COL 106 Assignment 1 Due: Friday Aug 8, 11:59 pm

Total : 30 points

1 (10 pts). Implement the following interface for stack using a growable array as discussed in class

```
template <typename Object>
class Stack {
public:
   int size();
   bool isEmpty();
   Object& top()
                          throw(EmptyStackException);
   void push(Object o);
   Object pop()
                           throw(EmptyStackException);
};
```

2 (10 pts). Implement the following interface for queue using a circular linked list

```
template <typename Object>
class Queue {
public:
   int size();
   bool isEmpty();
   Object& front()
                          throw(EmptyQueueException);
   void enqueue(Object o);
   Object dequeue()
                           throw(EmptyQueueException);
};
```

3 (10 pts). A queue can also be implemented using two stacks. One stack is used to enqueue elements, while the other is used to dequeue elements. That is, when an element is added to the queue it is pushed on the in stack. When an element is removed from the queue it is popped off the out stack. If the out stack is empty, the contents of the in stack is transferred to the out stack.

Implement the queue using two stacks (that you implemented in Problem 1). What is the amortized run time of enqueue and dequeue operations?

4. (Need not be submitted but please solve) Alice has three array-based stacks, *A*, *B*, and *C*, such that *A* has capacity 100, *B* has capacity 5, and *C* has capacity 3. Initially, *A* is full, and *B* and *C* are empty. Unfortunately, the person who programmed the class

for these stacks made the push and pop functions private. The only function Alice can use is a static function, transfer(S,T), which transfers (by iteratively applying the private pop and push functions) elements from stack S to stack T until either S becomes empty or T becomes full. So, for example, starting from our initial configuration and performing transfer(A,C) results in A now holding 97 elements and C holding 3. Describe a sequence of transfer operations that starts from the initial configuration and results in B holding 4 elements at the end.