Homework Assignment # 1

Do the following problems in the textbook:
page 27:
#1.5;
#1.7 (b);
#1.8 (a), (b);
#1.9;
#1.11(a) [hint: by induction];
#1.12 (a).

Due:

Programing Assignment # 1

Due Date

Late Policy
-1 point per minute late.
Instruction
This is an individual assignment. All work should be your own.

Description
This assignment consists of 2 parts.

Part 1 [50 points]:
For integer \( n \geq 0 \), define

\[
\begin{align*}
c(n) &= \sum_{i=1}^{n} c(i-1) \cdot c(n-i) \\
&= c(0) \cdot c(n-1) + c(1) \cdot c(n-2) + \cdots + c(n-1) \cdot c(0)
\end{align*}
\]

where \( c(0) = c(1) = 1 \), and

\[
d(n) = \frac{(2n)!}{n!(n+1)!}
\]

Write a recursive method

\[
\text{static long } c\text{(int } n\text{)}
\]

that returns the value \( c(n) \) and a (not necessarily recursive) method

\[
\text{static long } d\text{(int } n\text{)}
\]

that returns the value \( d(n) \). Try to reduce the number of multiplications used in calculation of \( d(n) \) (hint: calculation of \( n! \) can be avoided when calculating \( (n+1)! \) and \( (2n)! \)).

Write a test main method which, for a given \( n \geq 0 \) (say \( n = 10 \)), outputs the value \( c(n) \) and \( d(n) \), and true if \( c(n) = d(n) \), and false if \( c(n) \neq d(n) \). Your test should be using \( n = 10 \).

Part 2 [50 points]:
Use Java 5 (or newer version) to create a generic class DrawingBox with a type parameter that simulates drawing an item at random out of a box. This class could be used for simulating a random drawing. For example, the box might contain Strings representing names written on a slip of paper, or the box might contain Integers representing a random drawing for a lottery based on numeric lottery picks. Create an add method that allows the user of the class to add an object of the specified type along with an isEmpty method that determines whether or not the box is empty. Finally, your class should have a drawItem method that randomly selects an object from the box and returns it. If the user attempts to draw an item out of an empty box, return null.
Create two input files, `inputS` and `inputI`, which contains 50 character strings and 50 integers, respectively. Write a `main` method that reads `inputS` (respectively, `inputI`) and insert the strings (resp. integers) into the “drawingbox” using the `add` method. Then perform 3 random drawing and print out the results for each of the two drawingboxes. To generate a random number $x$, where $0 \leq x \leq 1$, use $x = Math.random()$. Then, convert $x$ into an integer in the range between 0 and 50.

Submit your program and the two input files. You can also submit a text file named README, in which you can state instructions for compiling and running your program, and any additional information you want the grader to know. Your program will be compiled and tested by the grader.