Statistics

Lecture 6

Feb 19-8:47 AM

Given $P(A) = .125$

1) write $P(A)$ in percent notation

$P(A) = .125 = .125(100)\% = \boxed{12.5\%}$

2) write $P(A)$ in reduced fraction

$P(A) = .125 = \frac{125}{1000} = \boxed{\frac{1}{8}}$ $.125$ $\boxed{\text{Math}}$ $\boxed{1{:}\blacktriangleright\text{Frac}}$ $\boxed{\text{Enter}}$

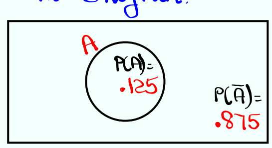
3) find $P(\bar{A}) = 1 - P(A) = 1 - .125 = \boxed{.875}$

Complement Rule

4) find the ratio of $P(A)$ to $P(\bar{A})$ in reduced form. → Fraction $\frac{P(A)}{P(\bar{A})}$

$\frac{.125}{.875} = \frac{1}{7}$ $.125$ $\boxed{\div}$ $.875$ $\boxed{\text{Math}}$ $\boxed{1{:}\blacktriangleright\text{Frac}}$ $\boxed{\text{Enter}}$

5) Construct Venn Diagram.



Total = 1

Oct 3-8:03 AM

Given $P(A) = .65$, $P(B) = .45$, $P(A \text{ and } B) = .25$

1) $P(\bar{A}) = 1 - P(A)$
$= 1 - .65 = \boxed{.35}$

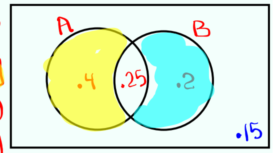
2) $P(\overline{A \text{ and } B})$
$= 1 - P(A \text{ and } B)$
$= 1 - .25 = \boxed{.75}$

3) $P(A \text{ or } B) =$
Addition Rule
$P(A) + P(B) - P(A \text{ and } B)$
$= .65 + .45 - .25 = \boxed{.85}$

4) Construct Venn diagram

$P(A \text{ only}) = P(A) - P(A \text{ and } B)$
$= .65 - .25 = \boxed{.4}$

$P(B \text{ only}) = P(B) - P(A \text{ and } B)$
$= .45 - .25 = \boxed{.2}$



Total = 1

5) $P(A \text{ only OR } B \text{ only}) = .4 + .2 = \boxed{.6}$

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

Impossible event

A only & B only are { mutually Exclusive Events.

No overlap { Disjointed Events

Oct 3-8:15 AM

Given $P(A) = .72$, $P(B) = .18$, A & B are disjointed events.

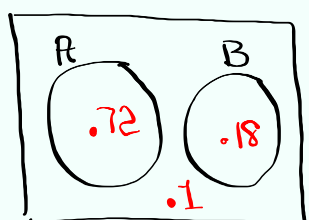
1) $P(\bar{A}) = 1 - .72 = \boxed{.28}$

2) $P(\bar{B}) = 1 - P(B) = \boxed{.82}$

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

4) $P(A \text{ or } B)$
$= P(A) + P(B) - P(A \text{ and } B)$
$= .72 + .18 - 0 = \boxed{.9}$

5) Construct Venn diagram.



Total = 1 ✓

Oct 3-8:28 AM

De Morgan's Law:

It is about $\overline{A}$ and $\overline{B}$ or $\overline{A}$ or $\overline{B}$

$$\boxed{\begin{aligned} P(\overline{A} \text{ and } \overline{B}) &= P(\overline{A \text{ or } B}) \\ P(\overline{A} \text{ or } \overline{B}) &= P(\overline{A \text{ and } B}) \end{aligned}}$$

Ex: $P(A) = .8$ $\quad P(B) = .4$ $\quad P(A \text{ and } B) = .25$

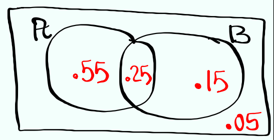
Find

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

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

$= .8 + .4 - .25 = \boxed{.95}$

2) Construct Venn Diagram



Total = 1

3) $P(A \text{ only} \text{ OR } B \text{ only}) = .55 + .15 = \boxed{.7}$

4) $P(\overline{A} \text{ and } \overline{B}) = P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - .95 = \boxed{.05}$

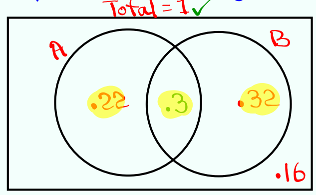
De Morgan's Law

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

Oct 3-8:35 AM

Complete the Venn diagram below

Total = 1 ✓



1) $P(A \text{ only}) = \boxed{.22}$

2) $P(A) = \boxed{.52}$

3) $P(B \text{ only}) = \boxed{.32}$

4) $P(B) = \boxed{.62}$

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

6) $P(A \text{ or } B) = .22 + .3 + .32 = \boxed{.84}$ ✓

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

$= .52 + .62 - .3 = \boxed{.84}$ ✓

7) $P(A \text{ only or } B \text{ only}) = .22 + .32 = \boxed{.54}$

8) $P(\overline{A} \text{ and } \overline{B}) = P(\overline{A \text{ or } B}) = 1 - .84 = \boxed{.16}$

De Morgan's Law

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

SG 11 ✓

Oct 3-8:46 AM

SG12

Intro. to odds:

odds in favor of event E are

$$a : b$$

# of times E happes

# of times $\bar{E}$ happens

in a+b attempts.

odds in favor of event E are

$3 : 7$

in 10 attempts, 3 times E happens

7 " $\bar{E}$ happen

I tossed coin 100 times, it landed tails 40 times.

40 Tails, 60 $\overline{\text{Tails}}$

odds in favor of landing tails are

$40 : 60$

I most reduce this

40 $\boxed{:}$ 60 $\boxed{\text{Math}}$ $\boxed{\text{1:▸Frac}}$ $\boxed{\text{Enter}}$ $\frac{2}{3}$

$\boxed{2 : 3}$

Oct 3-9:17 AM

Consider a deck of playing cards with 40 cards, 25 red, 8 face, 3 aces.

1) P(draw a red card) $= \frac{25}{40} = \boxed{\frac{5}{8}} = \boxed{.625}$

2) what are the odds in drawing a red card?

25 Red : 15 $\overline{\text{Red}}$

$\boxed{5 : 3}$

3) what are the odds in drawing a face card?

8 Face : 32 $\overline{\text{Face}}$

$\boxed{1 : 4}$

Oct 3-9:24 AM

odds in favor of event E are

$a : b$

odds against event E are

$b : a$

using last example

Find odds in favor of drawing an Ace.

3 Ace : 37 $\overline{\text{Ace}}$ $\boxed{3:37}$

find odds against drawing an ace. $\boxed{37:3}$

Oct 3-9:30 AM

If odds in favor of E are

$a : b$

then $P(E) = \dfrac{a}{a+b}$ and $P(\overline{E}) = \dfrac{b}{a+b}$

Suppose odds in favor of event E are $3:17$.

$$P(E) = \frac{3}{3+17} = \frac{3}{20} = \boxed{.15}$$

$$P(\overline{E}) = \frac{17}{3+17} = \frac{17}{20} = \boxed{.85}$$

Oct 3-9:35 AM

I flipped a coin 420 times, it landed tails 300 times.

1) P(lands tails) $= \frac{300}{420} = \boxed{\frac{5}{7}}$ ✓

2) odds in favor of landing tails.

300 tails : 120 ~~tails~~ $\boxed{5:2}$

3) odds against landing tails.

$\boxed{2:5}$

$P(\text{tails}) = \frac{5}{5+2} = \frac{5}{7}$, $P(\overline{\text{tails}}) = \frac{2}{5+2} = \frac{2}{7}$

Oct 3-9:38 AM

How to find odds when prob. is given

If we have P(E), then

odds in favor of event E are

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

Always reduce to whole #s.

ex: Given $P(E) = .45$, find odds in favor of event E.

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

$.45 : .55$ $\rightarrow$ $\boxed{9:11}$

$.45 \boxed{\div} .55$ $\boxed{\text{Math}}$ $\boxed{\text{1:}\blacktriangleright\text{Frac}}$ $\boxed{\text{Enter}}$

Oct 3-9:44 AM

Prob. that LA Dodgers win the World Series this year is .25.

$P(W) = .25$, $P(\overline{W}) = .75$

odds in favor of Dodgers to win the World Series $P(W) : P(\overline{W})$

$.25 : .75$

$\boxed{1:3}$

+125 → bet \$100
Net Return \$125

against

-150 → Bet \$150
Net Return \$100

$\boxed{3:1}$

\$1 bet on Dodgers to win the World Series,
If it happens → Net return \$3.

\$3 bet on Dodgers for not to win
If they don't win → Net return \$1.

Oct 3-9:49 AM

Multiplication Rule:

Keyword AND

It must be multiple action event

$P(A \text{ and } B) =$
A happens, then B happens.

If A & B are independent events, then

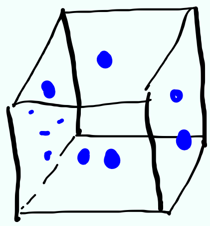
$$P(A \text{ and } B) = P(A) \cdot P(B)$$

what are independent events?

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

Oct 3-9:58 AM

Rolling a fair die,



$\{1, 2, 3, 4, 5, 6\}$

$P(\text{get } 5) = \frac{1}{6}$

on every roll

Let's roll it twice,

$P(\text{Double } 5) = P(5 \text{ and } 5) = \frac{1}{6} \cdot \frac{1}{6} = \boxed{\frac{1}{36}}$

Oct 3-10:03 AM

A Family with 3 Kids,

$P(\text{All Boys}) = P(\text{Boy}, \text{Boy}, \text{Boy})$

$= \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$

Consider a standard deck of playing cards, draw 2 cards, with replacement

$P(\text{Both aces}) = P(\overbrace{\text{Ace}, \text{Ace}}^{\text{Rare event}})$

$= \frac{4}{52} \cdot \frac{4}{52} = \frac{1}{169} = \boxed{.006}$

4 $\boxed{\div}$ 52 $\boxed{\times}$ 4 $\boxed{\div}$ 52 $\boxed{\text{Math}}$ $\boxed{\text{1:▶Frac}}$ $\boxed{\text{Enter}}$

$\boxed{\text{Math}}$ $\boxed{\text{2:▶Dec}}$ $\boxed{\text{Enter}}$

$P(\text{Both faces}) = P(\text{Face \& Face})$

$= \frac{12}{52} \cdot \frac{12}{52} = \boxed{\frac{9}{169}} = \boxed{.053}$

Draw 3 cards with replacement,

$P(\text{All Red}) = P(RRR) = \frac{26}{52} \cdot \frac{26}{52} \cdot \frac{26}{52} = \boxed{\frac{1}{8}}$

$P(\text{All Black}) = P(BBB) = \frac{26}{52} \cdot \frac{26}{52} \cdot \frac{26}{52} = \boxed{\frac{1}{8}}$

$P(\text{Same Color}) = P(RRR \text{ or } BBB) = \frac{2}{8} = \boxed{\frac{1}{4}}$

$P(\overline{\text{Same Color}}) = 1 - P(\text{Same Color}) = 1 - \frac{1}{4} = \boxed{\frac{3}{4}}$

Oct 3-10:06 AM

Given $P(A) = .7$, $P(B) = .5$, A & B are independent events.

1) $P(\bar{A}) = .3$

2) $P(\bar{B}) = .5$

3) $P(A \text{ and } B) = P(A) \cdot P(B)$
A then B
$= (.7)(.5) = \boxed{.35}$

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .7 + .5 - .35 = \boxed{.85}$

Independent Events is different from Mutually Exclusive events.

Oct 3-10:34 AM

Given $P(A) = .3$, $P(B) = .4$,
A & B are independent events.

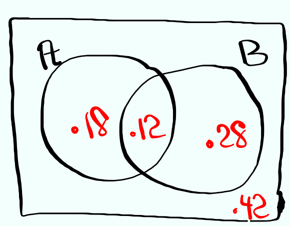
1) $P(\bar{A}) = .7$

2) $P(\bar{B}) = .6$

3) $P(A \text{ and } B) = P(A) \cdot P(B) = (.3)(.4) = \boxed{.12}$
A then B

4) $P(A \text{ or } B)$
$= P(A) + P(B) - P(A \text{ and } B)$
$= .3 + .4 - .12 = \boxed{.58}$

5) Construct Venn Dia.



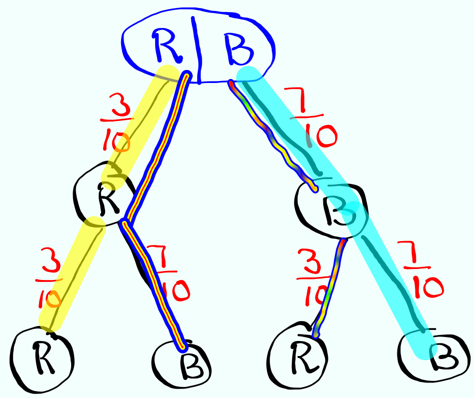
Total = 1 ✓

Oct 3-10:39 AM

Tree Diagram

3 Red
7 Black Balls

Select 2 balls with replacement



$P(RR) = \frac{3}{10} \cdot \frac{3}{10} = \frac{9}{100}$

$P(BB) = \frac{7}{10} \cdot \frac{7}{10} = \frac{49}{100}$

$P(1R\ 1B) = P(RB \text{ or } BR) = \frac{3}{10} \cdot \frac{7}{10} + \frac{7}{10} \cdot \frac{3}{10} = \frac{42}{100}$

Oct 3-10:45 AM

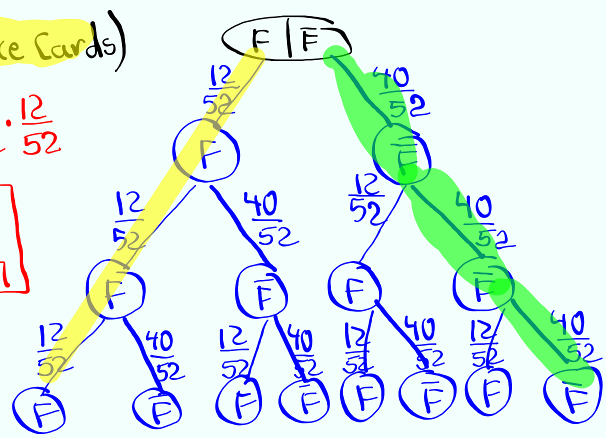
a standard deck of cards,

Draw 3 cards with replacement

$P(\text{all face cards})$

$= \frac{12}{52} \cdot \frac{12}{52} \cdot \frac{12}{52}$

$= \boxed{\frac{27}{2197}}$



$P(\text{No face cards}) = \frac{40}{52} \cdot \frac{40}{52} \cdot \frac{40}{52} = \boxed{\frac{1000}{2197}}$

Oct 3-10:51 AM