

LECTURE 7

01-31-18

FULL HOUSE PROBABILITY

- DO IT WITHOUT CONSIDERING ORDER

$$\frac{13 \binom{4}{3} \times 12 \binom{4}{2}}{\binom{52}{5}}$$

$$\frac{13 \binom{4}{2} \times 12 \binom{4}{3}}{\binom{52}{5}}$$

- DO IT CONSIDERING ORDER

$$\frac{13 \cdot P_{3,4} \cdot 12 P_{2,4}}{P_{5,52}}$$

000
3♥ 3♦ 3♣

X X
4♥ 4♦

0 X 0 X 0
3♥ 4♦ 3♠ 4♥ 3♣

$\binom{5}{2}$ NUMBER OF WAYS TO PLACE TWO "X'S" IN FIVE POSITIONS

$$13 \frac{4!}{1!} \cdot 12 \frac{4!}{2!} \frac{5!}{3!2!}$$

$$= \frac{13 \left(\frac{4!}{3!1!} \right) 12 \left(\frac{4!}{2!2!} \right)}{\frac{52!}{47!5!}}$$

$$\frac{52!}{47!}$$

$$\frac{52!}{47!5!}$$

$$\binom{4}{3} = \frac{4!}{3!1!} = 4 \quad \binom{4}{1} = 4!$$

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

$$\binom{n}{n-k}$$

$$\frac{n!}{(n-k)!(n-(n-k))!}$$

01-31-18

$$\binom{52}{5} = 2,598,960$$

$$\binom{13}{1} = 13$$

$$\binom{12}{1} = 12$$

$$\binom{n}{1} = \frac{n!}{(n-1)!} = n$$

$$\binom{13}{1} \binom{4}{3} \binom{12}{1} \binom{4}{2} = 3744$$

$$\frac{3744}{2598960} = 0.001440576$$

CONDITIONAL PROBABILITY

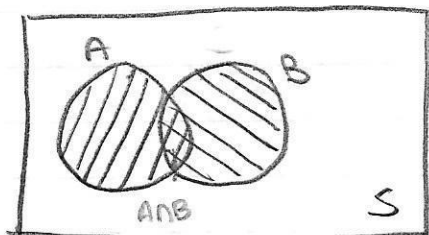
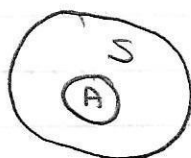
- UNCERTAINTY OF EVENT A, GIVEN B
- GIVEN THAT IT RAINED TODAY, HOW LIKELY IS IT TO RAIN TOMORROW?
- Q1: PSU FOOTBALL TEAM HAS WON 5 GAMES IN A ROW, WHAT IS THE PROBABILITY THEY WIN THE NEXT MATCH?
- CONDITIONAL PROBABILITY IS SUITABLE WHEN WE HAVE SOME PARTIAL INFORMATION OR CONDITION
- CONDITIONAL PROBABILITY OF EVENT A, GIVEN THAT EVENT B HAS OCCURRED IS DEFINED TO BE:

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \quad \text{WHENEVER } P(B) > 0$$

$$P(A|S) = \frac{P(A \cap S)}{P(S)} = P(A \cap S) = P(A)$$

$A \subset S$

$A \cap S = S$



$$\binom{5}{2} = \frac{5!}{3!2!} = \frac{P_{2,5}}{2!}$$

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} = \frac{P_{k,n}}{k!}$$

$$P_{k,n} = \frac{n!}{(n-k)!}$$

DRAW 1 CARD FROM 52. WE OBSERVE IT TO BE A FACE CARD. GIVEN THIS INFORMATION, WHAT IS THE PROBABILITY THAT THE CARD IS A KING?

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

\leftarrow PROBABILITY OF A KING
 \leftarrow PROBABILITY OF FACE CARD

$$P(A \cap B) = 4/52 \quad P(B) = \frac{4 \cdot 3}{52} = 12/52$$

\nearrow K, Q, J \times 4 SUITS

$$P(A|B) = \frac{\frac{4}{52} = \frac{1}{13}}{\frac{12}{52} = \frac{3}{13}} = \frac{4}{12} = \frac{1}{3}$$

$$P(A) = 1/13 \quad (\text{PROB OF PULLING A KING; UNCONDITIONAL})$$

- MULTIPLICATION RULE - SUPPOSE ALL CONDITIONAL 01-31-18
PROBABILITIES BELOW EXIST

$$P(A \cap B \cap C) = P(A) P(B|A) P(C|A \cap B)$$

$$P(A_1 \cap A_2 \cap \dots \cap A_n) = P(A_1) P(A_2|A_1) P(A_3|A_1 \cap A_2 \cap \dots \cap A_{n-1})$$

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

$$P(A \cap B) P(C|A \cap B) = P(A \cap B) \frac{P(A \cap B \cap C)}{P(A \cap B)} = P(A \cap B \cap C)$$