

Birla Institute of Technology and Science, Pilani Hyderabad Campus
BITS F232: Foundations of Data Structures and Algorithms
2nd Semester 2022-23 (Assignment 1) Max. Marks: 10

Date given: 19.02.2023

Date of submission: 04.03.2023

Q.1 (Linked List): Write a simple [airline ticket reservation](#) program. The program should display a menu with the following options: reserve a ticket, cancel a reservation, check whether a ticket is reserved for a particular person, and display the passengers. The information is maintained on an alphabetized linked list of names. In a simpler version of the program, assume that tickets are reserved for only one flight. In a fuller version, place no limit on the number of flights. Create a linked list of flights with each node including a pointer to a linked list of passengers. You are free to add additional features. A sample output is as shown below:

```
Airline ticket reservation
Enter your choice:
1) For Ticket_reservation
2) For cancel_ticket
3) For check_ticket
4) For display_ticket
5) For end_program

1
passenger name: Amit
flight name: Indigo123
Ticket reserved

Airline ticket reservation
Enter your choice:
1) For Ticket_reservation
2) For cancel_ticket
3) For check_ticket
4) For display_ticket
5) For end_program

1
passenger name: Bibhum
flight name: Indigo123

Airline ticket reservation
Enter your choice:
1) For Ticket_reservation
2) For cancel_ticket
3) For check_ticket
4) For display_ticket
5) For end_program

4
1) Passenger Name: Amit
Flight Name: Indigo123
2) Passenger Name: Bibhum
Flight Name: Indigo123

Airline ticket reservation
Enter your choice:
1) For Ticket_reservation
2) For cancel_ticket
3) For check_ticket
4) For display_ticket
5) For end_program

1
passenger name: Nitin
flight name: AirIndia

Airline ticket reservation
Enter your choice:
1) For Ticket_reservation
2) For cancel_ticket
3) For check_ticket
4) For display_ticket
5) For end_program

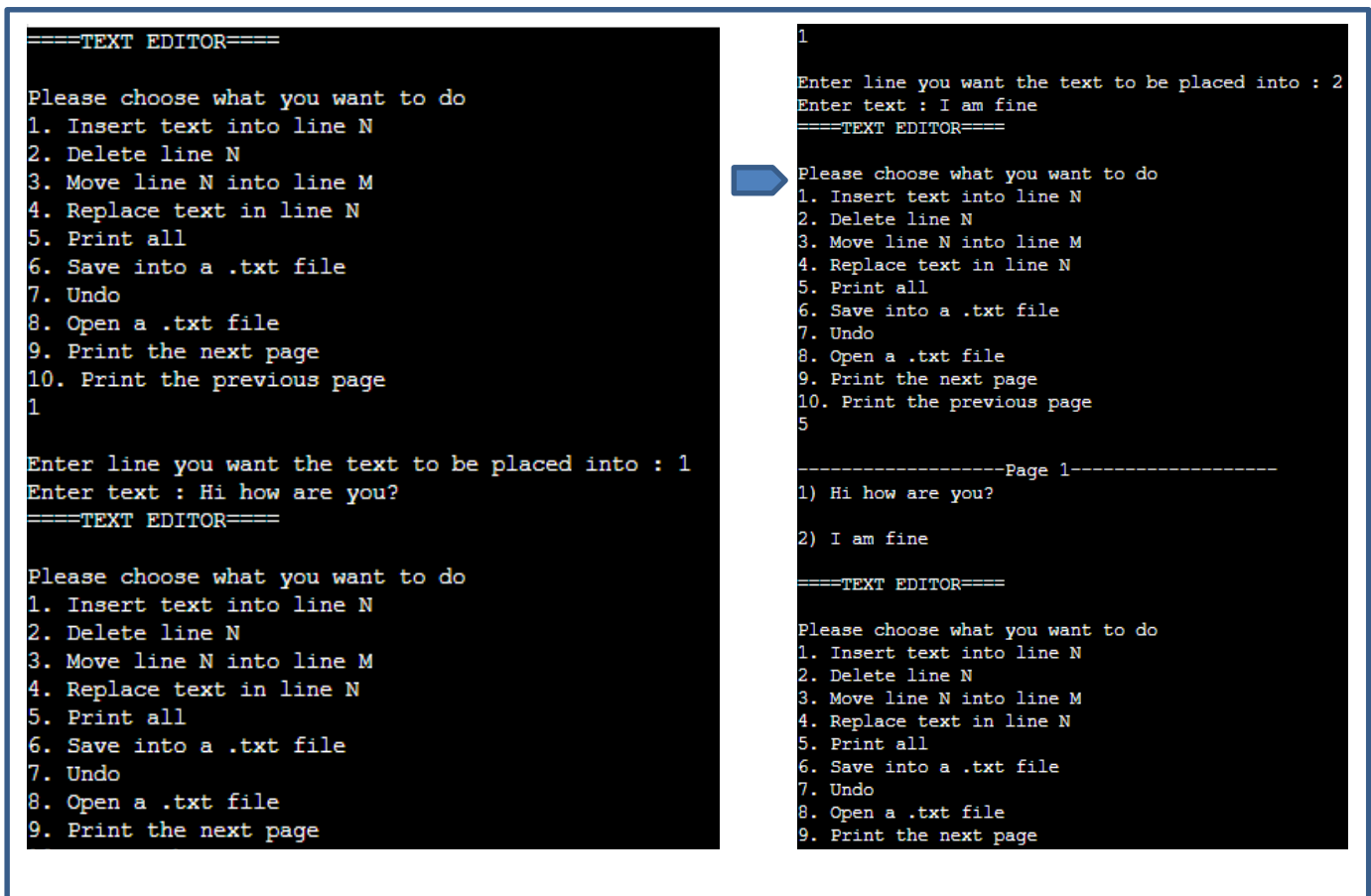
4
1) Passenger Name: Amit
Flight Name: Indigo123
2) Passenger Name: Bibhum
Flight Name: Indigo123
3) Passenger Name: Nitin
Flight Name: AirIndia

Airline ticket reservation
Enter your choice:
1) For Ticket_reservation
2) For cancel_ticket
3) For check_ticket
4) For display_ticket
5) For end_program
```

[3 Marks]

Q.2 (Linked List): Write a C++ program to implement a simple [line/ text editor](#). Keep the entire text on a linked list, one line in a separate node, with advanced features like inserting text into any line n, deleting a line n, moving line n to m, replace text in line n, printing all lines, etc. You are free to add more features of your choice, such as undo, opening and saving on a text file etc. as shown in the sample runs given in the next page. Use linked lists (either singly or doubly) to implement the functionalities of your Text editor.

[3 Marks]



Q.3 (Recursion): An $n \times n$ square consists of black and white cells arranged in a certain way. The problem is to determine the number of white areas and the number of white cells in each area. For example, a regular 8×8 chessboard has 32 one-cell white areas; the square in Figure.a consists of 10 areas, 2 of them of 10 cells, and 8 of 2 cells; the square in Figure.b has 5 white areas of 1, 3, 21, 10, and 2 cells. Write a program that, for a given $n \times n$ square, outputs the number of white areas and their sizes. Use an $(n + 2) \times (n + 2)$ array with properly marked cells. Two additional rows and columns constitute a frame of black cells surrounding the entered square to simplify your implementation. For instance, the square in Figure.b is stored as the square in Figure.c.

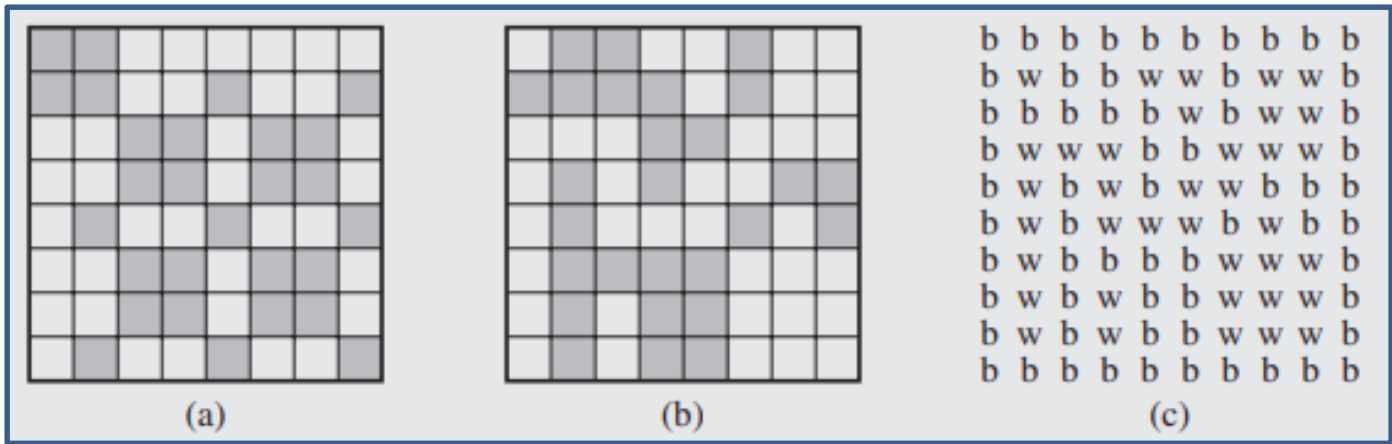


Fig.a and b: Two $n \times n$ squares of black and white cells and Fig.c is a $(n + 2) \times (n + 2)$ array implementing square in Fig.b.

Q.4 (Queue): Assume that Nitya's favorite data structure is Queue. He has first n natural numbers in a random order in a queue. His friend, Samandeep made a bet with him for a Margherita pizza if he can sort the elements. In order to do it, he can use an extra queue and stack. Write a C++ program to determine whether he will be able to get the Margherita on coming Sunday night.

Input: (arrives from the terminal/ Stdin)

Each input consists of several independent test cases, all of which need to be solved correctly to solve the entire input case. The first line contains T ($1 \leq T \leq 100$), giving the number of test cases to be solved. The T test cases follow, each described by a pair of lines. The first line of each pair contains N, and the second line contains n elements which are present in the queue. It is guaranteed that the sum of N over all test cases is at most 10^5 . Values of N might differ in each test case.

Output: (print output on the terminal/ Stdout):

You may write T lines of output, one for each test case:

<p>Sample Input:</p> <pre>2 5 5 1 2 3 4 7 5 1 2 6 3 4 8</pre> <p>Sample Output:</p> <pre>Yes No</pre>	<pre>Enter number of iterations 2 Enter number of elements 5 Enter element 5 Enter element 1 Enter element 2 Enter element 6 Enter element 3 Enter element 4 Enter element 4 Yes</pre>	<pre>Enter number of elements 7 Enter element 5 Enter element 1 Enter element 2 Enter element 6 Enter element 3 Enter element 4 Enter element 8 No</pre>
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Explanation: For the 1st test case:

Pop the first element of the given Queue i.e 5, then push 5 into the stack. Now, pop all the elements of the given Queue and push them to second Queue. Now, pop element 5 in the stack and push it to the second Queue.

For 2nd test case:

Push 5 to stack. Pop 1, 2 from given Queue and push it to another Queue. Pop 6 from given Queue and push to stack. Pop 3, 4 from given Queue and push to second Queue. Now, from using any of above operation, we cannot push 5 into the second Queue because it is below the 6 in the stack.

[2 marks]

Submission Instructions:

You should form your own group of maximum 4 students. This grouping is allowed only for allowing peer learning. However, you need to solve yourself all the questions. There will be a demo and viva for this assignment after submission. You should submit a compressed folder (a zip file) consisting of exe and source files no later than 24:00, 4th March 2023 (Saturday) at google class page (Assignment1). Your submitted code should also run on Ubuntu systems (that are there in the D block: regular labs) for the evaluation purpose. You should also keep a copy of your code. Any clarification or queries regarding this may be emailed to Samandeep Singh (f20200065@hyderabad.bits-pilani.ac.in) or Nitya Shah (f20201443@hyderabad.bits-pilani.ac.in).