Please complete the following from the CLRS book:

- 4-1
- 4-3
- 4.1-5
- 4.2-6
- 4.2-1

Additionally, please solve the following problems:

0.1 Problem 1

Given a set A of size N (i.e. $|A| = N$), determine the total number of sets that can be constructed by subsets of the members of A. For example, if $A = \{1, 2\}$, then the answer is 4, because the 4 possible subsets are $\{\}, \{1\}, \{2\}, \{1, 2\}$ (the empty set counts as a subset). Derive your answer using a recurrence relation as well as combinatorially, and verify that the results of the different methods agree with each other.

0.2 Problem 2

Suppose I am standing at the bottom of a staircase with N stairs. Now suppose that at any point I can ascend 1 stair, 2 stairs, or 3 stairs. Derive a (not necessarily closed form) relation that expresses the total number of different ways that I can climb the N stairs. **Then,** write a program in C that iteratively computes the total number of combinations for a staircase of increasing size (i.e. computes the total number of combinations for 1 stair, 2 stairs, 3 stairs, 4 stairs, 5 stairs, etc). Let your program run for about 5 minutes and report the highest N that you got to as well as the number of combinations for that N. (Use CTRL-C to halt a program's execution).