Statistics

Lecture 10

Feb 19-8:47 AM

Complement Rule

$$P(E) + P(\bar{E}) = 1$$

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

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

ex: Suppose $P(E) = .025$

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

.025 MATH 1:▶Frac Enter $\frac{1}{40}$

2) Write $P(E)$ in % Notation.

$.025(100\%) = \boxed{2.5\%}$

3) Find $P(\bar{E}) = 1 - P(E)$

$= 1 - .025 = \boxed{.975}$

Frac. → $\frac{39}{40}$

% → 97.5%

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

Draw one card,

$P(\text{Face}) = \frac{12}{52} = \boxed{\frac{3}{13}}$ $\quad P(\overline{\text{Face}}) = \frac{40}{52} = \frac{10}{13}$

$P(\text{Face}) + P(\overline{\text{Face}}) = 1$ ✓

$\frac{3}{13} + \frac{10}{13} = \frac{13}{13}$ ✓

$P(\overline{\text{Red Face}}) = 1 - P(\text{Red Face})$

$= 1 - \frac{6}{52} = \boxed{\frac{23}{26}}$

1 − 6 ÷ 52 [Math] [1: ▶Frac] [Enter]

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

Keyword OR

Single Action Event

Suppose $P(A) = .8$, $P(B) = .3$, $P(A \text{ and } B) = .2$

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

2) $P(\overline{B}) = 1 - P(B)$ $\quad = 1 - .3 = \boxed{.7}$

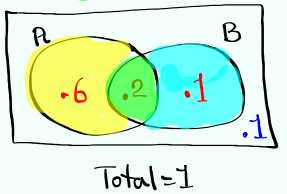
3) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$= .8 + .3 - .2 = \boxed{.9}$

Draw Venn Diagram

$P(A \text{ only}) = .8 - .2 = \boxed{.6}$

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



Total = 1

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

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

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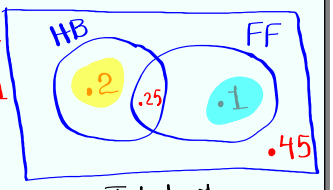
P(HB) = .45 .45 − .25 = .2

P(FF) = .35 .35 − .25 = .1

P(HB and FF) = .25



1) $P(\overline{HB}) = 1 - .45 = \boxed{.55}$

2) $P(\overline{FF}) = 1 - .35 = \boxed{.65}$

3) P(HB or FF) = P(HB) + P(FF) − P(HB and FF)
= .45 + .35 − .25 = .55

P(HB only or FF only, not both) = .2 + .1
= .3

$P(\overline{HB \text{ and } FF}) = 1 - P(HB \text{ and } FF)$
$= 1 - .25 = .75$

$P(\overline{HB \text{ or } FF}) = 1 - P(HB \text{ or } FF)$
$= 1 - .55 = .45$

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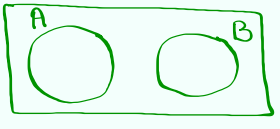
Mutually Exclusive Events
"Disjointed Events"

P(A and B) = 0 ⟺ A & B are M.E.E.



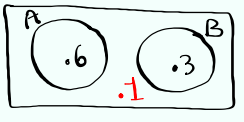
P(A) = .6, P(B) = .3, A & B are M.E.E.

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

2) $P(\overline{B}) = 1 - .3 = .7$

3) P(A and B) = 0

4) Draw Venn Diagram



4) P(A or B) = P(A) + P(B) − P(A and B) Total = 1
= .6 + .3 − 0 = .9

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A deck of cards has 40 Cards, 10 face Cards, and 4 aces.

Draw one Card,

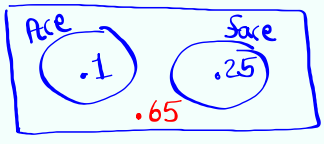
1) $P(\text{face}) = \frac{10}{40} = .25$

2) $P(\text{Ace}) = \frac{4}{40} = .1$

3) $P(\text{face and Ace}) = 0$ → M.E.E. → Impossible events

4) $P(\text{face or Ace}) = P(\text{face}) + P(\text{Ace}) - P(\text{face and Ace})$
$= .25 + .1 - 0 = .35$

5) Draw Venn Diagram



Total = 1

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De Morgan's Law

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

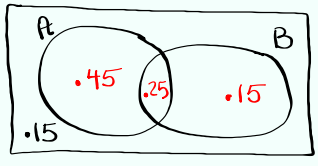
$P(\overline{A} \text{ or } \overline{B}) = P(\overline{A \text{ and } B})$

$P(A) = .7$ $P(B) = .4$ $P(A \text{ and } B) = .25$

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .7 + .4 - .25 = .85$

Draw Venn Diagram

$.7 - .25 = .45$
$.4 - .25 = .15$



Total = 1

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

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

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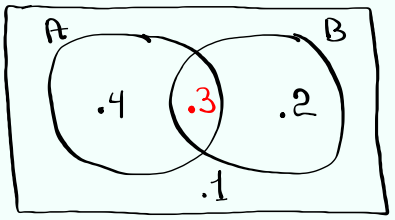
Complete the Venn Diagram below



Total = 1

1) P(A) = .7

2) P($\overline{A}$) = .3

3) P(B) = .5

4) P($\overline{B}$) = .5

5) P(A and B) = .3

6) P(A or B) = .9

7) P($\overline{A \text{ and } B}$) = .7

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

De Morgan's Law

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

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

SG 11

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SG 12

I flipped coin 20 times, it landed tails 14 times and heads 6 times

P(tail) = $\frac{14}{20}$ = .7 P($\overline{\text{tail}}$) = 1 − .7 = .3

odds in favor of event E are

a : b

a = # of times E happens

b = # of times $\overline{E}$ happens

14 : 6 ⇒ Simplify

tails $\overline{\text{tails}}$ 7 : 3

odds in favor of landing tails

odds against landing tails

3 : 7

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Suppose we have a deck of playing cards with 50 cards, 10 faces, and 4 aces.

Draw one card

$P(\text{face}) = \frac{10}{50} = .2$ $\quad P(\text{Ace}) = \frac{4}{50} = .08$

odds to draw a face card

$\#\text{face} : \#\overline{\text{face}}$

$10 : 40 \rightarrow 1 : 4$

odds against $\Rightarrow 4 : 1$

odds in favor of drawing an Ace.

$\#\text{Aces} : \#\overline{\text{Aces}} \quad 4 : 46 \rightarrow 2 : 23$

odds against drawing an Ace. $23 : 2$

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odds in favor of event E are $a : b$

" against " " " $b : a$

$P(E) = \frac{a}{a+b}$, $P(\overline{E}) = \frac{b}{a+b}$

Suppose odds for Dodgers to win world Series this year are 7:3.

1) odds against 3:7

2) $P(\text{win the world series}) = \frac{7}{7+3} = \frac{7}{10} = .7$

3) $P(\overline{\text{win}}\ \text{the world series}) = \frac{3}{7+3} = \frac{3}{10} = .3$

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Given odds in favor of event E are 3:17.

1) odds against 17:3

2) $P(E) = \frac{3}{3+17} = \frac{3}{20}$

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

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How to find odds if prob. is given.

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

Always Simplify.

P(Raiders win) = .025

P(Raiders win) = .975

$P(\text{win}) : P(\overline{\text{win}})$

.025 : .975

1 : 39

.025 ÷ .975 MATH ▶Frac Enter

$ bet

$ Net Profit

odds against 39:1

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$P(E) = .12$

1) $P(\bar{E}) = 1 - P(E) = .88$

2) odds in favor of E. $P(E) : P(\bar{E})$

$.12 : .88$

$3 : 22$

3) odds against E.

$22 : 3$

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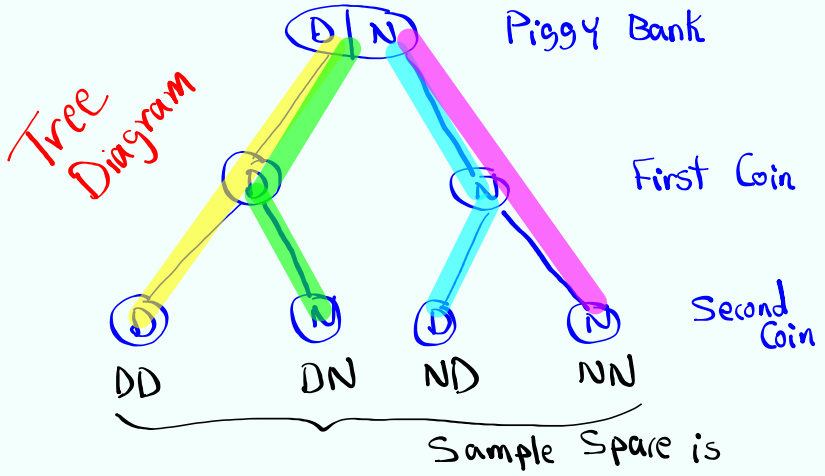
A piggy bank has 4 dimes & 6 Nickels.

Take one coin but do it twice.



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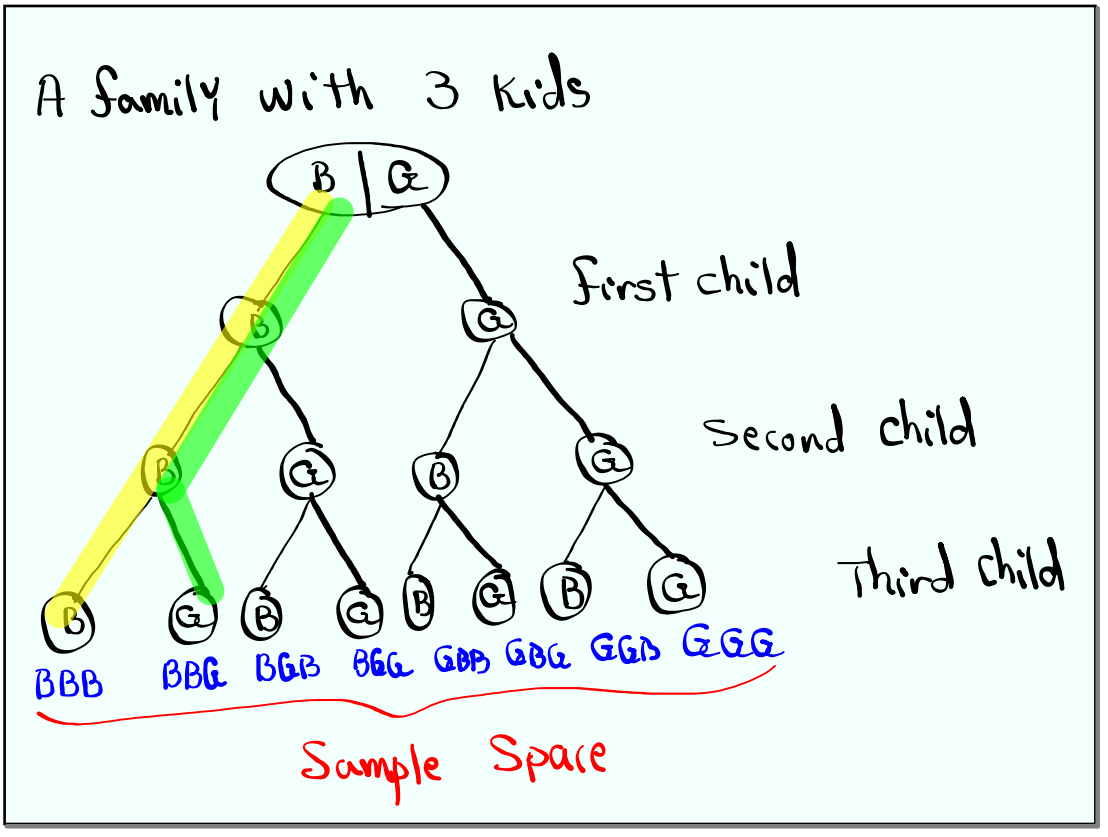

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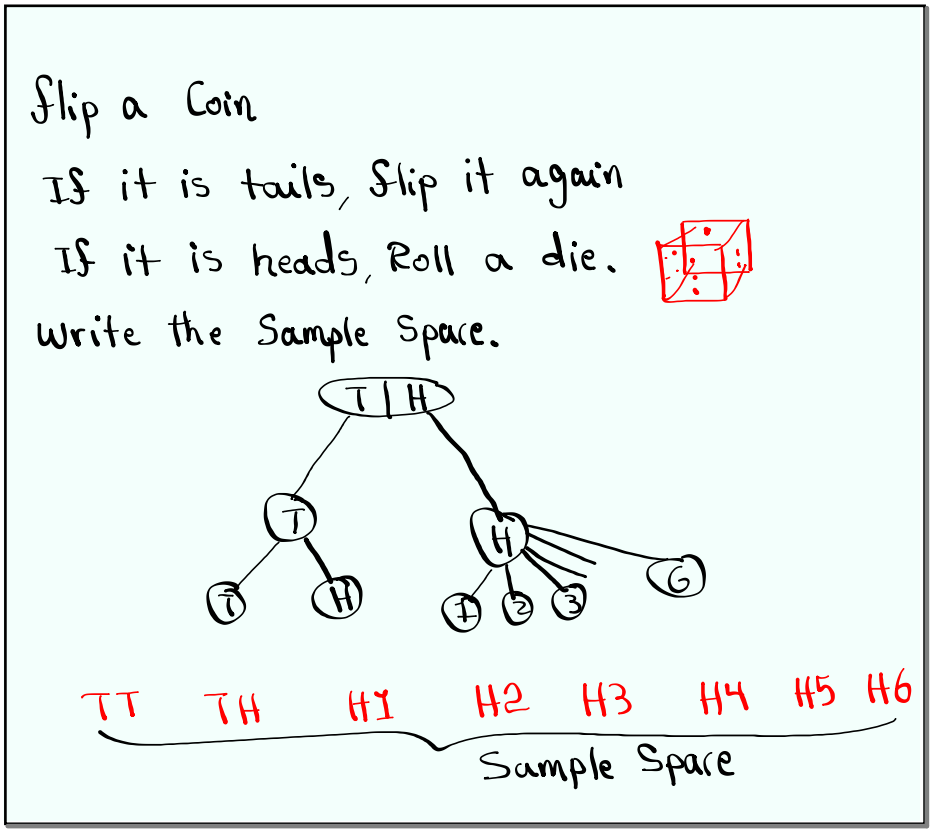

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