CSCI 33500 - Spring 2016 -
Homework #1, Covering chapters 1and 2.

Due in class February 18th

All questions are worth the same amount of points.

1 Chapter 1 - Mathematical Background

1.1 Prove by induction that $\sum_{i=1}^{N-2} F_i = F_N - 2$
where F_i is the i-th Fibonacci number, as defined in section 1.2 / page 6 of the book.

1.2 Prove by induction that $\sum_{i=1}^{N} i^3 = (\sum_{i=1}^{N} i)^2$

1.3 Prove that $2^{99} \equiv 1 \pmod 7$

2 Chapter 2 - Algorithm Analysis

2.1 Order the following functions by growth rate: $N, \sqrt{N}, N^{1.5}, N^2, N \log N, N \log \log N$
$N(\log N)^2, N \log N^2, 2/N, 2^N, 2^{N/2}, 99$ (constant), $N^2 \log N, N^3, N^N, N!$.
If two functions grow at the same rate, indicate so.

2.2 Find two function $f(N)$ and $g(N)$ such that neither $f(N) = O(g(N))$ nor $g(N) = O(f(N))$. Explain your answer.

2.3 Give a Big-O analysis of the running time of the following code:

```
sum = 0;
for(i=0; i<N; ++i)
    for(j=0; j<i*i; ++j)
       for(k=0; k<j; ++k)
           ++sum;
```

3 Extra Credit

Give a Big-O analysis of the running time of the following code:

```
sum = 0;
for(i=0; i<N; ++i)
    for(j=0; j<i*i; ++j)
        if (j%i == 0)
            for(k=0; k<j; ++k)
               ++sum;
```

Compare this to the running time of the algorithm in question 2.3