Statistics

Lecture 11

Feb 19-8:47 AM

Class Quiz 2

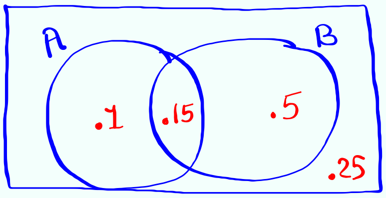
Given $P(A) = .25$, $P(B) = .65$, $P(A \text{ and } B) = .15$

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

$= 1 - .25$

$= \boxed{.75}$

2) Construct Venn Diagram



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

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

$= .25 + .65 - .15 = \boxed{.75}$

4) $P(A \text{ only OR } B \text{ only}) = .1 + .5 = \boxed{.6}$

5) $P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - .75 = \boxed{.25}$

De Morgan's Law

6) $P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .15 = \boxed{.85}$

Mar 19-1:41 PM

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

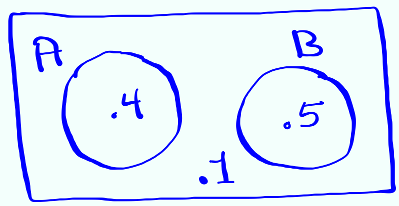
M.E.E.

1) $P(\bar{A}) = 1 - .4 = \boxed{.6}$

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

3) $P(A \text{ or } B) = .4 + .5 - 0 = \boxed{.9}$

4) Draw Venn Diagram



Mar 19-2:02 PM

A box has 4 Quarters and 6 nickels.

Take 2 Coins with replacement

$P(\text{Both Quarters}) = \frac{4}{10} \cdot \frac{4}{10} = \frac{2}{5} \cdot \frac{2}{5} = \boxed{\frac{4}{25}} = \boxed{.16}$

$P(\text{Both Nickels}) = \frac{6}{10} \cdot \frac{6}{10} = \frac{3}{5} \cdot \frac{3}{5} = \boxed{\frac{9}{25}} = \boxed{.36}$

$P(\text{one of each}) = 2 \cdot \frac{4}{10} \cdot \frac{6}{10} = \frac{48}{100} = \boxed{\frac{12}{25}} = \boxed{.48}$

QN or NQ

48 ÷ 100 Math 1:▸Frac Enter

what if we take 3 coins with replacement

$P(\text{All Quarters}) = \frac{4}{10} \cdot \frac{4}{10} \cdot \frac{4}{10} = \frac{2}{5} \cdot \frac{2}{5} \cdot \frac{2}{5} = \boxed{\frac{8}{125}}$

$P(\text{All Nickels}) = \frac{6}{10} \cdot \frac{6}{10} \cdot \frac{6}{10} = \frac{3}{5} \cdot \frac{3}{5} \cdot \frac{3}{5} = \boxed{\frac{27}{125}}$

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Independent Events

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

Dependent Events

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

Given

A full deck of playing cards has 52 Cards, 12 face Cards, and 4 aces.

Take two Cards without replacement

$$P(\underbrace{\text{Both Aces}}_{\text{Rare event}}) = \frac{4}{52} \cdot \frac{3}{51} = \frac{1}{13} \cdot \frac{1}{17} = \boxed{\frac{1}{221}}$$

$$\approx \boxed{.005}$$

$$P(\text{Both Face Cards}) = \frac{12}{52} \cdot \frac{11}{51} = \frac{11}{221} \approx \boxed{.050}$$

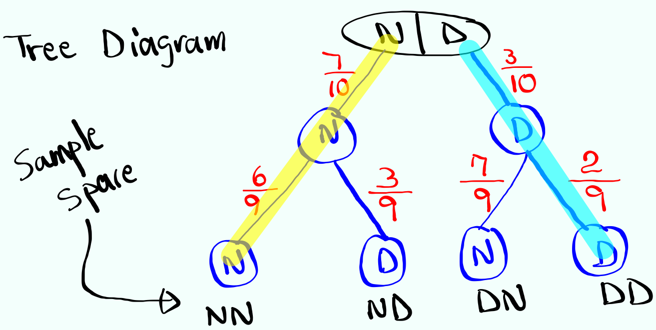
12 [÷] 52 [×] 11 [÷] 51 [Math] [1:▶Frac] [Enter]

Mar 19-2:17 PM

A box has 7 nickels & 3 dimes.

Take 2 coins, No replacement

Tree Diagram



$$P(NN) = \frac{7}{10} \cdot \frac{6}{9} = \boxed{\frac{7}{15}} \qquad P(DD) = \frac{3}{10} \cdot \frac{2}{9} = \boxed{\frac{1}{15}}$$

$$P(ND) = \frac{7}{10} \cdot \frac{3}{9} = \boxed{\frac{7}{30}} \qquad P(DN) = \frac{3}{10} \cdot \frac{7}{9} = \boxed{\frac{7}{30}}$$

$$\frac{7}{15} + \frac{1}{15} + \frac{7}{30} + \frac{7}{30} = \boxed{1} \text{ Total Prob.}$$

Mar 19-2:28 PM

4 Females, 8 Males, Select 3 people.

FFF

$$P(FFF) = \frac{4}{12} \cdot \frac{3}{11} \cdot \frac{2}{10} = \boxed{\frac{1}{55}}$$

Some F & Some M

$$P(MMM) = \frac{8}{12} \cdot \frac{7}{11} \cdot \frac{6}{10} = \boxed{\frac{14}{55}}$$

MMM

P(Same Gender) = P(All Females or All Males)

$$= \frac{1}{55} + \frac{14}{55} = \frac{15}{55} = \boxed{\frac{3}{11}}$$

P(Some F & Some M) = 1 − P(Same gender)

$$= 1 - \frac{3}{11} = \boxed{\frac{8}{11}}$$

Mar 19-2:36 PM

4 Females, 8 Males, Select 3 people.

FFF

$$P(FFF) = \frac{4}{12} \cdot \frac{3}{11} \cdot \frac{2}{10} = \boxed{\frac{1}{55}}$$

Some F & Some M

$$P(MMM) = \frac{8}{12} \cdot \frac{7}{11} \cdot \frac{6}{10} = \boxed{\frac{14}{55}}$$

MMM

P(at least 1 Female) = 1 − P(No Female)

$$= 1 - P(MMM) = 1 - \frac{14}{55} = \boxed{\frac{41}{55}}$$

P(at least 1 Male) = 1 − P(No Males)

= 1 − P(All Females)

$$= 1 - \frac{1}{55} = \boxed{\frac{54}{55}}$$

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

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

Conditional Prob.

$P(A) = .4$

$P(B) = .5$

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

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

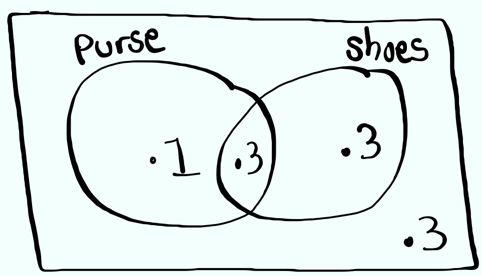
$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.3}{.4} = \boxed{.75}$$

Mar 19-2:48 PM

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

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

$P(\text{Purse and shoes}) = .3$



$$P(\text{shoes} \mid \text{purse}) = \frac{P(\text{Purse and Shoes})}{P(\text{Purse})} = \frac{.3}{.4} = \boxed{.75}$$

$$P(\text{Purse} \mid \text{shoes}) = \frac{P(\text{Purse and Shoes})}{P(\text{Shoes})} = \frac{.3}{.6} = \boxed{.5}$$

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John went shopping.

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

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

$P(\text{shirt} \mid \text{Pants}) = .6$

$P(\text{shirt and Pants}) = ?$

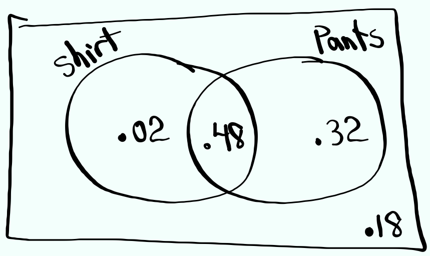
$$P(\text{Shirt} \mid \text{Pants}) = \frac{P(\text{S and P})}{P(\text{Pants})}$$

$$.6 = \frac{P(\text{shirt and Pants})}{.8}$$

Cross-Multiply

$P(\text{S and P}) = (.6)(.8)$

$= \boxed{.48}$



Total = 1

P(He buys one of them, not both)

$= .02 + .32 = \boxed{.34}$

Mar 19-2:59 PM

Introduction to Counting.

Think of your password of

1) 4 digits

$\underset{\text{First \#}}{\underline{10}}$ $\underset{\text{Second \#}}{\underline{10}}$ $\underset{\text{Third \#}}{\underline{10}}$ $\underset{\text{Fourth \#}}{\underline{10}}$

when repetition is allowed

$10 \cdot 10 \cdot 10 \cdot 10 = 10{,}000$

No repetition

$10 \cdot 9 \cdot 8 \cdot 7 = 5040$

2) Think of an ID

Have a letter, followed by 6 digits.

$26 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

Letter

Case Sensitive

$52 \cdot \underbrace{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5}_{\text{NO repetition.}}$

Mar 19-3:08 PM

Roll a die, then flip a coin.

How many outcomes?

$6 \cdot 2 = 12$ Total choices

1H 1T
2H 2T
3H 3T
⋮ ⋮
6H 6T

Mar 19-3:15 PM

5 people
Adam Bill Carol David Eddie

Select 2 people

$5 \cdot 4 = 20$ Total choices

what if oder does not matter

~~AB~~ ~~AC~~ ~~AD~~ ~~AE~~
BA ~~BC~~ ~~BD~~ ~~BE~~
CA CB ~~CD~~ ~~CE~~
DA DB DC ~~DE~~
EA EB EC ED

10 choices

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$_nC_r$ n choose r

n different items

Select r of them

order does not matter

No replacement

$$_nC_r = \frac{n!}{r! \cdot (n-r)!}$$

$3! = 3 \cdot 2 \cdot 1 = 6$

$6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

6 [MATH] [→] PRB [↓] ! [Enter]

$10! = 3{,}628{,}800$

$50! \approx 3.04 \times 10^{64}$

Mar 19-3:23 PM

$$_5C_2 = \frac{5!}{2! \cdot (5-2)!} = \frac{5!}{2! \cdot 3!} = \frac{5 \cdot \overset{2}{\cancel{4}} \cdot \cancel{3 \cdot 2 \cdot 1}}{\cancel{2} \cdot 1 \cdot \cancel{3 \cdot 2 \cdot 1}} = \boxed{10}$$

5 [MATH] [→] PRB [↓] [$_nC_r$] 2 [Enter]

A basketball team has 15 players, but 5 should start the game.

How many ways can this happen?

$$_{15}C_5 = \boxed{3003}$$

CA Lotto

50 numbers

choose 5 numbers

$$_{50}C_5 = \boxed{2118760}$$

Mar 19-3:28 PM

4 Females , 8 Males

Select 3 people, No replacement, order does not matter.

1) How many ways can we do this?

$_{12}C_3 = \boxed{220}$

2) How many ways can we select 3 Females?

$_4C_3 = 4$

3) $P(FFF) = \frac{_4C_3}{_{12}C_3} = \frac{4}{220} = \frac{1}{55}$

4) $P(MMM) = \frac{_8C_3}{_{12}C_3} = \frac{56}{220} = \boxed{\frac{14}{55}}$

5) $P(2F \,\&\, 1M) = \frac{_4C_2 \cdot {_8C_1}}{_{12}C_3} = \frac{48}{220} = \boxed{\frac{12}{55}}$

6) $P(1F \,\&\, 2M) = \frac{_4C_1 \cdot {_8C_2}}{_{12}C_3} = \frac{112}{220} = \boxed{\frac{28}{55}}$

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