1. In words, a *Power set* of a set $S$ is
   
The set of all subsets of $S$ (including the null set).

2. If a set $S$ has 13 objects, how big is the power set of $S$?
   
   $2^{13}$

3. What is another way to think of the power set?
   
   We could think of the power set as either all the ways to switch on $n$-lightbulbs or all the ways to fill $n$-boxes with stars or bars.

4. In words, what is $n!$?
   
   Multiply $n$ by $(n - 1)$ by $(n - 2)$ until 3 by 2 by 1.

5. Using factorials, what is $\binom{n}{k} = \frac{n!}{k! \cdot (n-k)!}$

6. Compute the following:
   
   - For any $n$, $\binom{n}{0} = \frac{n!}{0! \cdot (n-0)!} = \frac{n!}{0! \cdot n!} = \frac{1}{0!} = 1$
   
   - $\binom{6}{3} = \frac{6!}{3! \cdot (6-3)!} = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1 \cdot (3 \cdot 2 \cdot 1)} = \frac{6 \cdot 5 \cdot 4}{3 \cdot 2 \cdot 1} = 5 \cdot 4 = 20$
   
   - For any $k$, $\binom{k}{1} = \frac{k!}{1! \cdot (k-1)!} = \frac{k}{1} = k$
   
   - $\binom{7}{4} = \frac{7!}{4! \cdot (7-4)!} = \frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{4 \cdot 3 \cdot 2 \cdot 1 \cdot (3 \cdot 2 \cdot 1)} = \frac{7 \cdot 6 \cdot 5}{3 \cdot 2 \cdot 1} = 7 \cdot 5 = 35$