Probability Theory: Activity 4 Name: ____________________

Axioms & Properties of Probability

1. Show that for any events A and B, $P(A)+P(B)-1 \leq P(A\cap B) \leq P(A\cup B) \leq P(A)+P(B)$. For each of these three inequalities, give a simple criterion for when the inequality is actually an equality (e.g., give a simple condition such that $P(A \cap B) = P(A \cup B)$ if and only if the condition holds).

2. Let A and B be events. The dfference $B - A$ is defined to be the set of all elements of B that are not in A. Show that if $A \subseteq B$, then $P(B - A) = P(B) - P(A)$, directly using the axioms of probability.

3. Events A and B are independent if $P(A \cap B) = P(A)P(B)$ (independence is explored in detail in the next chapter). Show that if A and B are independent, then $P(A \cup B) = P(A) + P(B) - P(A)P(B) = 1 - P(A^c)P(B^c)$.

Inclusion-Exclusion

4. A fair 6-sided die is rolled n times. What's the prob that at least 1 of the 6 sides never appears?