hence the second last line in the output after performing all rotations is 6 7 2.

After sorting, the final line in the output is 2 4 6 7.

Good Tuples

20 points

Problem Statement

In this problem, you will be given an array A of integers of fixed size N and an integer K and you have to find the number of tuples (i, j) such that the following properties are satisfied,

- $A[i] * A[i+1] * A[i+2] \dots A[j-1] * A[j] < K$
- $-1 < i < N$
- $-1 < j < N$
- $i < j + 1$

Note that the array is 0-indexed.

Input Format

The first line will contain integers N and K separated by a single space. The second line will contain N space separated integers.

Output Format

A single line containing the number of tuples.

Constraints

- $0 < N < 5000$
- $-1000 < A[i] < 1000$
- $0 < K < 10^9$

Example

Input

For this problem, your program should accept the input as shown in the box below.

```
4 100
10 5 2 6
```

Output

For this problem, your program should produce the output as shown in the box below.

```
8
```

Explanation

The 8 tuples that satisfy the required properties are: (0, 0), (1, 1), (2, 2), (3, 3), (0, 1), (1, 2), (2, 3), (1, 3).