Permutations and Combinations: Takeaways

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Concepts

- If we have an experiment E_1 (like flipping a coin) with a outcomes, followed by an experiment E_2 (like rolling a die) with b outcomes, then the total number of outcomes for the composite experiment E_1E_2 can be found by multiplying a with b (this is known as the **rule of product**):

\begin{equation} \text{Number of outcomes} = a \cdot b \end{equation}

- If we have an experiment E_1 with a outcomes, followed by an experiment E_2 with b outcomes, followed by an experiment E_n with z outcomes, the total number of outcomes for the composite experiment E_1E_2 ... E_n can be found by multiplying their individual outcomes:

\begin{equation} \text{Number of outcomes} = a \cdot b \cdot ... \cdot z \end{equation}

- There are two kinds of arrangements:
  - Arrangements where the order matters, which we call **permutations**.
  - Arrangements where the order doesn't matter, which we call **combinations**.
- To find the number of permutations when we're sampling without replacement, we can use the formula:

\begin{equation} Permutation = n! \end{equation}

- To find the number of permutations when we're sampling without replacement and taking only k objects from a group of n objects, we can use the formula:

$$ {}_nP_k = \frac{n!}{(n-k)!} $$

- To find the number of combinations when we're sampling without replacement and taking only k objects from a group of n objects, we can use the formula:

$$ {}_nC_k = {n \choose k} = \frac{n!}{k!(n-k)!} $$

Resources

- A tutorial on calculating combinations when sampling with replacement, which we haven't covered in this mission
- An easy-to-digest introduction to permutations and combinations

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