Review - Set Theory and Counting

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Set Relations

Let A and B be sets.

- We say that $A \subset B$ (A is contained in B) if:
- We say that $A = B$ (A is equal to B) if:

Set Operations

- $$A \cup B =$$
- $$A \cap B =$$
- $$A^c =$$
- In terms of union, intersection and complementation,

$$A - B =$$

Properties of Set Operations

- Commutativity:
- Associativity:
- Distributivity:
- DeMorgans Laws:

Random Experiments and Sample Space

- A random experiment is
- The Sample Space S is
- A Sample space is discrete if (also give an example)
- A Sample space is continuous if (also give an example)

Events

Let A and B be events.

- Define an event.
- Events A and B are disjoint if
- Events A and B are exhaustive if
- Let $B_1, B_2, \cdots B_k$ be a collection of events. What does it mean for the collection of events to be disjoint? Exhaustive?
- The events $B_1, B_2, \cdots B_k$ form a partition if:
- Given an event B, what is the simplest partition including B?

Counting

Let S be a finite sample space such that every outcome is equally likely.

- For an event A, $P(A) =$
- Fundamental Theorem of Counting:
- Given n items, how many ways are there to choose an **ordered** sequence of k items **with replacement**? (License plate example)
- Given n items, how many ways are there to choose an **ordered** sequence of k items **without replacement**? (Race running example)
- Given n items, how many ways are there to choose an **unordered** sequence of k items **wihtout replacement**? (Yogurt lid race running example)
- Addition Rule:
$$|A \cup B| =$$
- If $B_1, B_2, \cdots B_k$ are disjoint, then
$$|B_1 \cup B_2 \cup \cdots B_k| =$$

Sampling With and Without Replacement

Suppose we have N items, K of which are *marked* and we plan to sample n of these items.

- If we sample with replacement, what is the probability the sample contains x marked items?
- If we sample without repalcement, what is the probability the sample contains x marked items?