Lec 8/31

Wednesday, August 31, 2016 7:52 AM

Conditional Probability

Occurrence of one event affects probability of another event.

Ex A, B, ~~C~~

Ex $P(\text{Roll a 5 or less}) = \frac{1+2+3+4}{36} = \frac{10}{36} = \frac{5}{18}$

Die on table is a 5 $\Rightarrow$ $P(\text{rolling} \leq 5) = 0$

" " " 3 $\Rightarrow$ $P(\text{rolling} \leq 5) = \frac{1}{3}$

" " " 1 $\Rightarrow$ $P(\text{rolling} \leq 5) = \frac{2}{3}$

Ex Pick a card

$P(\text{draw H}) = \frac{1}{4} = \frac{13}{52}$

$P(\text{draw H} \mid \text{drawn red}) = \frac{1}{2} = \frac{13}{26}$

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$ (note that $P(B) > 0$ is required)

"given" ↑ ↖ "conditional event"

Ex: pick a student at random from a class with the following makeup:

	So	Jr	Sr	total
female	31.44%	5.71%	0%	37.15%
male	40.00%	17.14%	5.71%	62.85%
total	71.44%	22.85%	5.71%	100%

1) What's prob student is soph male? 0.40

2) " " " male | soph? $40/71.44$

3) " " " soph | male? $40/62.85$

let A = "student is a sophomore"

B = "student is male"

1) $P(A \cap B) = 0.4$

2) $P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{0.4}{0.7144}$

3) $P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.4}{0.6285}$

Note $P(A \cap B) = P(B)\,P(A|B) = P(A)\,P(B|A)$

Ex: In a class w/ 40% F, 25% of females are Business Majors and 30% of the males are business majors.

1) Probability a randomly selected student is a female business major?

2) " " business major?

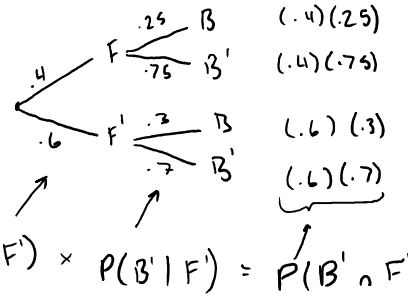
Let F = "student is female"

B = "student is a business major"

$P(F) = 0.4 \quad P(B|F) = 0.25 \quad P(B|F') = 0.3$

1) $P(F \cap B) = P(F)\,P(B|F) = (0.4)(0.25) = 0.1$

2) $P(B) = P(F \cap B) + P(F' \cap B) = 0.1 + P(F')P(B|F') = 0.1 + (0.6)(0.3) = 0.28$



2.7 is Independent events

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events A, B are independent iff $P(A) = P(A|B)$ iff $P(B) = P(B|A)$

$P(A \cap B) = P(B)P(A|B)$ so iff $P(A \cap B) = P(A)P(B)$ ← one to check