Assignment 2

1. Order the following functions by growth rate (4 points)

   N
   $\sqrt{N}$
   $N^{1.5}$
   N^2
   NlogN
   NloglogN
   $Nlog^2N$
   $Nlog(N^2)$
   2/N
   2^N
   37
   N^2logN
   N^3
   Indicate which of the functions grow at the same rate.

$2/N$, 37, $\sqrt{N}$, N, $N \log \log N$, $N \log N$, $N \log(N^2)$, $N \log^2 N$, $N^{1.5}$, N^2, $N^2 \log N$, N^3, $2^{N/2}$, 2^N.

$N \log N$ and $N \log (N^2)$ grow at the same rate.

2. For each of the following code fragments give running time analysis (Big Oh) (9 points)

   a.
   ```
   sum =0;
    for ( i=0; i < n ; i++)
                    sum++;
   ```
   The running time is $O(N)$.

   b.
   ```
   sum =0;
   for( i = 0; i < n; i++)
       for(j = 0; j < i ; j++)
                   sum++;
   ```
   The running time is $O(N^2)$.

   c.
   ```
   sum =0;
   for( i = 0; i < n; i++)
       for( j = 0; j < i *i ;  j++)
                   for( k = 0; k<j; k++)
                               sum++;
   ```

j can be as large as i^2, which could be as large as N^2. k can be as large as j, which is N^2. The running time is thus proportional to $N \cdot N^2 \cdot N^2$, which is $O(N^5)$.

3. Give efficient algorithm along with running time analysis to find the minimum subsequence sum (Assume the minimum sum is either 0 or a negative value) (5 points)

```
public static int minSubSum( int [] a) {
      int minSum = 0, this Sum =0;
      for ( int j = 0; j< a.length; j++)
      {
            thisSum += a[j];
            if(thisSum < minSum)
                  minSum = thisSum;
            else if(thisSum > 0)
                  thisSum = 0;
      }
      return minSum;
}
```