## Question 1

We want to use $Q_1$ and $Q_2$ queues and their fundamental Properties (i.e, first in, first out) to implement a stack with a first in, last out order. We shall consider $Q_1$ as the main queue and $Q_2$ as the temporary queue.

To push an element into the stack, we need to enqueue it to $Q_1$.

To pop an element from the stack, we must dequeue all elements from $Q_1$ to $Q_2$ except for the last one. The last element is then dequeued from $Q_1$ and returned as popped. All other elements in $Q_2$ are then enqueued back to $Q_1$.

This way, Pop is $O(n)$ and push is $O(1)$.

# Question 2

```
PROGRAM List-move(L, node x, node y):
    # Detach X
    IF (X.prev IS NULL) THEN    # x is head node.
        X.next.prev = NULL
        L.head = X.next         # New head of the list
    ELSE
        X.prev.next = X.next
    END IF

    IF (X.next IS NULL) THEN    # X is tail node
        X.prev.next = NULL      # New tail of the list
        L.tail = X.prev
    ELSE
        X.next.prev = X.prev
    END IF

    # Insert X
    IF (y.prev IS NULL) THEN    # y is head
        X.prev = NULL
        X.next = y
        y.prev = X
        L.head = X              # New head of the list
    ELSE
        X.prev = y.prev
        y.prev.next = X
        X.next = y
        y.prev = X
    END IF
END PROGRAM
```

# Question 3

**Step 1**

$A = \langle 6,4,7,9,1,8,2,3,5 \rangle$

**Step 2**

$X = A[9] = 5$

$i = 1-1 = 0$

**Step 3**

$J = 1$

$A[1] = 6$

$6 > 5$

$A = \langle 6,4,7,9,1,8,2,3,5 \rangle$

**Step 4**

$J = 2$

$A[2] = 4$

$4 < 5$

$i = i+1 = 1$

Swap A[1] and A[2]

$A = \langle 4,6,7,9,1,8,2,3,5 \rangle$

**Step 5**

$J = 3$

$A[3] = 7$

$7 > 5$

$A = \langle 4,6,7,9,1,8,2,3,5 \rangle$

**Step 6**

$J = 4$

$A[4] = 9$

$9 > 5$

$A = \langle 4,6,7,9,1,8,2,3,5 \rangle$

**Step 7**

$J = 5$

$A[5] = 1$

$1 < 5$

$i = i+1 = 2$

Swap A[2] and A[5]

$A = \langle 4,1,7,9,6,8,2,3,5 \rangle$

**Step 8**

$J = 6$

$A[6] = 8$

$8 > 5$

$A = \langle 4,1,7,9,6,8,2,3,5 \rangle$

**Step 9**

$J = 7$

$A[7] = 2$

$2 < 5$

$i = i+1 = 3$

Swap A[3] and A[7]

$A = \langle 4,1,2,9,6,8,7,3,5 \rangle$

**Step 10**

$J = 8$

$A[8] = 3$

$3 < 5$

$i = i+1 = 4$

Swap A[4] and A[8]

$A = \langle 4,1,2,3,6,8,7,9,5 \rangle$

**Step 11**

$i = i+1 = 5$

Swap A[5] and A[9]

$A = \langle 4,1,2,3,5,8,7,9,6 \rangle$

Therefore, output array after first partition $= \langle 4,1,2,3,5,8,7,9,6 \rangle$