

## STACKS AND QUEUES

The following are two examples that will improve your understanding of how to manipulate stacks and queues (Problem 2 on the midterm)

**Example 1:** First, let us look at what happens when we run the following sequence of operations:

ENQUEUE(Q,1)

ENQUEUE(Q,2)

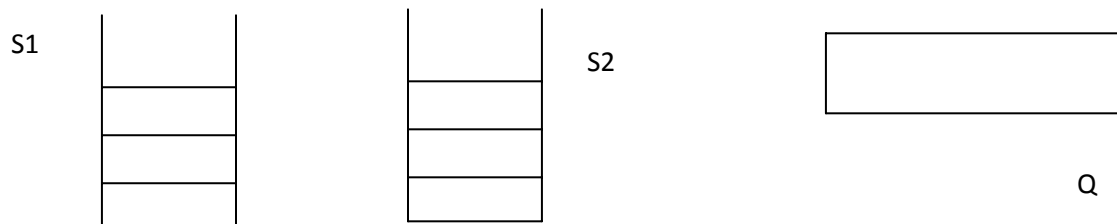
ENQUEUE(Q,3)

DEQUEUE(Q)

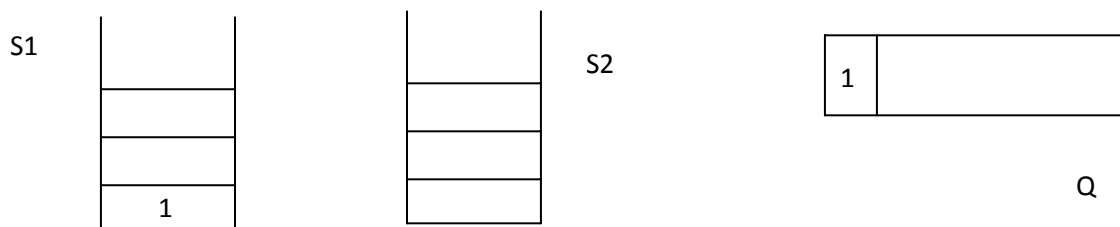
DEQUEUE(Q)

DEQUEUE(Q)

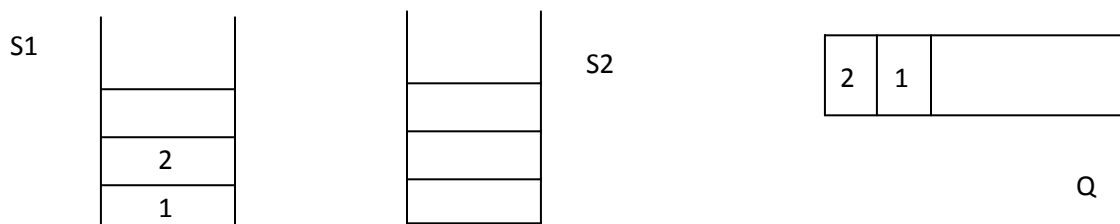
1) S1 and S2 are both empty



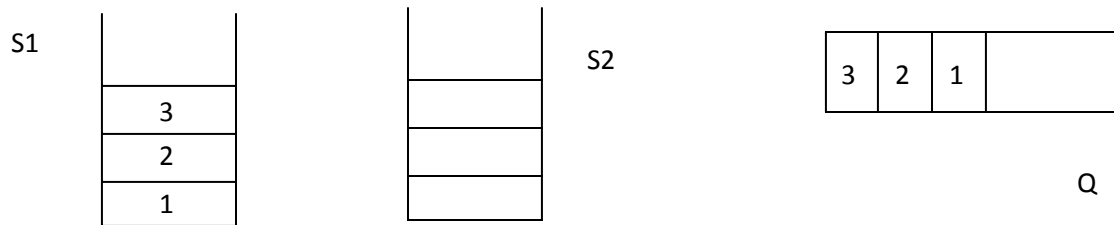
2) As a result of ENQUEUE(Q,1), "1" gets pushed into S1 (since S2 is empty, this is all ENQUEUE has to do do).



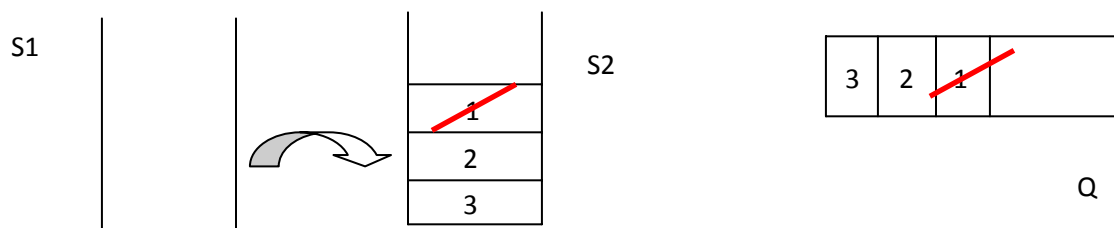
3) As a result of ENQUEUE(Q,2), "2" gets pushed into S1 (since S2 is empty, this is all ENQUEUE has to do do).



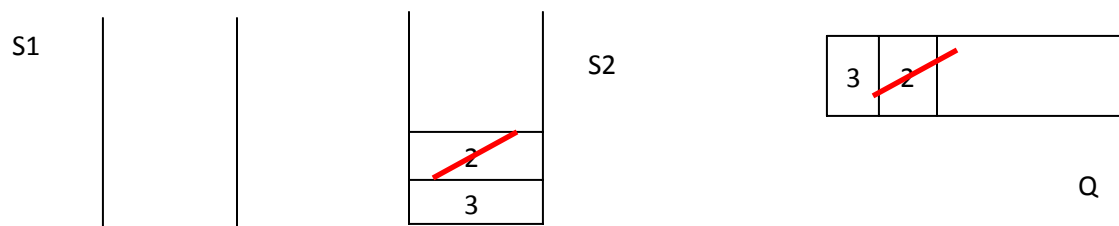
4) As a result of ENQUEUE(Q,3), “3” gets pushed into S1 (since S2 is empty, this is all ENQUEUE has to do do).



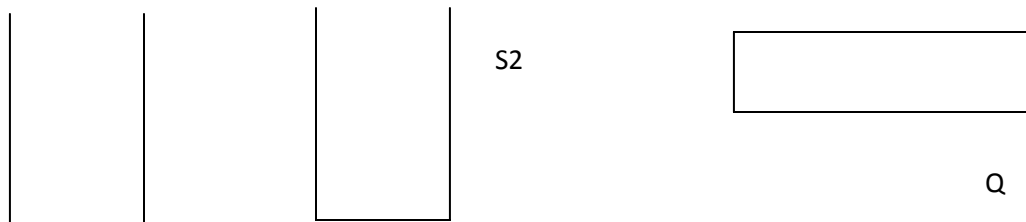
5) As a result of DEQUEUE(Q), since S1 is not empty, we have to move all the elements of S1 into S2 and then remove the top element.



6) As a result of DEQUEUE(Q), since S1 is now empty, all we have to do is remove the top element.



7) As a result of DEQUEUE(Q), since S1 is now empty, all we have to do is remove the top element. So, we get back the empty queue.



**Example 2:** Now, let us look at what happens when we run the following sequence of operations:

ENQUEUE(Q,a)

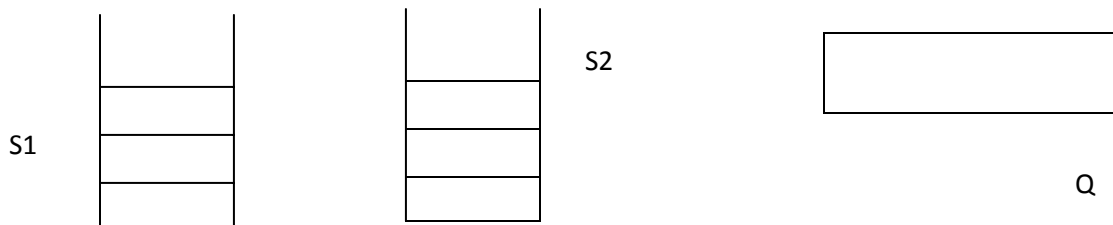
ENQUEUE(Q,b)

ENQUEUE(Q,c)

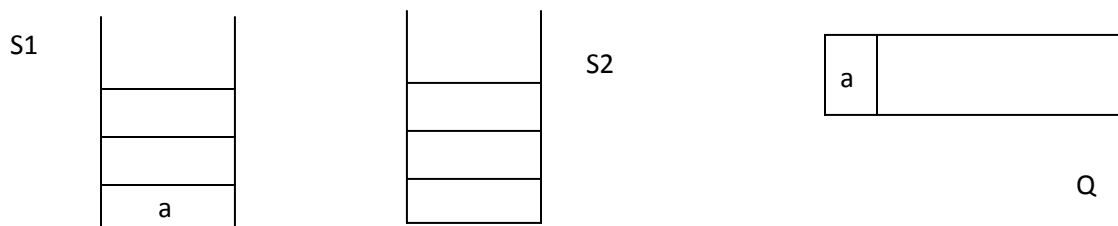
DEQUEUE(Q)

ENQUEUE(Q,d)

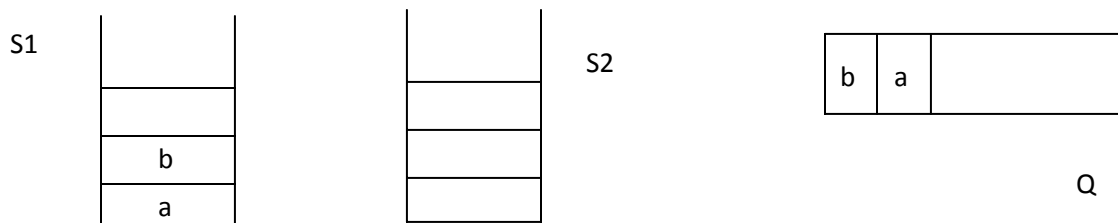
1) S1 and S2 are both empty



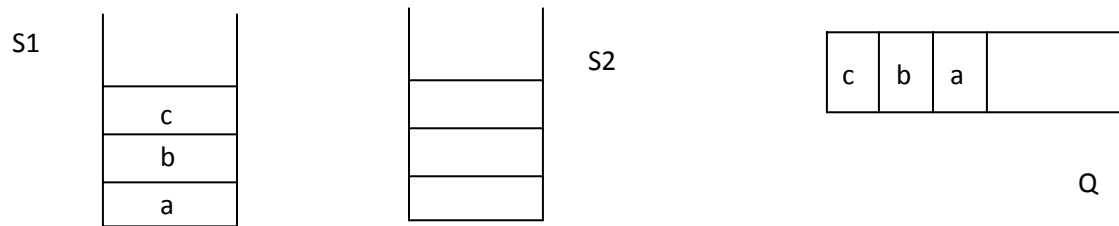
2) As a result of ENQUEUE(Q,a), “a” gets pushed into S1 (since S2 is empty, this is all ENQUEUE has to do do).



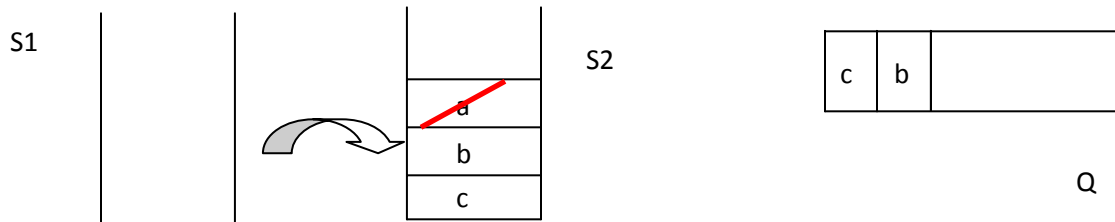
3) As a result of ENQUEUE(Q,b), “b” gets pushed into S1 (since S2 is empty, this is all ENQUEUE has to do do).



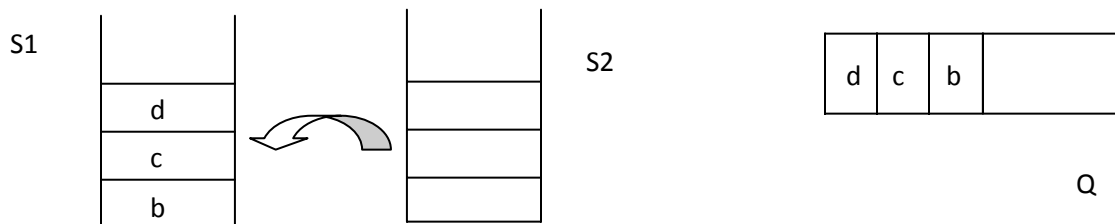
4) As a result of ENQUEUE(Q,c), “c” gets pushed into S1 (since S2 is empty, this is all ENQUEUE has to do do).



5) As a result of DEQUEUE(Q), since S1 is not empty, we have to move all the elements of S1 into S2 and then remove the top element.



6) As a result of ENQUEUE(Q,d), since S2 is not empty, we have to move all the elements of S2 into S1 and then add the new element to the top of S1.



7) As a result of DEQUEUE(Q), since S1 is not empty, we have to move all the elements of S1 into S2 and then remove the top element.

