NANYANG TECHNOLOGICAL UNIVERSITY
School of Electrical & Electronic Engineering

EE2008/IM1001 Data Structures and Algorithms

Tutorial No. 4 (Sem 2, AY2021-2022)

1. Suppose that *S* is a stack. List the content of the stack after each operation and show the output value if a value is returned from the operation.

Operation	Output	Bottom – Stack – Top
`S.stack_init( )`		
`S.empty( )`		
`S.push(8)`		
`S.push(-5)`		
`S.pop( )`		
`S.push(2)`		
`S.top( )`		
`S.pop( )`		
`S.empty( )`		
`S.top( )`		

2. Suppose that *Q* is a queue. List the content of the queue after each operation and show the output value if a value is returned from the operation.

Operation	Output	Front – Queue – Rear
`Q.queue_init( )`		
`Q.empty( )`		
`Q.enqueue(8)`		
`Q.enqueue(-5)`		
`Q.dequeue( )`		
`Q.enqueue(2)`		
`Q.front( )`		
`Q.dequeue( )`		
`Q.empty( )`		
`Q.front( )`		

3. Using the abstract data type *stack*, write a function *invert*(*S*) to invert the contents of a stack `S`. You may use additional stacks in your function.
Note: If the number 3 is at the top of the stack *S*, after *invert*(*S*), 3 will be at the bottom of *S*.

4. Suppose that *start* is a reference to the first node of a singly-linked list. Write an algorithm that begins at *start* and insert a value *val*. Specifically, the algorithm adds a node to the end of the linked list whose data field is *val*. Discuss the worst-case time complexity of your algorithm.

5. A pointer *start* points to the first element of a doubly-linked list *L*. Write an algorithm that deletes the smallest element in *L*.

6. Using the operations *front*(), *enqueue*(*val*) and *dequeue*(), write the pseudo-code of a **recursive algorithm** to append a queue *P* (which may be empty) onto the end of another queue *Q*, leaving *P* empty.

7. The pointer *start* points to the first element of a singly-linked list *L*. Write a **recursive algorithm** to return a reference to the first element that has a value that is greater than the next element in *L*. If no such element exists, return null. For example, if the linked list is arranged as in Fig. 1, then the algorithm will return a reference to the third element (which has the value 7).

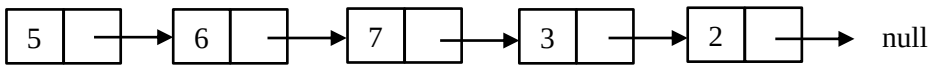

Fig. 1