Homework assignment 1

Please read these instructions carefully for each assignment, though they are generally do not vary between the assignments

1. You need to follow carefully the specific instructions for the assignment as written below.

2. All your answers should be justified. In particular, if you are asked to design an algorithm for a certain problem, you have to explain why you algorithm solves the problem (so-called correctness). If you are asked to design an algorithm with certain complexity, you have to explain why your algorithm has this complexity.

3. For the first stage, each student must submit his/her solution set as a *single* pdf file to NYUClasses. You can submit a scanned pdf, or pdf converted from jpg photos. But multiple pdfs must be joined together. *Caveat:* If you submit handwritten solutions, the readability is your responsibility. Unreadable submissions will not be graded. Please, if you write by hand, do it with a pen, not a pencil.

4. Leave 1.5 inches (or 4.0 centimeters) of space between each part of each problem for the second stage.

5. The submissions for the first stage are due on Tuesday, September 11 by 11:55pm.

6. Solutions will be posted after the lecture on Wednesday, September 12.

7. Once you get the solutions you are required to self-criticize your original answers as described below. Based on the posted solutions, use space that follows each homework answer to write your own self-criticisms of mention some ideas from the correct solution, you have to explain how these ideas are related to your initial solution. If you think that your solution is correct, write this *explicitly*.

8. The submissions for the second stage are due to Friday, September 14 by 11:55pm.

9. For every problem below, the number of points is specified as "$a + b$ points". This means that you get from 0 to a points for your solution submitted on the first stage and form 0 to b points for your self-criticism. In total, you get at most $a + b$ points for the problem.

10. Be sure to follow the academic integrity rules listed on the course webpage. The department and the university treat academic integrity very seriously and I am required to report all possible violations.

Problems

Problem 1: $(2 + 1$ points) Prove $3^n > n + 1$ for all integer $n \geqslant 1$ by induction on n.

Problem 2: $(3 + 1$ points) Design an recursive function that takes a list of items and a positive integer k as an input and returns a list of all subsets of items of size at most k.

For example, if items are $[a, b, c]$ and $k = 2$, then the output should be

$$[[], \ [a], \ [b], \ [c], \ [a, b], \ [a, c], \ [b, c]]$$

(the order of the subsets and elements in the subsets does not matter)