7.1 Rules for Unions of Events Con't

7.1.1 Non-Mutually Exclusive Events

- In events which aren't mutually exclusive, there is some overlap

- When P(A) and P(B) arr added, the probability of intersection is added twice

- To compensate for that double addition, the intersection needs to be subtracted.

For two events A and B : $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
For any three events, A,B,and C : $P(A \cup B \cup C) = P(A) + P(B) + P(B) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$

7.2 Intersection of Events and Independence

- Two events are independent if they do not influence each other.

- Knowing the outcome of one event does not help with knowing the outcome of the other event.

Definition 7.1 *Events A and B are **Independent** if and only if $P(A \cap B) = P(A)P(B)$*
*If they are not independent, the events are referred to as **dependent***

7.3 Independence of Three Events

Three events, A, B and C are independent events if and only if all of the following statements hold:

- $P(A \cap B) = P(A)P(B)$

- $P(A \cap C) = P(A)P(C)$

- $P(B \cap C) = P(B)P(C)$

- and , $P(A \cap B \cap C) = P(A)P(B)P(C)$