ECE368 Data Structures Assignment 3
Assigned: Thursday, January 25, 2018
Due Date: Tuesday, February 6, 2018

Q1. Using the stack-based algorithm discussed in the class, transform the following infix expression to postfix:
A + (((B – C) * (D – E) + F) / G) $ (H – J)
Show the state of the stack after each step of the algorithm.

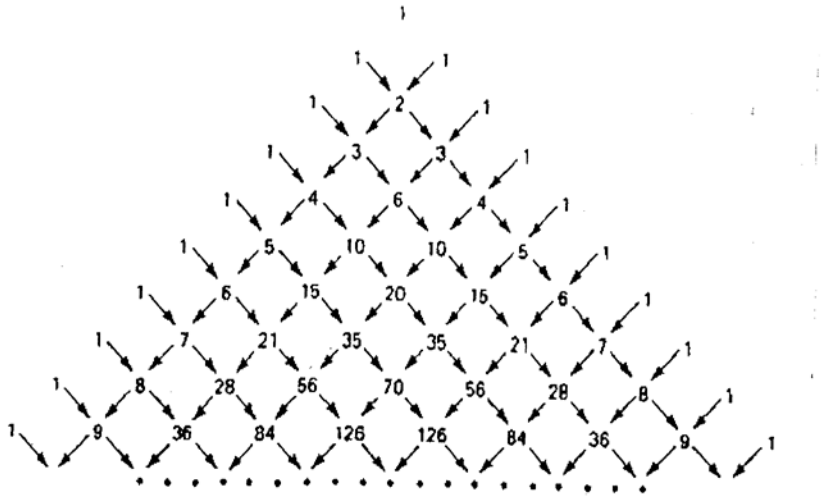
Q2. The word **deque** is the shortened form of **double ended queue** and denotes a list in which items can be added or deleted from either the first or the last position of the list, but no changes can be made elsewhere in the list. Thus a deque is a generalization of both a stack and a queue. Suppose that data items numbered 1, 2, 3, 4, 5, 6 come in the input stream in this order. By using a (1) FIFO queue and (2) a deque, which of the following rearrangements can be obtained in the output order:

(a) 1 2 3 4 5 6	(b) 2 4 3 6 5 1	(c) 1 5 2 4 3 6
(d) 4 2 1 3 5 6	(e) 1 2 6 4 5 3	(f) 5 2 6 3 4 1

Q3. In an M/M/I queue, jobs arrive at a rate of 8 jobs/unit time. If the average number of jobs in the system (queue plus server) is 4, what is the average service rate of the system?

Q4. A mechanic can fix cars at an exponential rate of two cars a day. If customers have to wait, on the average, one day before retaking their cars, then determine the exponential rate at which the cars break down.

Q5. The binomial coefficients may be defined by the following recurrence relation, which is the idea of Pascal's triangle, the top of which is shown in the following figure:



The top of Pascal's triangle of binomial coefficients

The recurrence relation formula is:

C(n,0) = 1 and C(n,n) = 1 *for n ≥ 0*
C(n,k) = C(n-1,k) + (C(n-1,k-1) *for n > k > 0*

(a) Write a recursive function in C to generate C(n,k) using the above formula.

(b) Draw the recursive tree for calculating C(6,4). Show the value computed by each node of this tree.

Q6. Define a ***generalized Fibonacci sequence*** of $f0$ and $f1$ as the sequence $gfib(f0,f1,0)$, $gfib(f0,f1,1)$,$gfib(f0,f1,2)$,…,where

$$gfib(f0, f1, 0) = f0$$

$$gfib(f0, f1, 1) = f1$$

$$gfib(f0, f1, n) = gfib(f0, f1, n-1) + gfib(f0, f1, n-2) \text{ if } n > 1$$

Write a recursive C function to compute $gfib(f0, f1, n)$. Find an iterative method for computing this function.

Q7. Show how to transform the following iterative procedure into a recursive procedure. $f(i)$ is a function returning a logical value based on the value of i, and $g(i)$ is a function that returns a value with the same attributes as i.

```
void iter(int n)
{
        int I;

        i = n;
        while(f(i) == TRUE) {
                /* any group of C statements that */
                /* does not change the value of i */
                i = g(i);
        } /* end while */
} /* end iter */
```

Q8. Write recursive and nonrecursive algorithms to determine:
(a) The number of nodes in a binary tree
(b) The sum of the contents of all the nodes in a binary tree

Q9. Two binary trees are **similar** if they are both empty or if they are both nonempty, their left subtrees are similar, and their right subtrees are similar. Write an algorithm to determine if two binary trees are similar.