Sec 11.7

Events involving <u>And</u>
conditional probability

Two events are <u>independent events</u> if the occurrence of either has no effect on the probability of the other

[Different from mutual exclusivity]

If A and B are independent events, then $P(A \text{ and } B) = P(A) \cdot P(B)$

Example: Draw a card from a 52-card Deck. Return it. Draw again. Find the probability of drawing a heart twice.

Event A draw a heart
Event B draw a heart.

$P(A \text{ and } B) = \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}.$

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Example:

What is the probability of a family having 3 sons in a row?

$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$

~~The pro~~

P(event happening at least once) = 1 - P(event does not happen)

If the probability that a hurricane hits south Florida in any given year is $\frac{5}{19}$,

a) what is P(hit in 4 consecutive years)

$= \frac{5}{19} \cdot \frac{5}{19} \cdot \frac{5}{19} \cdot \frac{5}{19} = \frac{625}{130321} \approx 0.0048$

b) what is P(not hit in next 4 years)

$\frac{14}{19} \cdot \frac{14}{19} \cdot \frac{14}{19} \cdot \frac{14}{19} = \frac{38416}{130,321} \approx 0.295$

c) what is P(hit at least once in 4 years)

$1 - 0.29578 \approx 0.7052$ 70.5%

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Two events are <u>dependent</u> <u>events</u> if the occurence of one of them has an effect on the probability of the other.

If A and B are dependent events, then

$P(A \text{ and } B) = P(A) \cdot P(B \text{ given that } A \text{ has occured})$

Example: Draw a card, ~~Re~~ without replacing, draw another.

Event A: First card is a heart

Event B: 2nd card is a heart.

$P(A \text{ and } B) = P(A) \cdot P(B \text{ given } A)$

$= \frac{13}{52} \cdot \frac{12}{51} = \frac{156}{2652} = \frac{1}{17}$

Section 11.7

Conditional Probability

The probability of Event B, given that event A has occurred, is called the conditional probability of B, given A. This probability is denoted $P(B|A)$.

Think of this as the probability of B if the sample space is restricted to the outcomes associated with event A.

Example: A letter is selected at random from the English alphabet. Find the probability of selecting a consonant given that the letter selected precedes j.

$P(\text{consonant} \mid \text{precedes } j)$

$S = \{a, b, c, d, e, f, g, h, i\}$ $\quad n(S) = 9$

~~P(consonant~~ number of consonants = 6.

$P(\text{consonant} \mid \text{precedes } j) = \frac{6}{9} = \frac{2}{3}$

Example: A card is drawn from a 52-card deck. What is the probability that the card is ~~a~~ the two of hearts, given that it is a heart?

$P(\text{2 of hearts} \mid \text{heart})$

hearts = 13

of 2 of hearts = 1

$P(\text{2 of hearts} \mid \text{heart}) = \frac{1}{13}$.