IOE 543
Homework 1
Due in class on Thursday 09/16

1. Think about three different situations in life where you can observe scheduling problems. What are the resources, tasks (jobs) and objectives? How would you characterize them in terms of the $\alpha \mid \beta \mid \gamma$ notation? Please give different examples than those in Chapter 1 of the textbook. If there are any scheduling problems of special interest to you, then please say so!

2. Using mathematical induction, prove that the number of possible sequences in which you can schedule n jobs on a single machine is $n!$

3. Problem 3.1 from Pinedo.

4. Consider the Knapsack problem which can be stated as follows:
   Given a set of n items with weights w_j and benefits b_j , find the set of items which give the maximum benefit while not exceeding the capacity W, of the knapsack.

   The Knapsack problem can be solved by using the following algorithm:

   ```
   For w = 0 to W do f[w]=0; (* initialize *)
   For j =1 to n do
       for w =W down to w_j do
           if f[w-w_j] + b_j > f[w] then
               f[w] = f[w-w_j] + b_j
   ```

   where f[v] = maximum total benefit obtained by including items whose total weight is at most v.

   Find the computational complexity (Order relation) of the above algorithm in terms of n, w_j , b_j and W. (Eg. The solution could be $O(n^2 . \max\{b_j\})$. Also, state which complexity class this optimization problem falls under when we consider the size of the problem in terms of n.