R1

Set Notation
Ω is the universe

six sided die $S = \{1, 2, 3, 4, 5, 6\}$
fair coin $S = \{H, T\}$

B^C complement of B

$A \cup B$ All that which $\{X \mid X \in A \mid X \in B\}$

disjoint sets $A \wedge B = \text{null}$

if disjoing $P(A) + P(B) = P(A \cup B)$

$B \wedge B^C = \text{null}$

$B \cup B^C = \Omega$

Probability Laws
Ω universe
event A has n elements
Ω has N elements

Discrete uniform law - means each one is equally likely
$P(A) = \frac{n}{N}$

Continuous Uniform Law, $P(A) = P(x, y) = \left\{x, y | x + y \leq \frac{1}{2}\right\} = \frac{1}{8}$

Axioms of Probabiliy
1. Non-negativity
   - $P(A) \geq 0$
2. Normalization
   - $P(\Omega) = 1$
3. Additivity
   - if $A \cup B = \text{null}$, then $P(A \cup B) = P(A) + P(B)$ (disjoint set)

Practice Problems
1 Probabilility difference of 2 events
$P\left[\left(A \cap B^C\right) \cup \left(A^C \cap B\right) = P(A) + P(B) - 2P(A \cap B)\right]$
This is like saying A only plus B only is what

Observation $A = (A \cap B)$

2 Romeo and Juliet time

- Each one will arrive between 0 and 1 hour $[0, 1]$
- All delays are equally likely
- The first to arrive will wait 15 minutes then leave

Between $[0, 1]$ means that its continuous and because all equaly, also uniform problem

M : Event that Romeo and Juliet meet, what is $P(M)$

Graph the problem where x is romeo and y is juliet, from 0 to 1 where Ω is the 1x1 square

15min = 1/4 of an hour

M is like a diagonal banner line, so $P(M) = 1 - 2\left(\frac{3}{4} \cdot \frac{3}{4} \cdot \frac{1}{2}\right)$
$P(M) = 1 - \frac{9}{16} = \frac{7}{16}$

3 Bonferroni's Inequality

Prove $P(A_1 \cap A_2) \geq P(A_1) + P(A_2) - 1$

4 Proving through induction