1. Work Problem 15.14 from the text.
2. This is problem 16.14 from the text. How many rectangles can be formed from an \( m \times n \) chessboard? For example, for a \( 2 \times 2 \) chessboard, there are nine possible rectangles.
3. This is problem 16.21 from the text. Give a combinatorial proof of the following identity:

\[
\binom{n}{0} \binom{n}{n} + \binom{n}{1} \binom{n}{n-1} + \binom{n}{2} \binom{n}{n-2} + \cdots + \binom{n}{n-1} \binom{n}{1} + \binom{n}{n} \binom{n}{0} = \binom{2n}{n}
\]

Hint: Consider an urn with \(2n\). For one side of the identity, it helps to think of the balls being colored red and green.
4. Use proof by contradiction to prove the following: If $a$ is a rational number and $b$ is an irrational number, then $a + b$ is an irrational number.