

# Math 262

## Section 1.2

Day 2

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

$$(A \cap B)'$$

$$A' \cup B'$$

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

2. Write down probability Axiom 3. Let  $A_i = \emptyset$  for all  $i \in \{1, 2, 3, \dots\}$ . Explain why this implies  $P(\emptyset) = 0$ .

3. The **Complement Rule** says that for any event  $A$ ,  $P(A) = 1 - P(A')$ . (This can be proved using Axiom 3.) Show how the Complement Rule implies that  $P(A) \leq 1$  for any event  $A$ .

4. If  $A$  and  $B$  are disjoint, Axiom 3 implies that  $P(A \cup B) = P(A) + P(B)$ . If  $A$  and  $B$  are *not* disjoint, what is the relationship between  $P(A \cup B)$ ,  $P(A \cap B)$ ,  $P(A)$ , and  $P(B)$ ?

*Hint:* Use a Venn diagram.

5. Generalize your answer from #4 to three sets. That is, what can you say about  $P(A \cup B \cup C)$ ?

★ **BONUS:** If  $A \subseteq B$  (meaning that  $A$  is a subset of  $B$ ), show that  $P(A) \leq P(B)$ .