

Statistics

Lecture 7



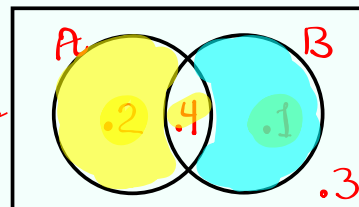
Feb 19-8:47 AM

Class QZ 3

Given $P(A) = .6$, $P(B) = .5$, $P(A \text{ and } B) = .4$

1) Construct Venn Diagram

Total = 1



2) $P(\bar{A}) = 1 - P(A) = \boxed{.4}$

3) $P(A \text{ or } B) = \boxed{.7}$ ✓
 $P(A) + P(B) - P(A \text{ and } B) =$
 $.6 + .5 - .4 = \boxed{.7}$

3) $P(\text{A only or B only}) = .2 + .1 = \boxed{.3}$

4) $P(\text{A only and B only}) = \boxed{0}$

Oct 10-11:27 AM

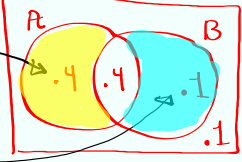
Given $P(A) = .8$ $P(B) = .5$ A & B are independent events.

1) $P(\bar{A}) = 1 - .8 = \boxed{.2}$

2) $P(A \text{ and } B) = P(A) \cdot P(B)$
 $= (.8)(.5)$
 $= \boxed{.4} \checkmark$

3) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
 $= .8 + .5 - .4 = \boxed{.9}$

4) Construct Venn Diagram



5) $P(A \text{ only or } B \text{ only})$
 $= .4 + .1 = \boxed{.5}$

6) $P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - .9 = \boxed{.1}$

De Morgan's Law

7) $P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B)$
 $= 1 - .4 = \boxed{.6}$

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Multiplication Rule

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

$\swarrow$ A happens
 $\searrow$ then B happens $\swarrow$ Given

A box has 3 red and 7 blue balls.

Select 2 balls, No replacement

RR RB BR BB Sample Space

$P(RR) = \frac{3}{10} \cdot \frac{2}{9} = \boxed{\frac{1}{15}}$

$P(BB) = \frac{7}{10} \cdot \frac{6}{9} = \boxed{\frac{7}{15}}$

$P(\text{Same Color}) = P(RR \text{ or } BB) = \frac{1}{15} + \frac{7}{15} = \boxed{\frac{8}{15}}$

$P(\text{not Same Color}) = P(\overline{\text{Same Color}}) = 1 - P(\text{Same Color})$
 $= 1 - \frac{8}{15} = \boxed{\frac{7}{15}}$

is the Complete list of all outcomes.

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Draw 3 Cards From a standard deck of playing cards **without replacement.**

$$1) P(\text{All red Color}) = \frac{26}{52} \cdot \frac{25}{51} \cdot \frac{24}{50} = \boxed{\frac{2}{17}}$$

$$2) P(\text{All Face Cards}) = \frac{12}{52} \cdot \frac{11}{51} \cdot \frac{10}{50} = \boxed{\frac{11}{1105}}$$

Rare event

$\approx .010$
 $\leq .05$

$$3) P(\text{no Aces}) = P(\overline{A A A})$$

$\uparrow$
Almost a
Sure event

$$= 1 - P(A A A)$$

$$= 1 - \frac{4}{52} \cdot \frac{3}{51} \cdot \frac{2}{50} = \boxed{\frac{5524}{5525}}$$

$\approx .99981 \dots$
 ≈ 1

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A piggy bank has 2 quarters and 8 dimes.

Take 2 Coins no replacement.

QQ QD DQ DD

Sample Space

$$P(QQ) = \frac{2}{10} \cdot \frac{1}{9} = \boxed{\frac{1}{45}}$$

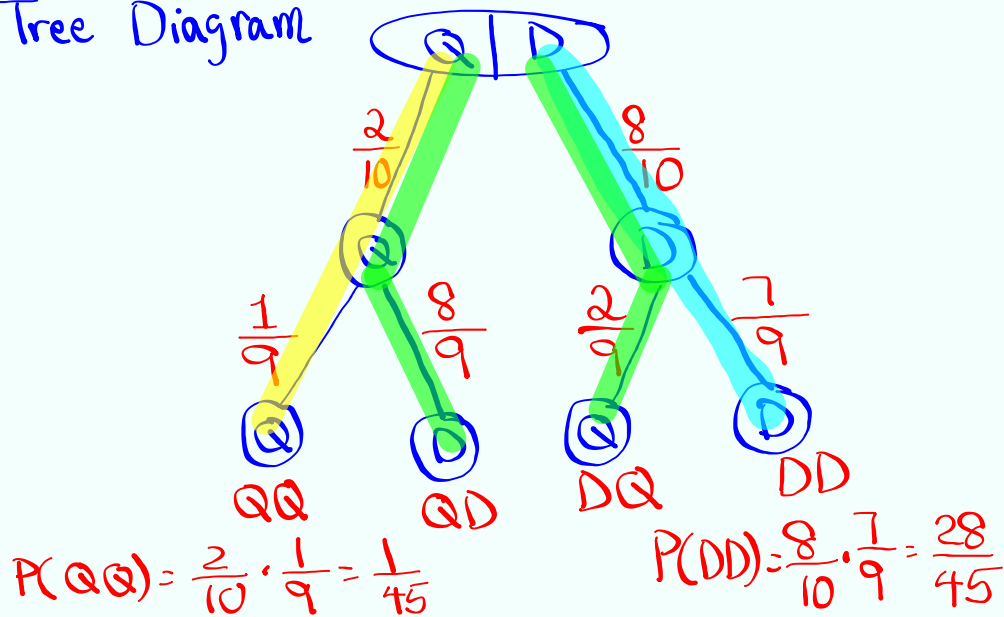
$$P(DD) = \frac{8}{10} \cdot \frac{7}{9} = \boxed{\frac{28}{45}}$$

$$\text{Total} = \frac{45}{45} = 1$$

$$P(1D 1Q) = P(DQ \text{ OR } QD) = 2 \cdot \frac{8}{10} \cdot \frac{2}{9} = \boxed{\frac{16}{45}}$$

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Tree Diagram



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Multiplication Rule

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

Divide both Sides 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.

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$$P(A) = .6 \quad P(B) = .5 \quad P(A \text{ and } B) = .4$$

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.4}{.6} = \frac{4}{6} = \boxed{\frac{2}{3}} = \boxed{.667}$$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.4}{.5} = \boxed{\frac{4}{5}} = \boxed{.8}$$

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$$P(\text{Coffee}) = .8$$

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

$$P(\text{Coffee and Donut}) = .35$$

$$P(\text{Donut} | \text{Coffee}) = \frac{P(\text{Donut and Coffee})}{P(\text{Coffee})} = \frac{.35}{.8} \approx \boxed{.438}$$

$$P(\text{Coffee} | \text{Donut}) = \frac{P(\text{Donut and Coffee})}{P(\text{Donut})} = \frac{.35}{.4} = \boxed{.875}$$

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$$P(A) = .6$$

$$P(B) = .5$$

$$P(A|B) = .8$$

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

$$.8 = \frac{P(A \text{ and } B)}{.5}$$

Cross-Multiply

$$1) P(A \text{ and } B)$$

$$P(A \text{ and } B) = (.5)(.8)$$

$$= \boxed{.4}$$

$$2) P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.4}{.6} = \frac{2}{3} = \boxed{.667}$$

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