Statistics

Lecture 6

Feb 19-8:47 AM

Given $P(A) = .4$, $P(B) = .3$, $P(A \text{ or } B) = .8$

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

2) $P(\bar{B}) = 1 - P(B) = \boxed{.7}$

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

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

we know

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

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

$$.8 - .4 - .3 = -P(A \text{ and } B)$$

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

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

Since $0 \le P(E) \le 1$

Impossible

Jan 16-4:33 PM

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

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

2) $P(\bar{B})=\boxed{.7}$

3) $P(\overline{A \text{ or } B}) = 1-.5=\boxed{.5}$ ✓

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

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

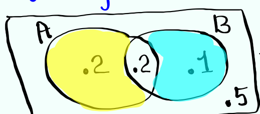
$.5 = .4 + .3 - P(A \text{ and } B)$

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

$-.2=-P(A \text{ and } B)$

$\boxed{P(A \text{ and } B)=.2}$ ✓

5) Venn Diagram



Total=1

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

7) $P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = \boxed{.5}$

De Morgan's Law

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

$=1-.2=\boxed{.8}$

Jan 16-4:33 PM

I flipped a coin 300 times, it landed tails 120 times.

1) P(Flip this coin and lands tails)

$= \frac{120}{300} = \frac{12}{30} = \boxed{\frac{2}{5}}$

2) Find odds in favor of landing tails.

\# tails : # tails

$120 : 180 \longrightarrow \boxed{2:3}$

3) Find odds against landing tails.

$\boxed{3:2}$

Jan 16-4:49 PM

Given odds in favor of event E to be

$$3 : 32$$

1) odds against. $\Rightarrow$ $\boxed{32 : 3}$

2) $P(E) = \dfrac{3}{3+32} = \boxed{\dfrac{3}{35}}$

3) $P(\overline{E}) = \dfrac{32}{3+32} = \boxed{\dfrac{32}{35}}$

Jan 16-4:54 PM

Suppose $P(E) = 2.5\%$

1) Find $P(E)$ in reduced fraction.

$2.5\% = \dfrac{2.5}{100} = \boxed{\dfrac{1}{40}}$ math $\boxed{2: \blacktriangleright \text{Dec}}$ $\boxed{\text{Enter}}$

2) Find $P(E)$ in decimal notation.

$2.5\% = 2.5(.01) = \boxed{.025}$

3) Find $P(\overline{E})$ in decimal.

$P(\overline{E}) = 1 - P(E) = 1 - .025 = \boxed{.975}$

4) Find odds in favor of event E.

$P(E) : P(\overline{E})$

$.025 : .975 \rightarrow \boxed{1 : 39}$

5) Find odds against E. $\boxed{39 : 1}$

SG 12

Pages 1 & 2

Jan 16-4:56 PM

Multiplication Rule

Keyword AND

Multiple Action Event

P(A and B)

A happens, then B happens.

Independent Events

one outcome does not change the prob. of next outcome.

Two Newborn babies

First one $P(Boy) = .5$

Next one $P(Boy) = .5$

Draw two Cards with replacement

$P(\text{first Card is Ace}) = \frac{4}{52}$

$P(\text{Second Card is Ace}) = \frac{4}{52}$

Jan 16-5:04 PM

If A and B are independent events,

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

You flip a fair coin twice,

T T

T H

H T

H H

Sample Space

Complete list of all possible outcomes.

$P(T\ T) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

$P(T\ H) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

$P(H\ T) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

$P(H\ H) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

Jan 16-5:11 PM

You take a quiz with two questions.

It is multiple choice.

Each question has 3 choices but only one correct choice.

You are making Random Guesses.

$C \to$ Correct

$\overline{C} \to$ Incorrect

Sample space

$P(C) = \frac{1}{3}$

$P(\overline{C}) = \frac{2}{3}$

$\left\{ \begin{array}{l} CC \\ C\overline{C} \\ \overline{C}C \\ \overline{C}\,\overline{C} \end{array} \right.$

$P(CC) = \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}$

$P(C\overline{C}) = \frac{1}{3} \cdot \frac{2}{3} = \frac{2}{9}$

$P(\overline{C}C) = \frac{2}{3} \cdot \frac{1}{3} = \frac{2}{9}$

$P(\overline{C}\,\overline{C}) = \frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$

Jan 16-5:16 PM

Draw 2 Cards with replacement from a standard deck of playing cards.

P(Both Face Cards) = P(F F)

$= \frac{12}{52} \cdot \frac{12}{52} = \boxed{\frac{9}{169}}$

P(No Face Cards) = $P(\overline{F}\,\overline{F})$

$= \frac{40}{52} \cdot \frac{40}{52} = \boxed{\frac{100}{169}}$

If You draw 3 Cards,

P(All aces) $= \frac{4}{52} \cdot \frac{4}{52} \cdot \frac{4}{52} = \boxed{\frac{1}{2197}}$

$= 4.55 \times 10^{-4}$

$= .000455$

Rare event

What are the odds in favor of getting all Aces?

P(All Aces) : P($\overline{\text{All Aces}}$)

$\frac{1}{2197} : \frac{2196}{2197}$

$\boxed{1 : 2196}$

\$1 bet

\$2196 Net profit.

Jan 16-5:22 PM

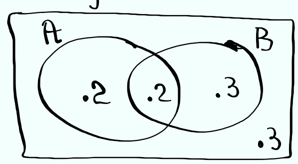
$P(A) = .4$ $P(B) = .5$ A & B are independent Events

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

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

$= .4 + .5 - .2 = \boxed{.7}$

3) Draw Venn Diagram



Total = 1

4) $P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = \boxed{.3}$

De Morgan's Law

5) $P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = \boxed{.8}$

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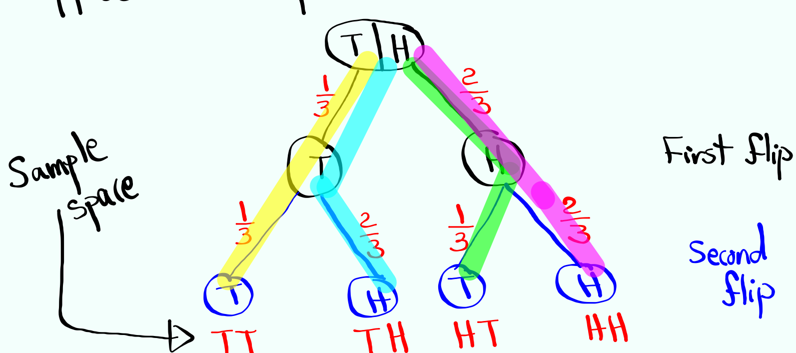
Multiplication Rule with $\boxed{\text{Tree Diagram}}$

$P(\text{Tails}) = \frac{1}{3}$ $P(\text{Heads}) = \frac{2}{3}$

Suppose we flip this coin twice.



$P(TT) = \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}$ $P(TH) = \frac{1}{3} \cdot \frac{2}{3} = \frac{2}{9}$

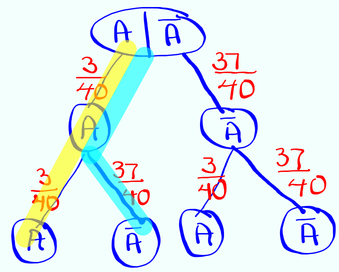
$P(HT) = \frac{2}{3} \cdot \frac{1}{3} = \frac{2}{9}$ $P(HH) = \frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$

Jan 16-6:01 PM

A deck of playing Cards has 40 Cards with 3 aces. Draw 2 Cards with replacement.

$A \rightarrow$ Ace

$\overline{A} \rightarrow \overline{Ace}$



$P(\text{Both are aces}) = P(A\,A) = \frac{3}{40} \cdot \frac{3}{40} = \frac{9}{1600}$

$P(\text{exactly one Ace}) = 2 \cdot \frac{3}{40} \cdot \frac{37}{40} = \boxed{\frac{111}{800}}$

$A\overline{A}$ or $\overline{A}\,A$

$P(\text{No aces}) = P(\overline{A}\,\overline{A}) = \frac{37}{40} \cdot \frac{37}{40} = \boxed{\frac{1369}{1600}}$

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Dependent Events

outcome of one event changes the prob. of the next outcome.

If A and B are dependent events,

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

A happens, then B happens

Given

Jan 16-6:15 PM

Draw 2 Cards without replacement from a full deck of playing Cards.

$$P(2\ \text{Aces}) = \frac{4}{52} \cdot \frac{3}{51} = \boxed{\frac{1}{221}}$$

First Card is Ace

Second Card is Ace

If You draw 3 Cards,

$$P(\text{All ACES}) = \frac{4}{52} \cdot \frac{3}{51} \cdot \frac{2}{50}$$

$$= \boxed{\frac{1}{5525}}$$

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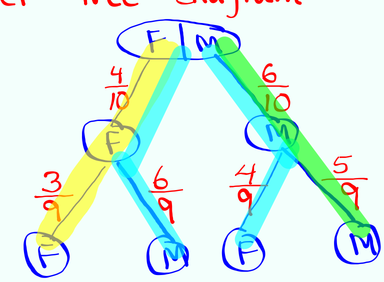
4 Females 6 Males Need two people.

1) Sample Space FF FM MF MM

2) Construct Tree diagram



$$P(2\ \text{Females}) = \frac{4}{10} \cdot \frac{3}{9} = \frac{\boxed{12}}{90}$$

$$P(1\ \text{Female}) = 2 \cdot \frac{4}{10} \cdot \frac{6}{9} = \frac{\boxed{48}}{90}$$

$$P(0\ \text{Females}) = \frac{6}{10} \cdot \frac{5}{9} = \frac{\boxed{30}}{90}$$

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# Females	P(# Females)
2	12/90
1	48/90
0	30/90

L1 (# Females column) L2 (P(# Females) column)

$\boxed{\text{STAT}}$ → CACL $\boxed{\text{1:1-Var Stats}}$ L1 & L2

$\bar{x} = .8$

$S = S_x =$ Blank

$n = 1$ ← Total Prob.

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A piggy bank has 3 quarters and 12 nickels. Randomly take 2 coins with No replacement.

Sample Space: NN, NQ, QN, QQ

NN = 10¢; NQ, QN = 30¢; QQ = 50¢

$P(\text{Total} = 10¢) = \frac{12}{15} \cdot \frac{11}{14} = \frac{22}{35}$

$P(\text{Total} = 30¢) = 2 \cdot \frac{12}{15} \cdot \frac{3}{14} = \frac{12}{35}$

$P(\text{Total} = 50¢) = \frac{3}{15} \cdot \frac{2}{14} = \frac{1}{35}$

Total ¢	P(Total ¢)
10¢	22/35
30¢	12/35
50¢	1/35

L1 (Total ¢ column) L2 (P(Total ¢) column)

use $\boxed{\text{1-Var Stats}}$ with L1 & L2

$\bar{x} = 18$

$S = S_x =$ Blank

$n = 1$ ← Total Prob.

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3 Boys

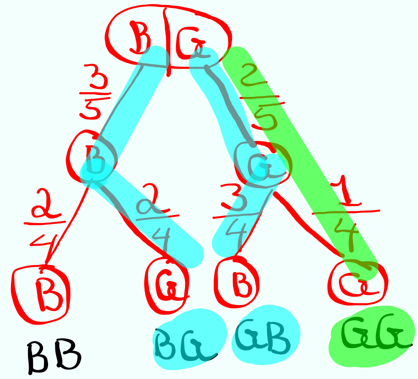
2 Girls

Select 2

Complete

# Girls	P(# Girls)
2	2/20
1	12/20
0	6/20

L1 L2



$\boxed{\text{1-Var Stats}}$

L1 & L2

$\bar{x} = .8$

$S = S_x =$ Blank

$n = 1 \leftarrow$ Total prob.

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Conditional Probability:

Given

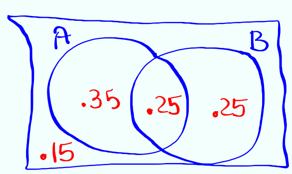
$$P(A \text{ and } B) = P(A) \cdot \boxed{P(B|A)}$$

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

$P(A) = .6$ $\quad$ $P(B) = .5$ $\quad$ $P(A \text{ and } B) = .25$

$.6 - .25 = .35$

$.5 - .25 = .25$



Total = 1

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

$$= \frac{.25}{.6} = \frac{5}{12} \approx \boxed{.416}$$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.25}{.5} = \boxed{.5}$$

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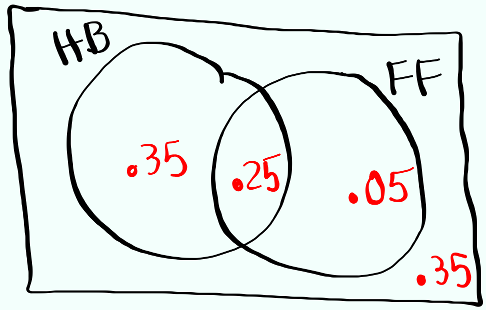
$P(HB) = .6$

$P(FF) = .3$

$P(HB \text{ and } FF) = .25$



Total=1

$P(FF \mid HB) = \frac{.25}{.6} = \frac{5}{12} \simeq \boxed{.416}$

$P(HB \mid FF) = \frac{.25}{.3} = \frac{5}{6} \approx \boxed{.833}$

Jan 16-7:04 PM

Erick is going shopping.

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

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

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

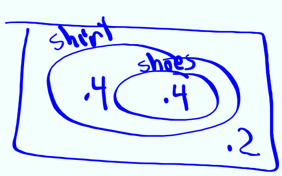
$P(\text{Shirt and Shoes})$

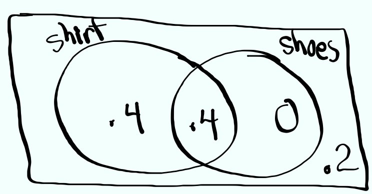
$\underbrace{P(\text{Shoes} \mid \text{shirt})} = \frac{P(\text{shirt \& shoes})}{\underbrace{P(\text{Shirt})}}$

$.5 = \frac{P(\text{Shirt \& shoes})}{.8}$

Cross-Multiply

$\boxed{P(\text{Shirt \& Shoes}) = .4}$





Total=1

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