

**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI  
HYDERABAD**

**CAMPUS,**

**Data Structures and Algorithms**

**CS F211**

**Homework Assignment – 8**

1. Write a menu driven C program to implement a **queue** with 2 **stacks**. Your queue should have an enqueue() and a dequeue() function and it should be "first in first out" (FIFO). Your program must support the following operations.
  - a. Insert an element (enqueue)
  - b. Delete an element (dequeue) – print the element
  - c. Print the elements of the stack (1. stack1, 2. stack2)
  - d. Exit
  
2. Write a menu driven C program to implement a **stack** with 2 **queues**. Your stack should have a push and a pop function and it should be "last in first out" (LIFO). Your program must support the following operations.
  - a. Insert an element (Push)
  - b. Delete an element (Pop) – print the element
  - c. Print the elements of the queue (1. queue1, 2. queue2)
  - d. Exit
  
3. Write a Menu driven program to implement Max Heap data structure asking choices 1 to insert a number (representing priority), 2 to delete maximum number, 3 to find maximum and any other to exit.
  
4. You are given an array comprising of both positive and negative integers. Your job is to now compute the sum of the minimum and maximum elements of all contiguous sub-arrays of size k

Eg: I/P:  $n = 5$  and  $arr[] = \{2, -8, 5, 6, -5\}$

$k = 3$

O/P: -4

Explanation: Subarray 1 =  $\{2, -8, 5\} = -8 \text{ (min)} + 5 \text{ (max)} = -3$

Subarray 2 =  $\{-8, 5, 6\} = -8 + 6 = -2$

Subarray 3 =  $\{5, 6, -5\} = -5 + 6 = 1$

Total Sum =  $(-3) + (-2) + 1 = -4$

5. For a string of '(' and ')' characters, find the length of the longest substring that is a balanced bracket sequence. Find the number of such substrings as well. If there are none, print "0 1".

Sample Input 1: )((()))(())      Output 1: 6 2

Sample Input 2: ))(      Output 2: 0 1

6. Write a menu driven C program to find the  $k^{\text{th}}$  largest element in a max-heap? Your program must support the following operations.
- Insert an element into the max heap
  - Print the elements of the max heap
  - Find the  $k^{\text{th}}$  largest element of the max heap (requires input k)
  - Exit

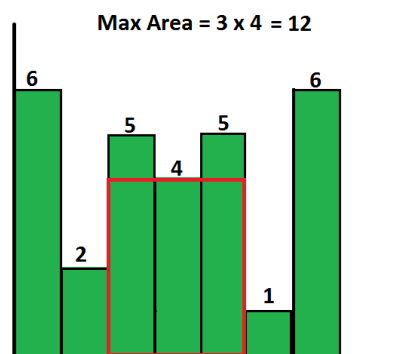
7. Write a C program to sort a given array elements based on heap sort algorithm.

8. In a village N people have bought lottery with different lottery number. The criteria of the winner is : Any lottery number will be broken into different contiguous subsequence (like substring) parts and if product for every digit of a contiguous subsequence are different then that person will win that lottery. There could be multiple winners. You have to read N lottery number (containing only digits) and find out the winners.

Ex : if lottery number is 782 : then he is winner since different contiguous subsequence of 782 is 7, 8, 2, 78, 82, 782 and their product are 7, 8, 2, 56, 16, 112 and all are distinct.

**Note :** You can assume that product of any subsequence cannot exceed 10000.

9. You have been given a histogram and you want to find the largest area in it. Example refer to figure below. Consider the following histogram with 7 bars of heights {6, 2, 5, 4, 5, 2, 6}. The maximum area rectangle is highlighted in red). The largest area here is  $4 \times 3 = 12$  (given that width of each block is 1.) You have to read an array storing the heights of histogram and assume the width to be 1 unit. You have to solve this problem through stack data structure.



10. This question is designed to help you get a better understanding of basic heap operations. You will be given queries of types:

- Add an element to the min-heap.
- Delete the element from the min-heap.
- Print the minimum of all the elements in the min-heap

**NOTE:** *It is guaranteed that the element to be deleted will be there in the heap. Also, at any instant, only distinct elements will be in the heap.*

**Input Format:** The first line contains the number of queries,  $Q$ . Each of the next  $Q$  lines contains a single query of any one of the 3 above mentioned types.

**Constraints:**  $1 \leq Q \leq 10^5$  and  $10^{-9} \leq v \leq 10^9$

**Output Format:** For each query of type 3, print the minimum value on a single line.

-----XXXXXXXXXXXXXXXXXXXXXXXXXXXX-----