STAT 134: Section 1

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Welcome to Stat 134! Alongside lecture, discussion sections are a key way to clarify and reinforce the course content. We hope to make discussions an engaging and welcoming environment!

Conceptual Review

Please discuss these short questions. These problems are intended to highlight concepts that will be relevant for today's problems.

a. What is an outcome space (typically denoted by Ω)?

b. What is an event?

c. What are the three axioms of probability?

Manipulating Events

Consider an outcome space Ω, and two events $A, B \subseteq \Omega$. In each of the parts below, fill in the blanks with either an event, or $\cup$ or $\cap$ symbols so that the equalities hold. (It may help to draw Venn diagrams.)

Events are subsets of the outcome space, so we can manipulate them using set operations like intersection, union, and complement. To calculate the probability of an event, it often helps to first manipulate the event (we'll see an example below). So we need to know how to manipulate sets.

a. Partitioning: $A = (A \_\_\_\_\_ B) \_\_\_\_\_ (A \_\_\_\_\_ B^c)$

b. DeMorgan's Law I: $(A \cap B)^c = A^c \_\_\_\_\_ B^c$

c. DeMorgan's Law II: $(A \cup B)^c = A^c \_\_\_\_\_ B^c$

d. Suppose $B \subset A$. Then $A \cap B = \_\_\_\_\_\_$.

e. Suppose P is a probability on the outcome space Ω. Use partitioning from (a) and two axioms to prove the ever–useful *complement rule*:

$$P(A) = 1 - P(A^c).$$

The Birthday Problem

CLASS ACTIVITY: In your discussion section, how many students do you think have the same birthday? As time permits, your GSI will write down your birthdays to see how many shared birthdays there are.

Suppose you are in a classroom of n students ($n \leq 365$). In the following calculations, ignore leap days and assume that students' birthdays are independent and distributed uniformly at random across the year.

How are these assumptions violated in reality? How does this affect the true probability of these events?

a. Find the chance that at least one other student shares *your* birthday.

b. Find the chance that at least two students share the same birthday.

From Section 1.6, Example 5 (pg 62) in Pitman's Probability

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