



## Indian Institute of Information Technology Sri City, Chittoor

(An Institute of National Importance under An Act of Parliament)

Name: **DSA Lab - 5**

Date: **29/04/2021**

Duration: **3 Hrs**

Maximum Marks: **15**

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### INSTRUCTIONS:

1. Please carefully read all assignment problems and answer in the same .c file.
2. The first **THREE PROBLEMS** are **COMPULSORY** and the **FOURTH one is BONUS PROBLEM** which is **OPTIONAL**.
3. Submit **single .c file** for the first **FOUR PROBLEMS only**. At a time only one code can be used for execution. Rest should be commented.
4. Implement all the problems using the concept of **STACK OR QUEUES** only.
5. Name the file as follows: S2020xxxxx\_A5.c
6. **DO NOT** zip. Just attach single .c file directly to your submission in the common Google classroom.
7. For the first four problems, **print the Time Complexity** and provide the description as **COMMENTS in the code**.

*\*If you do not follow the above instruction, a suitable penalty would be imposed.*

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### ASSIGNMENT PROBLEMS

1. Implement a stack using two queues. Also analyze the running time complexity of the algorithm. **[2 Marks]**
2. Implement two stacks in one array **A[1...n]** in such a way that neither stack overflows unless the total number of elements in both stacks together is n. The PUSH and POP operations should run in  $O(1)$  time. **[3 Marks]**
3. A and B are playing a game. In this game, both of them are initially provided with a **list of numbers**. (**Both have the same list but their own copy**). **[5 Marks]**

Now, they both have a different strategy to play the game. A picks the element from the start of his list. B picks from the **end of his list**.

You need to generate the result in the form of an output list. Method to be followed at each step to build the output list is:

- i. If the number picked by A is **bigger than B** then this step's **output is 1**. B removes the number that was picked from their list.
- ii. If the number picked by A is **smaller than B** then this step's **output is 2**. A removes the number that was picked from their list.
- iii. If both have the **same number** then this step's **output is 0**. Both A and B remove the number that was picked from their list.

This game **ENDS** when atleast one of them has no more elements to be picked i.e. when the **list gets empty**. Print the built output list and analyze the time complexity.

### **BONUS PROBLEM**

4. During this COVID19 outbreak, the gold price is very much unstable. Raja Indraverma is very tensed. He has asked Shiva to analyze the gold price rate. Now Shiva is given a report of  $N$  consecutive days containing the gold price of those  $N$  consecutive days. Shiva has to check for how many days (including the  $i^{\text{th}}$  day) the  $i^{\text{th}}$  price was greater than or equal to its previous consecutive days. After analyzing the report, he will report the final result for each given  $N$  days. Analyze the time complexity of the algorithm. **[5 Marks]**

### **-----PRACTICE PROBLEM-----**

Your task is to construct a tower in  $N$  days by following these conditions:

- **Every day** you are provided with **one disk of distinct size**.
- The disk with larger sizes should be placed at the bottom of the tower.
- The disk with smaller sizes should be placed at the top of the tower.

The order in which tower must be constructed is as follows:

- You cannot put a new disk on the top of the tower until all the larger disks that are given to you get placed.

Print  $N$  lines denoting the disk sizes that can be put on the tower on the  $i^{\text{th}}$  day. If on the  $i^{\text{th}}$  day no disks can be placed, then leave that line empty. Analyze the running time complexity of the algorithm.

*[Hint: All the disk sizes are distinct integers in the range of 1 to  $N$ .]*

\*\*\*\*\* GOOD LUCK \*\*\*\*\*