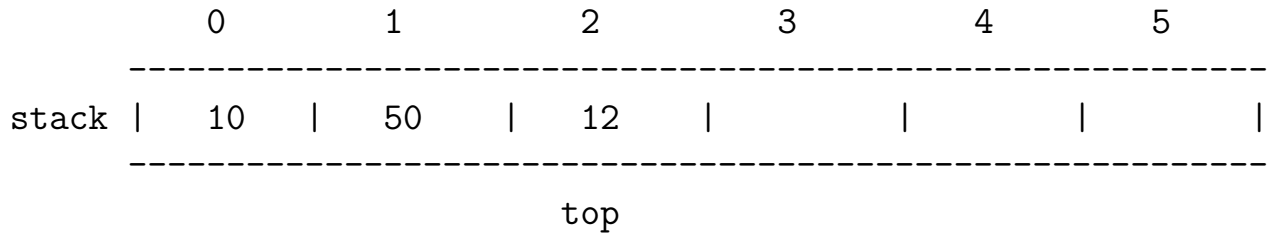


CS35, Spring 2010, Practice Quiz 2

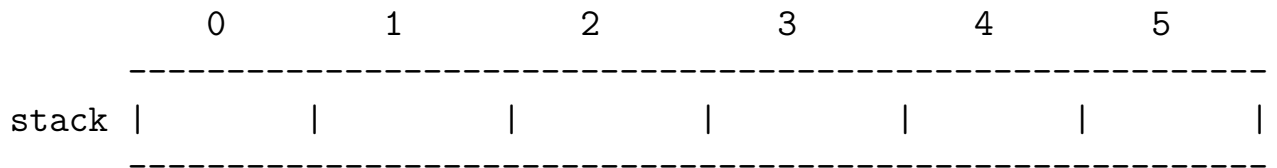
1. Stacks and Queues

(a) Given the following contents of an array implementation of a stack:

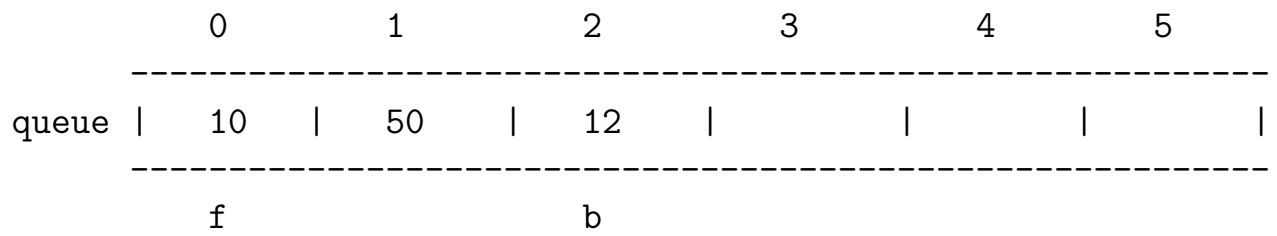


Show the contents of the stack and the location of **top** after doing the following:

```
stack.pop();
stack.push(7);
stack.push(8);
stack.push(9);
stack.pop();
stack.push(11);
```

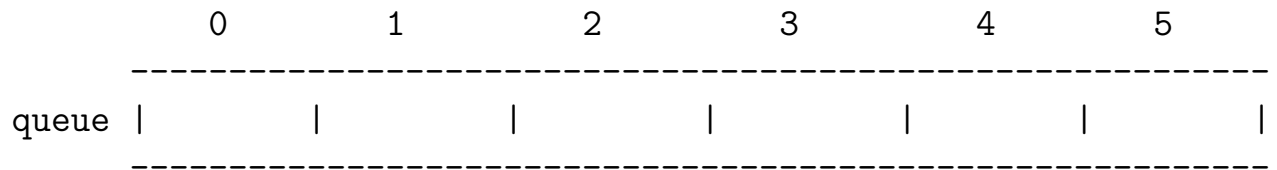


(b) Given the following contents of a **circular array** implementation of a queue:



Show the contents of the queue and the locations of **f** and **b** after doing the following:

```
queue.dequeue();
queue.enqueue(7);
queue.enqueue(8);
queue.enqueue(9);
queue.dequeue();
queue.enqueue(11);
```



## 2. Linked implementations of data structures

```
class LinkedQueue<ITEM> : public Queue<ITEM> {
private:
    Node<ITEM> *f;
    Node<ITEM> *b;
    int length;
public:
    ~LinkedQueue();
    LinkedQueue();
    int size();
    bool isEmpty();
    ITEM* front();
    void enqueue(ITEM item);
    ITEM dequeue();
};
```

Given the declaration of a linked implementation of a queue shown above, complete the definition of the `enqueue` method below:

```
void LinkedQueue<ITEM>::enqueue(ITEM item) {
```

### 3. Analysis of Algorithms

- (a) True or false, an  $O(n^2)$  algorithm is always slower than an  $O(n)$  algorithm?
- (b) If you said true, explain why this is the case. If you said false, give a specific example when an  $O(n^2)$  algorithm is faster than an  $O(n)$  algorithm.

- (c) Describe an algorithm in pseudocode that uses the function given below to find the third largest element in an array of integers. For example, given an array containing [5, 9, 1, 8, 10, 3, 6, 4], it should return 8 (Hint: what are the contents of the array `a` after `moveLargest(a,5)`, for the array above).

```
void moveLargest(int a[], int steps) {  
    for (int i=0; i<steps; i++)  
        if (a[i] > a[i+1])  
            swap(a, i, i+1);  
}
```

- (d) What is the running time of your algorithm in big-O notation? Explain.