University of Washington Bothell
CSS 342B: Data Structures, Algorithms, and Discrete Mathematics
Quiz
Wednesday, November 19, 2014

1. What is the BigO upper bound of the code snippet below as a function of n assuming that the Func1(n) is O(n)?

```
int j = n;
while (j >= 1)
{
        for (int i = 1; i <= j; i++)
        {
                int val = Func1(n);
        }
        j = j / 2;
}
```

2. Determine the BigO upper bound as a function of n for the following code snippet. Do this by finding a formula, g(n) for the number of times Func2() is called. Assume Func2 is completed in constant time, C. Prove your answer.

```
for (int i = 9; i <= n; i *= 3)
{
        for (int j = -n; j < n; j++)
        {
                if (j % 2)
                {
                        Func2(i, j);
                }
        }
}
```
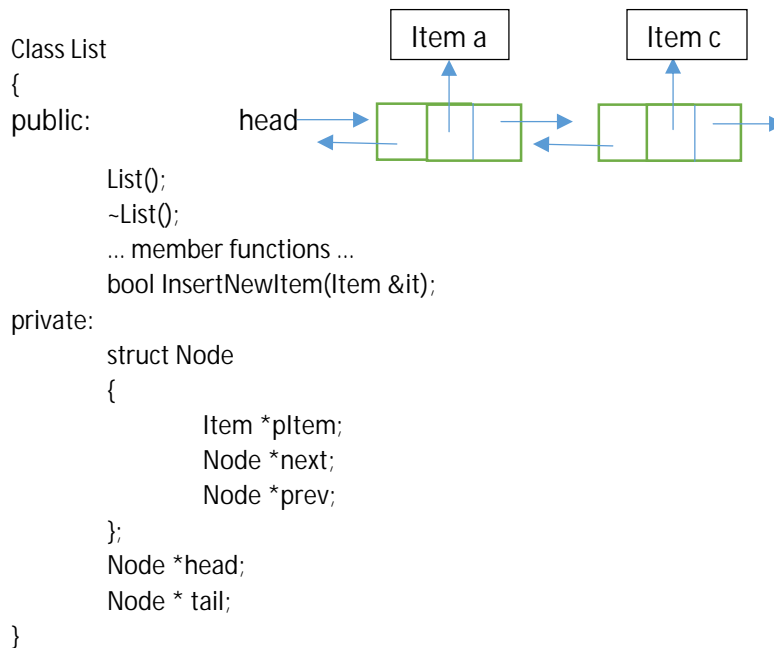
3. A Catalan number is defined by the following recursive formula:

$$C_0 = 1 \quad \text{and} \quad C_{n+1} = \sum_{i=0}^{n} C_i \, C_{n-i} \quad \text{for } n \geq 0;$$

Write a recursive function which computes the nth Catalan number.

4. Assume a List class which is a doubly linked-list of ordered nodes. The node and class is defined as follows:


```
Class List
{
public:          head

        List();
        ~List();
        ... member functions ...
        bool InsertNewItem(Item &it);
private:
        struct Node
        {
                Item *pItem;
                Node *next;
                Node *prev;
        };
        Node *head;
        Node * tail;
}
```

Write the member function InsertNewItem which takes an item by reference and inserts it into the proper place in the list. Duplicates are not allowed. Return true if the item was inserted; false if the item already is in the list and does not need to be inserted.