Statistics

Lecture 7

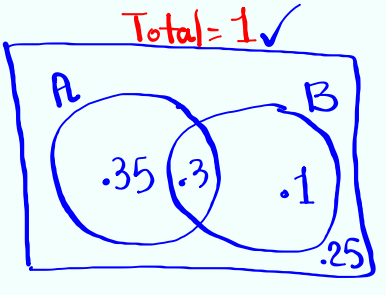
Feb 19-8:47 AM

Class QZ 3

Given $P(A) = .65$ $P(B) = .4$

$P(A \text{ and } B) = .3$

1) Construct Venn Diagram.



2) $P(\bar{A}) = 1 - P(A) = .35$

3) $P(A \text{ or } B) = .75$

$= P(A) + P(B) - P(A \text{ and } B)$

$= .65 + .4 - .3 = .75$

Oct 10-8:10 AM

Suppose $P(A)=.5$, $P(B)=.4$ A & B are independent events

1) $P(\overline{B}) = 1-.4 = .6$

2) $P(A \text{ and } B) = P(A)\cdot P(B) = (.5)(.4)$

3) $P(A \text{ or } B) = P(A)+P(B)-P(A \text{ and } B) = .2$
$= .5+.4-.2 = .7$

4) $P(\overline{A} \text{ and } \overline{B}) = P(\overline{A \text{ or } B}) = 1-.7 = .3$

De Morgan's Law

5) $P(\overline{A} \text{ or } \overline{B}) = P(\overline{A \text{ and } B}) = 1-.2 = .8$

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Multiplication Rule

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

A happens, then B happens

$P(B|A)$: Given

A box has 4 red and 6 blue balls.

Select 2 balls without replacement

$P(\text{two red Balls}) = \frac{4}{10}\cdot\frac{3}{9} = \frac{12}{90} = \frac{4}{30} = \frac{2}{15}$

$P(\text{two blue balls}) = \frac{6}{10}\cdot\frac{5}{9} = \frac{30}{90} = \frac{3}{9} = \frac{1}{3}$

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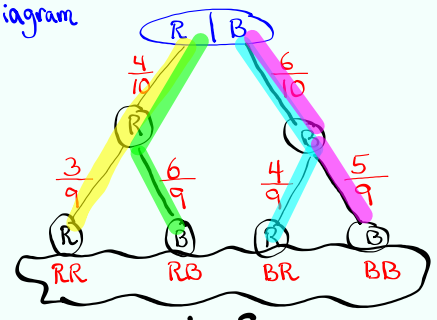
Tree Diagram



Sample Space

A complete list of all possible outcomes

$P(1R, 1B) = P(RB \text{ or } BR) = 2 \cdot \frac{4}{10} \cdot \frac{6}{9} = \frac{48}{90} = \boxed{\frac{8}{15}}$

Verify

$P(2 \text{ reds}) + P(1R\,1B) + P(2 \text{ blues}) = 1$

$\frac{2}{15} + \frac{8}{15} + \frac{1}{3} = 1$

2 ÷ 15 + 8 ÷ 15 + 1 ÷ 3 enter

Oct 10-8:35 AM

Draw 3 cards without replacement from a full deck of playing cards.

$P(\text{All red Color}) = \frac{26}{52} \cdot \frac{25}{51} \cdot \frac{24}{50} = \boxed{\frac{2}{17}}$

$P(\text{All Black color}) = \cdots = \boxed{\frac{2}{17}}$

$P(\text{All Same Color}) = P(RRR \text{ or } BBB) = \frac{2}{17} + \frac{2}{17} = \boxed{\frac{4}{17}}$

$P(\text{not all Same Color}) = P(\overline{\text{Same Color}})$

$= 1 - P(\text{Same Color}) = \frac{13}{17}$

$P(\text{All face Cards}) = \frac{12}{52} \cdot \frac{11}{51} \cdot \frac{10}{50} = \boxed{\frac{11}{1105}}$

Rare event

$\approx .010$

$\leq .05$

Oct 10-8:44 AM

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

Divide by $P(A)$

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

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

Conditional Prob.

Oct 10-8:53 AM

Given $P(A) = .5$, $P(B) = .4$, $P(A \text{ and } B) = .3$

1) $P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.3}{.5} = \frac{3}{5} = .6$

2) $P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.3}{.4} = \frac{3}{4} = .75$

Oct 10-8:56 AM

$P(\text{Coffee}) = .6$

$P(\text{Donut}) = .5$

$P(\text{Coffee and Donut}) = .4$

$$P(\text{Donut} \mid \text{Coffee}) = \frac{P(\text{Coffee and Donut})}{P(\text{Coffee})} = \frac{.4}{.6} = \frac{4}{6} = \frac{2}{3} = .667$$

$$P(\text{Coffee} \mid \text{Donut}) = \frac{P(\text{Coffee and Donut})}{P(\text{Donut})} = \frac{.4}{.5} = \frac{4}{5} = .8$$

Oct 10-8:59 AM

$P(A) = .75$

$P(B) = .6$

$P(B|A) = .8$

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

$$.8 = \frac{P(A \text{ and } B)}{.75}$$

Cross-Multiply

$P(A \text{ and } B) = (.75)(.8)$

$= .6$

Find $P(A \text{ and } B)$

Find $P(A|B)$ (Sure event)

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.6}{.6} = 1$$

Oct 10-9:04 AM