DIS 5A

Monday, July 16, 2018 12:44 PM

Topic: Independence

Review

- **Union of events**

$$\mathbb{P}(A \cup B) = \mathbb{P}(A) + \mathbb{P}(B) - \mathbb{P}(A \cap B)$$

can be generalized to more than two events (inclusion-exclusion principle)

$$\mathbb{P}\left(\bigcup_{i=1}^{n} A_i\right) \leq \sum_{i=1}^{n} \mathbb{P}(A_i)$$

special case: A_i's are mutually exclusive

$$\Rightarrow \mathbb{P}\left(\bigcup_{i=1}^{n} A_i\right) = \sum_{i=1}^{n} \mathbb{P}(A_i)$$

- **Intersection of events**

$$\mathbb{P}(A \cap B) = \mathbb{P}(A) \cdot \mathbb{P}(B|A)$$

can be generalized to more than two events (Product Rule)

Special case ... ?

Independence

- A, B independent $\Leftrightarrow \mathbb{P}(B|A) = \mathbb{P}(B)$

$$\Leftrightarrow \mathbb{P}(A \cap B) = \mathbb{P}(A)\mathbb{P}(B)$$

- generalization for more than two events

A_i's are mutually independent

$\Leftrightarrow$ for all k-element subset of $\{A_i\}_{i=1}^{n}$, we have $P\left(\bigcap_{i=1}^{k} A_i\right) = \prod_{i=1}^{k} P(A_i)$