

Problems 1 - 7: in-class discussion

8. Basic set theory is important for probability. Suppose the "universe" (the set of all objects under consideration) is  $U = \{a, b, c, d, e\}$ . Let  $S = \{a, b, c\}$  and  $T = \{c, d\}$ .

Write the contents of each of the following sets:

$$S \cap T = \{c\}$$

This is the **INTERSECTION**:  
the set of items in both  $S$  and  $T$ .

$$S \cup T = \{a, b, c, d\}$$

This is the **UNION**:  
the set of items in either  $S$  or  $T$ .

$$S' = \{d, e\}$$

This is the **COMPLEMENT** of  $S$ :  
the set of items not in  $S$ .

$$\emptyset = \{ \}$$

This is the **EMPTY SET**.

$$S \cap T' = \{a, b, c\} \cap \{a, b, e\} = \{a, b\}$$

9. For each of the following experiments, state the sample space and any three events:

(a) A coin is flipped until heads appears, and the number of flips is recorded.

There are many ways to write the sample space. For example:

$$S = \{H, TH, TTH, TTTH, \dots\}$$

or

$$S = \{1, 2, 3, 4, \dots\} \quad \text{or} \quad S = \{1, 2, 3, 4, \dots\} \cup \{\infty\}$$

outcome that heads never appears ↗

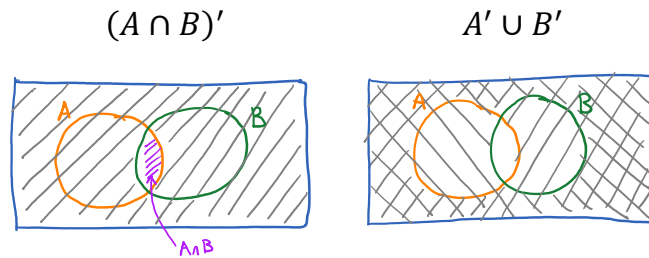
some events:  $\{1\}$ ,  $\{2, 4, 6, 8, \dots\}$ ,  $\{2, 3, 5, 7\}$

(b) A real number is selected between 0 and 1.

$S$  is the interval  $(0, 1) = \{x \mid 0 < x < 1\}$

some events:  $\{\frac{1}{2}\}$ ,  $(0, \frac{1}{2})$ ,  $(\frac{1}{4}, \frac{3}{4})$

10. Let  $A$  and  $B$  be some events in a sample space. Draw Venn diagrams to illustrate each of the following events:



How do your diagrams illustrate one of De Morgan's Laws?

$$(A \cap B)' = A' \cup B' \leftarrow \text{the complement of an intersection is a union of complements}$$