COMP 314 Homework Assignment 7

1. (5 points) Examine the program `sillySort.py`, distributed with the code for class 17. What is the nondeterministic running time of this program? (Don't be too concerned with details in your answer. At a minimum, state whether or not the program is in NPoly, and justify your answer. Try to be a bit more specific than this if possible, and feel free to make reasonable assumptions about the cost of the various Python operations involved.)

2. (15 points) Write a nondeterministic program, in the programming language of your choice, to solve the subset sum problem. Specifically, the input is a list of N numbers such as "`5 2 15 20`". The output is either: (i) a subset of the first $N-1$ numbers, such that the sum of the elements in the subset equals the Nth number; or (ii) "`no`" if no such subset exists. Examples:

input	output
5 2 15 20	5 15
5 2 3 15 20	5 15 or 2 3 15
5 2 3 15 21	no

   The nondeterministic running time of your program must be linear in N.

3. (5 points) What is the *deterministic* running time of your program from the previous question, as a function of N? (Note: the deterministic running time is the time the program would take to execute on a single core. Detailed analysis is not required. Give an informal argument for membership in one or more common complexity classes.)

4. (5 points) Construct an nfa for the language on the alphabet $\{\mathtt{x}, \mathtt{y}, \mathtt{a}, \mathtt{b}\}$ given by

$$\{(\mathtt{xy})^n \mathtt{a}^m : n, m \geqslant 1\} \cup \{(\mathtt{xy})^j (\mathtt{ab})^k : j, k \geqslant 2\}.$$

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5. (5 points) Convert the following nfa into a dfa. You must compute the answer manually first, but feel free to check your answer using JFLAP. Your answer must use the notational conventions described in class and in the notes. In particular, the states of your dfa must be labeled using subsets of the nfa states.