CS-151 **Stacks, Queues, and Analysis** **2012-03-14**

This Exam is being given under the guidelines of the **Honor Code**. You are expected to respect those guidelines and to report those who do not. Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page. There are 7 questions for a total of 52 points.

Name: _____

1. (5 points) Convert the following expression to its Postfix form. You do not need to demonstrate the algorithm, just write the final form.

$$A \ / \ B \ * \ C \ + \ D$$

2. (5 points) Show how the stack is used in evaluating the following postfix expression. Make sure you show the stack at enough stages to convince me that you understand the algorithm.

$$7 \ 13 \ * \ 12 \ 8 \ - \ 4 \ + \ 10 \ * \ +$$

3. (5 points) Rank the following functions in order from slowest growing to fastest.

   - N
   - $Nlog(N)$
   - 1
   - $log(N)$
   - N^2

4. (5 points) Give the Big-O limits for the following Python operations.

   - `list.pop(0)`
   - `list.pop()`
   - `dict[x]`
   - `list.append()`
   - `dict[key] = value`

5. (10 points) For this question you must implement a `Stack` class. However you may **not** use a Python list in your implementation. You **must** use The *Node* class shown below. Implement the methods `__init__`, `push`, `pop`, and `isempty`.

```
class Node:
    def __init__(self,initdata):
        self.data = initdata
        self.next = None

    def getData(self):
        return self.data

    def getNext(self):
        return self.next

    def setData(self,newdata):
        self.data = newdata

    def setNext(self,newnext):
        self.next = newnext
```

6. Using the following code fragment:

```
1 for i in range(n):
2     for j in range(n):
3             sum = sum + 1
4 for p in range(0,n*n):
5     for q in range(p):
6         sum = sum - 1
7 for s in range(20):
8     for t in range(5):
9         sum = sum + 1
```

(a) (3 points) Using Big-O notation, What is the worst case performance for the set of loops in lines 1–3?

(b) (3 points) Using Big-O notation, What is the worst case performance for the set of loops in lines 4–6?

(c) (3 points) Using Big-O notation, What is the worst case performance for the set of loops in lines 7–9?

(d) (3 points) Using Big-O notation, What is the overall worst case performance?

7. (10 points) In this question you must implement a Queue. However you may not use a Python list, or the `Node` class. You must use two **Stacks** to implement the Queue functionality. Write the methods `__init__` `enqueue`, `dequeue`, and `isEmpty`.