**HW 2**

**Question 1 (30 Points):** Let we have a queue and a stack of size 𝑛, where 5 ≤ 𝑛 ≤ 20. Now, write a java code that will take 𝑛 integer values from the user, and then reverse the queue. You need to use the stack to perform this operation and only following standard operations are allowed on queue:

• enqueue(x) : Add an item x to rear of queue.

• dequeue() : Remove an item from front of queue.

• empty() : Checks if a queue is empty or not No built-in functions are allowed.

Text

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**Question 2 (12 Points)**: Here is a pseudocode for the algorithm which is supposed to determine whether a sequence of parentheses is balanced: What will be printed for the following three sequences?

• ())(() - **Unbalanced**

• (()())) - **Unbalanced**

• ((()) - **Balanced**

• (()())())() – **Unbalanced**

**Question 3 (10+20 = 30 Points)**: consider the following expression: 𝐹 = 𝐷 2 + 𝐴 ∗ 𝐶 2 ∗ 𝐶 − 𝐵 + 4𝐶 𝐴 − 2𝐷 3 𝐴

a) Express it by RPN/Postfix notation.

**F = D D \* A C \* 2 / C \* + B – 4 C \* A / + 2 D \* 3 / A / -**

b) Assume, A = D=10, B = 5, C= 30. Implement the RPN notation in a STACK and show final outcome. To earn full credit you must show each step.

**F = 100 -> 100 300 -> 100 150 -> 100 4500 -> 4600 -> 4595 -> 4595 120 -> 4595 12 -> 4607 -> 4607 20 -> 4607 6.66 10 -> 4607 1.49 -> 4605.51**

**Question 4 (12 Points):** In the class, we have seen an array can be used to implement a stack. Now, let’s tweak the problem a little. Can you implement two different stack (say S1 and S2) using a single array? In this case, if you call push1(item), the item will be pushed to S1, and if you call push2(item), the item will be pushed to S2. In the same manner, if you call pop1(), the top item from S1 will be poped, and if you call pop2(), the top item from S2 will be poped. If

• You think the above mentioned operation is possible, describe how it can be done and provide a pseudocode to implement it. Provide adequate comment in your pseudocode, but make sure they are relevant.

**This can be done by using top different tops, pushing, and popping off one array.**

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• You think the above mentioned operation is not possible, describe why it is not possible.

**Question 5 (16 Points)**: Consider the following applications/scenarios. If you have the option to use STACK, QUEUE, Linked List and Graph, which one you should use for which application. Mention clearly at the beginning, and then explain your answer.

1. Your browser deletes the history past one month. **Queue, uses the concept of FIFO. If the browser deletes history after one month, than the browser’s history is storing that webpage as the first item in the queue, and will delete it first.**
2. II. E-commerce websites : category -> subcategories -> products **Graph, you have to go to categories, then subcategories, then products.**
3. III. Music player where you can play next or previous song. **Linked List, basically a doubly linked list. Previous song has a pointer to the current song, and the next song is pointed to from the current song, making it a doubly linked list.**
4. IV. While booking bus/flights, you get list of available routes. **Stack, holds the routes, and can pop off the fastest routes first, slowest routes last.**