TECHNO INDIA UNIVERSITY
WESTBENGAL

Data Structures & Algorithms
(PCC-CS 301)

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Topics Covered

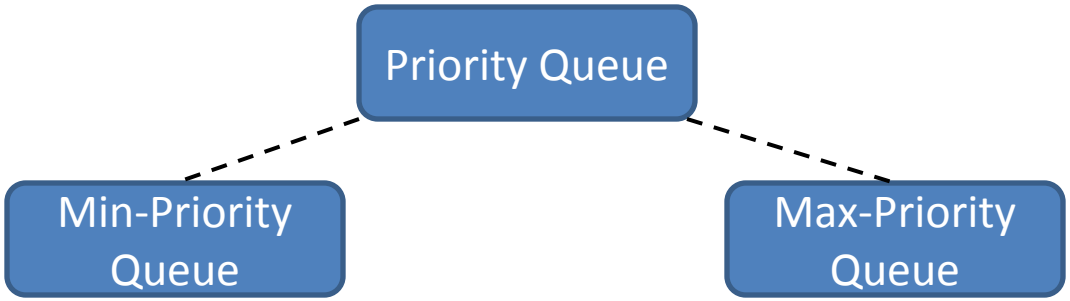
1. Linear Data Structure
   a. Priority Queue
   b. Implementation of Queue using Stack
   c. Implementation of Stack using Queue

Queue

- Priority Queue
  - Properties
    - Each element of the queue will be assigned with a priority
    - An element is processed based on its priority value
      - Higher priority data is processed before the less priority data
    - Priorities are fixed based on various applications
      - Minimum value sometimes considered as highest priority
      - In few applications, maximum data value is regarded as the highest priority
    - Priority queue does not follow **F**irst **I**n **F**irst **O**ut concept

Queue

- Priority Queue



- Min-priority Queue
  - Element with minimum priority is considered as highest priority element and that to be processed first
- Max-priority Queue
  - Element with maximum priority is considered as highest priority element and that to be processed first

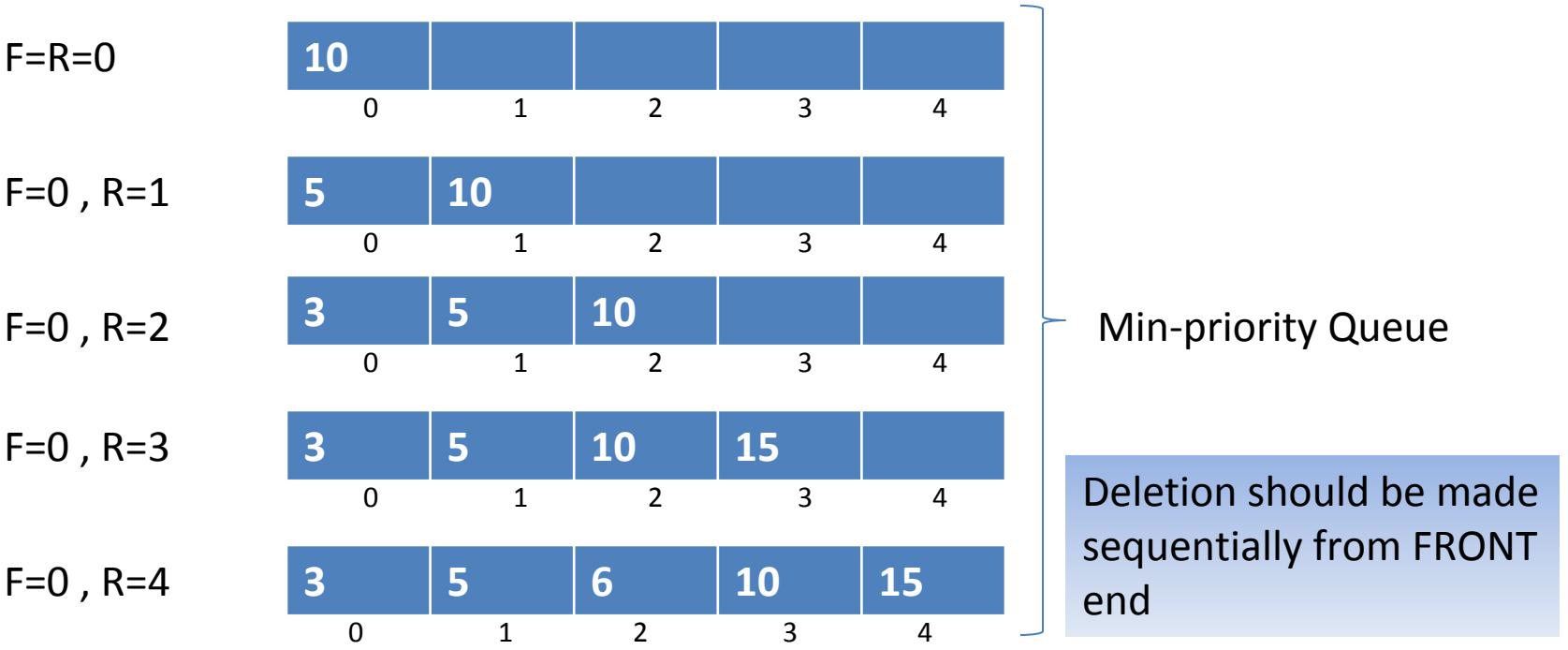
Queue

- Priority Queue
  - Representation
    - Using array
    - Using Heap (non-linear data structure, to be discussed later)
  - Array representation
    - Data can be inserted in a sequence of its priority so that it can be processed (deleted) sequentially from the start index
      - Enqueue requires O(n) and Dequeue requires O(1)
    - Data can be inserted sequentially as it encounters whereas data processing (deletion) is performed by searching the highest priority data present in the list
      - Enqueue requires O(1) and Dequeue requires O(n)

Priority Queue

- Array representation
  - Type- I

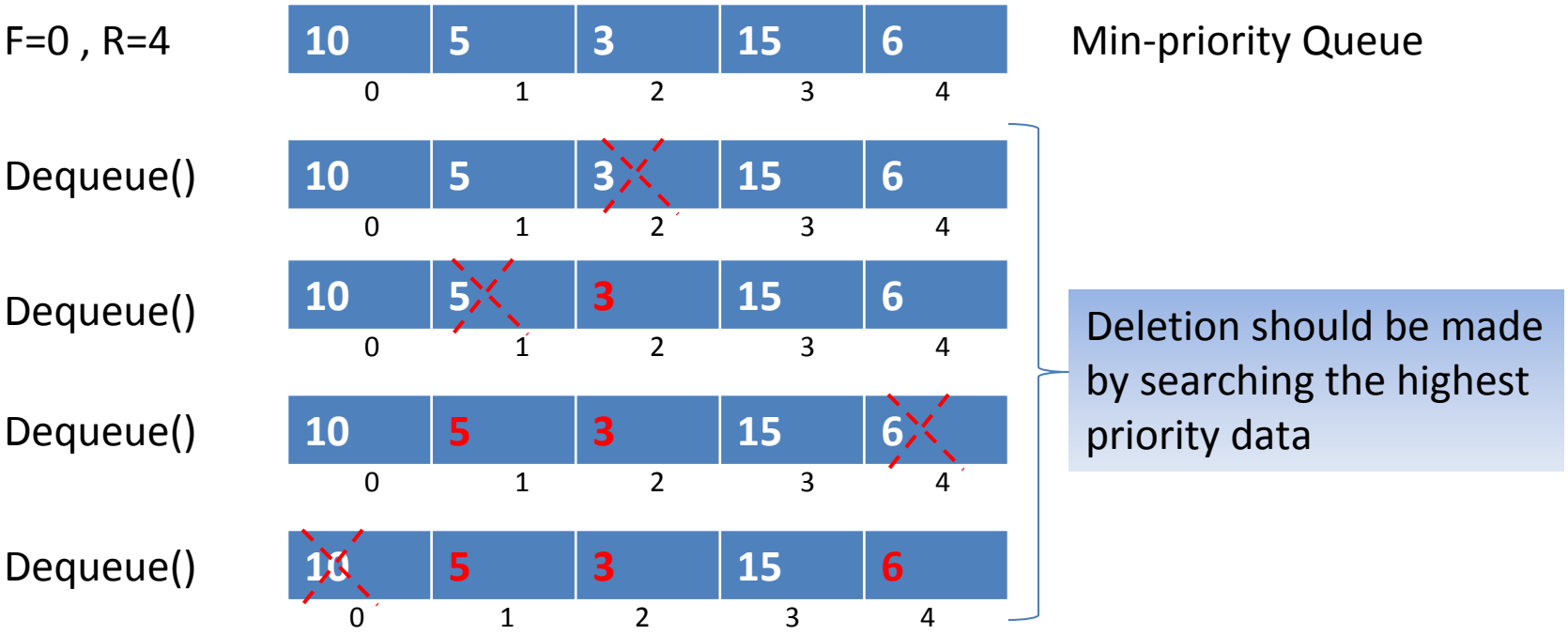
Input data: 10, 5, 3, 15, 6



Priority Queue

- Array representation
  - Type- II

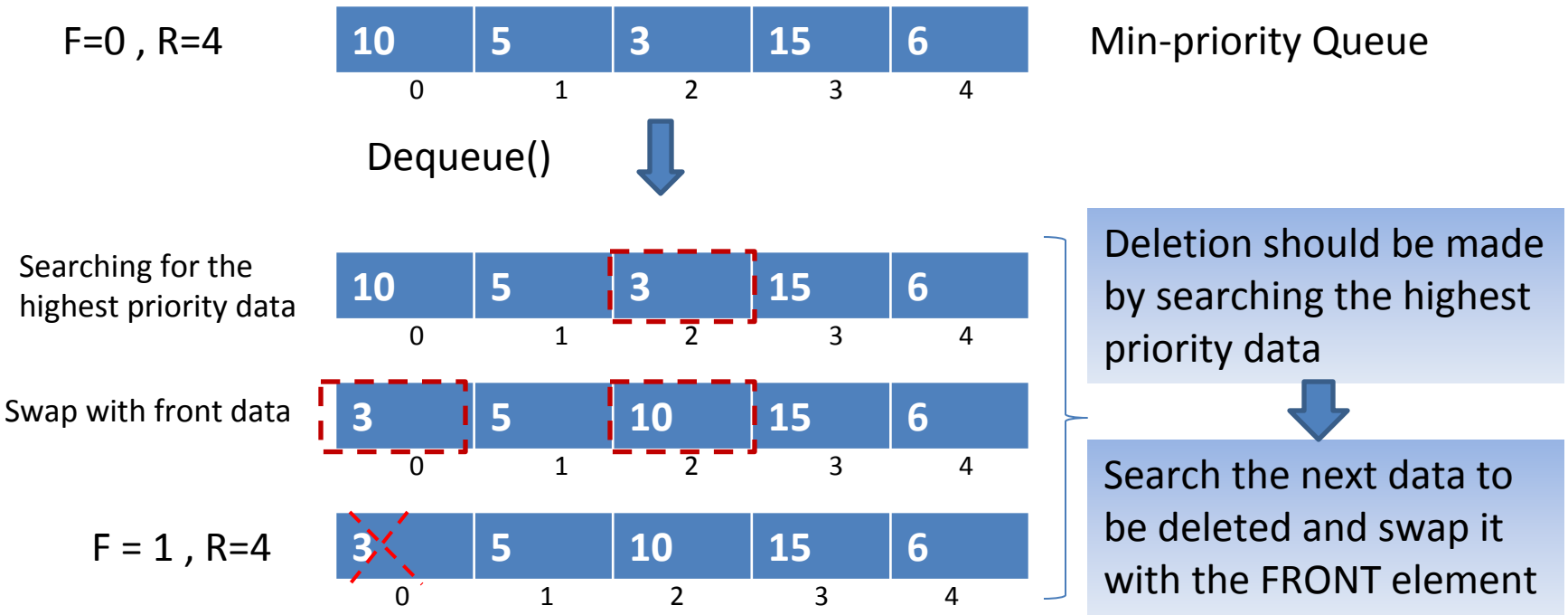
Input data: 10, 5, 3, 15, 6



Priority Queue

- Array representation
  - Type- II (implementation issue)

Input data: 10, 5, 3, 15, 6



Queue using Stack

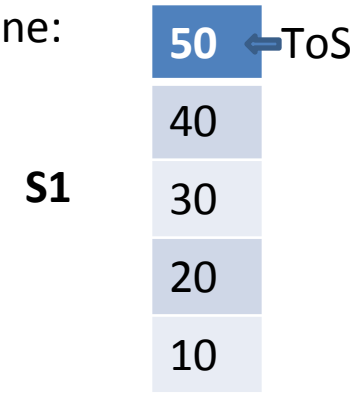
Queue using Stack

- Mechanism
  - We require 2 stacks to implement a Queue
    - Element will be inserted and deleted by following LIFO
    - Element need to be processed like FIFO concept
    - We require one Stack for data storing
    - We require another auxiliary Stack through which the data will be processed
    - We can accomplish the job by making data insertion phase costly or we can make the data deletion phase costly
      - Here, we will insert data normally but delete in costly manner

Queue using Stack

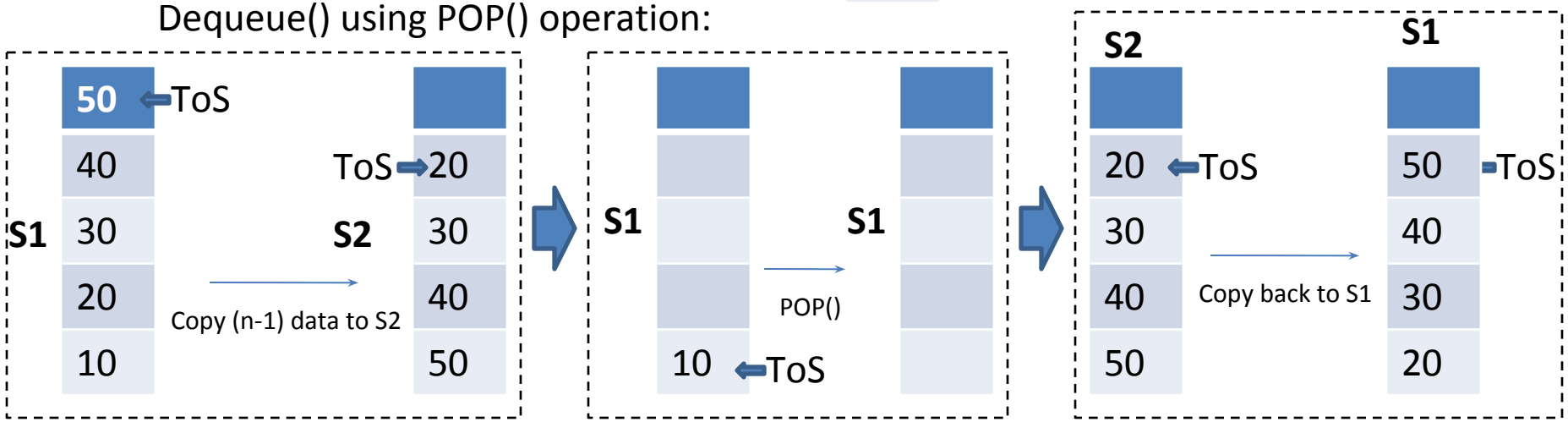
Data : 10 , 20 , 30 , 40 , 50

PUSH all data into stack1 one by one:



S1 : main stack
S2: auxiliary stack

Dequeue() using POP() operation:

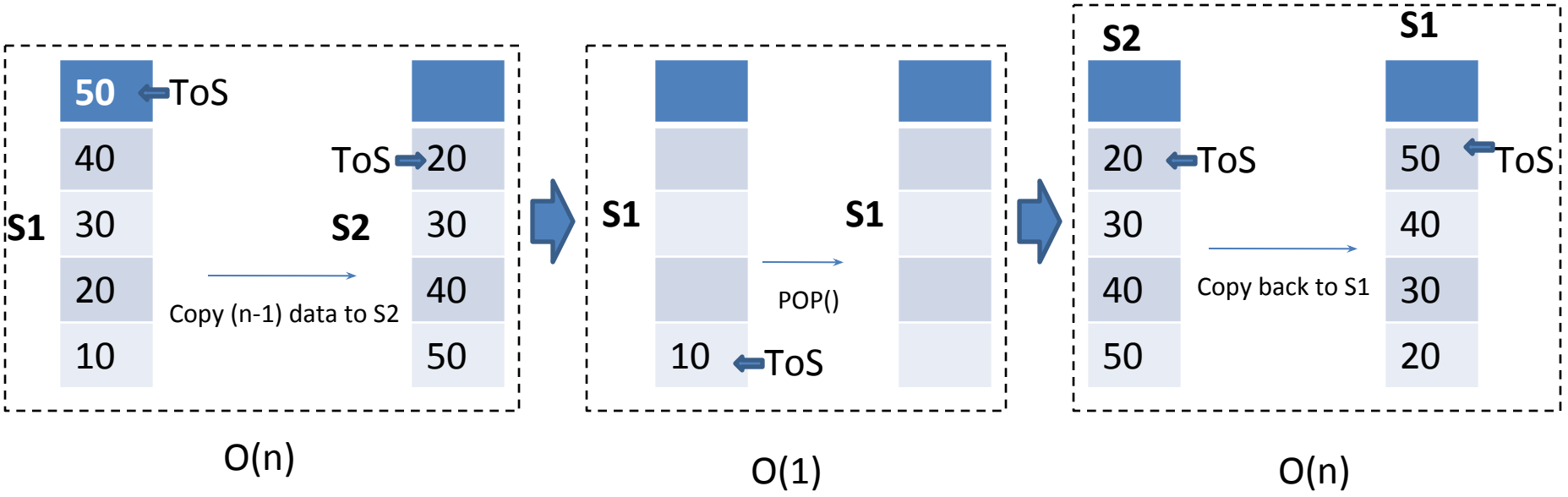


Queue using Stack

Time Complexity:

PUSH data into stack: O(1)

Dequeue() using POP() operation: O(n)



Stack using Queue

- Mechanism
  - We require 2 Queues to implement a Stack
    - Element will be inserted and deleted by following FIFO
    - Element need to be processed like LIFO concept
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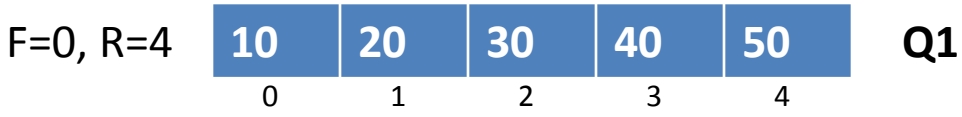
Stack using Queue

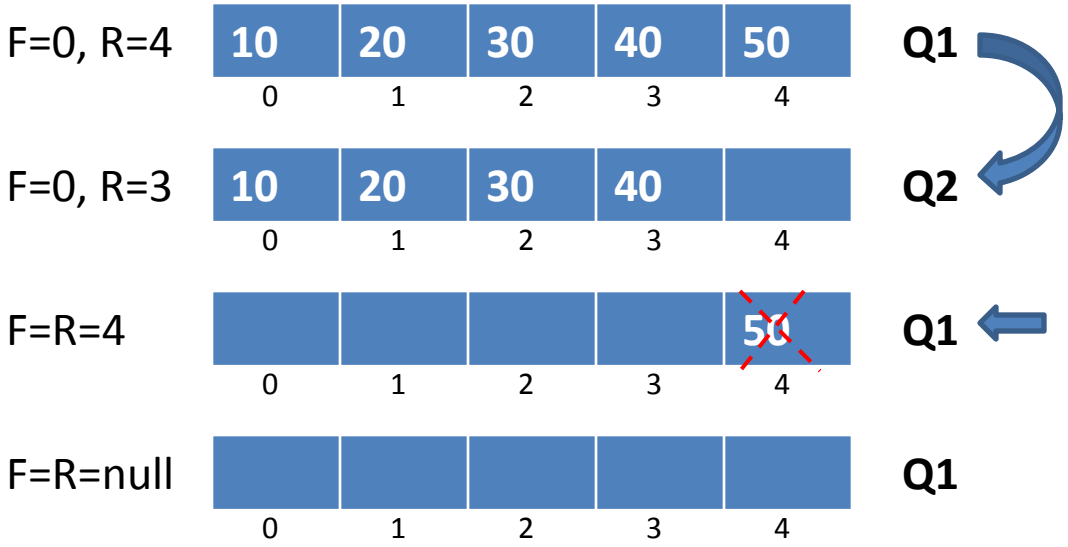
Data : 10 , 20 , 30 , 40 , 50

Enqueue all data into Q1 one by one:



Q1 : main queue
Q2: auxiliary queue

POP using Dequeue() operation:



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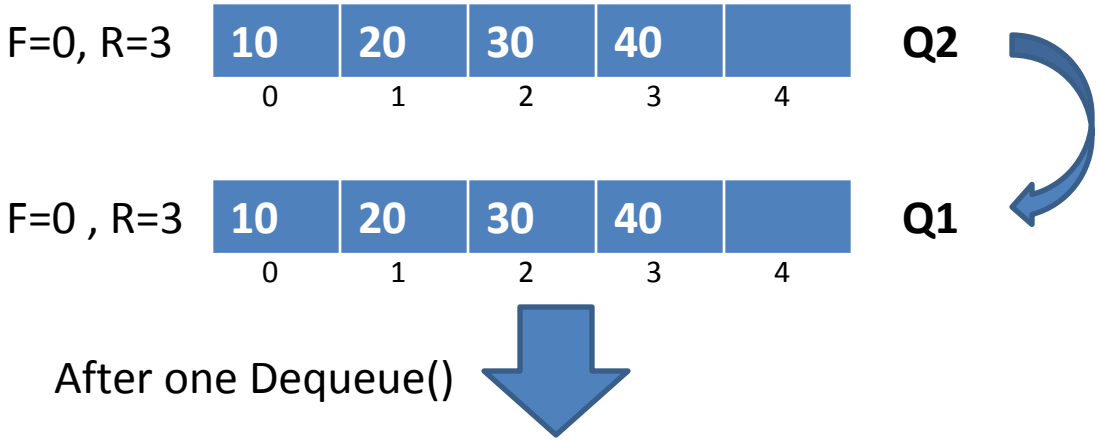
Stack using Queue

Contd…

POP using Dequeue() operation:

Q1 : main queue
Q2: auxiliary queue



Copy all data from **Q2** back to **Q1**. Dequeue() from Q2 and Enqueue() in Q1

Last inserted data **50** is deleted from **Q1** i.e. it works as a Stack

Queries?