1. 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.

$S = \{H, TH, TTH, \ldots, T^nH, \ldots\}$ or $\mathbb{N}^+ = \{1, 2, 3, 4, \ldots\}$

events: $\{H\}$ $\{T^6H\}$ $\{49\}$

first heads occurs on a even numbered flip $= \{2, 4, 6, 8, \ldots\}$

$\{2, 3, 5, 7, 11, \ldots\}$

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

$S = \{x \in \mathbb{R} \mid 0 < x < 1\} = (0, 1)$

↑ interval notation

event: $\{0.1\}$ $\{0.2\}$

$\{x \mid \frac{1}{e} < x < \gamma\}$ $(0, \frac{1}{2})$

$\{x \mid x \in \mathbb{Q}\}$

↑ rational

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

$(A \cap B)'$ $A' \cup B'$

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

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

4. 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.

5. 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 $P(B)$?

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