Statistics

Lecture 10

Feb 19-8:47 AM

A piggy bank has 5 Dimes, 8 nickels, and 7 quarters. If we randomly select one coin,

20 Coins total

1) $P(\text{Dime}) = \frac{5}{20} = \boxed{\frac{1}{4}} = \boxed{.25}$

2) $P(\text{Nickel}) = \frac{8}{20} = \boxed{\frac{2}{5}} = \boxed{.4}$

3) $P(\overline{\text{Quarter}}) = 1 - P(\text{Quarter}) = 1 - \frac{7}{20} = \boxed{\frac{13}{20}} = \boxed{.65}$

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Suppose $P(A) = .025$

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

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

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

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

3) Find $P(\bar{A}) = 1 - P(A) = 1 - .025 = \boxed{.975}$

4) Simplify $\frac{P(\bar{A})}{P(A)} = \frac{.975}{.025} = \boxed{39}$

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Are you in support of mass deportation?

	Yes	NO	Total
Republicans	120	30	150
Democrats	100	250	350
Indep.	50	50	100
Total	270	330	600

If we randomly select one of them,

1) $P(\text{Democrat}) = \frac{350}{600} = \boxed{\frac{7}{12}}$ 2) $P(\text{NO}) = \frac{330}{600} = \boxed{\frac{11}{20}}$

3) $P(\text{Democrat and NO}) = \frac{250}{600} = \boxed{\frac{5}{12}}$

4) $P(\text{Democrat or NO}) = \frac{430}{600} = \frac{43}{60}$

5) $P(\text{Republican and Independent}) = \frac{0}{600} = \boxed{0}$

Do not use $\emptyset$ for 0.

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Suppose $P(A) = .35$, $P(B) = .75$, $P(A \text{ and } B) = .15$

1) $P(\overline{A}) = 1 - P(A) = .65$

2) $P(\overline{B}) = 1 - P(B) = .25$

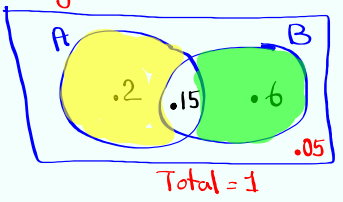
3) $P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .15 = .85$

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ (Addition Rule)
$= .35 + .75 - .15$
$= .95$

5) Construct Venn Diagram

$P(A \text{ only}) = .35 - .15 = .2$

$P(B \text{ only}) = .75 - .15 = .6$



6) $P(A \text{ only OR } B \text{ only}) = .2 + .6 = .8$

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Suppose $P(A) = .3$, $P(B) = .6$, A and B are mutually exclusive events

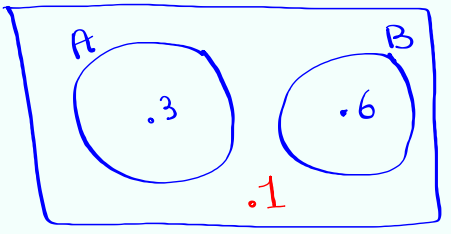
1) $P(\overline{A}) = .7$

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

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

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .3 + .6 - 0 = .9$

5) Construct Venn Diagram



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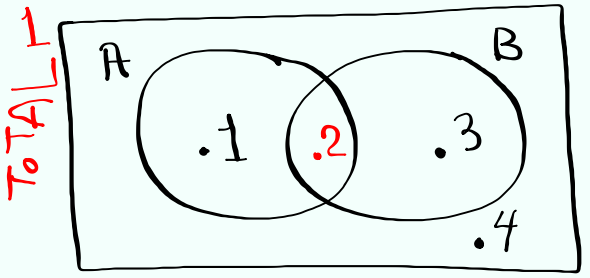
Complete the Venn diagram below



1) $P(A) = .3$

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

3) $P(B) = .5$

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

5) $P(A \text{ or } B) = .3 + .5 - .2 = \boxed{.6}$

$\hookrightarrow .1 + .2 + .3 =$

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De Morgan's Law

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

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

Suppose $P(A) = .45$, $P(B) = .65$, $P(A \text{ or } B) = .9$

1) $P(\overline{A}) = \boxed{.55}$ 2) $P(\overline{B}) = \boxed{.35}$

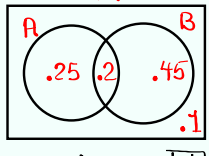
3) $P(A \text{ and } B)$

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

$.9 = .45 + .65 - P(A \text{ and } B)$

$P(A \text{ and } B) = .45 + .65 - .9 = \boxed{.2}$

4) Draw Venn Diagram.



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

De Morgan's Law

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

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odds vs Probability

odds in favor of event E are

$a : b$

odds against event E are $b : a$

I flipped a coin 100 times.
It landed tails 60 times.

$P(\text{Tails}) = \frac{60}{100} = .6$

odds in favor of landing tails are

60 tails : 40 tails

$60 : 40 \rightarrow 3 : 2$

odds against landing tails $\rightarrow 2 : 3$

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Standard deck of playing Cards

52 Cards 4 Aces

$P(\text{Draw an Ace}) = \frac{4}{52} = \frac{1}{13}$

odds in favor of drawing an ace

Aces : # Aces

$4 : 48 \Rightarrow 1 : 12$

4 ÷ 48 Math 1:▶Frac Enter $\frac{1}{12}$

Odds against drawing an ACE

$12 : 1$

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Suppose odds for Lakers to win the championship this year are 1:7

1) odds against 7:1

2) Meaning of 1:7

$1 → $7 Net profit

+250 → $100 bet → $250 Net

−150 → $150 → $100

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How to find odd if P(E) is given.

odds in favor of event E are

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

Always simplify

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

1) $P(\bar{E}) = .975$

2) odds in favor of event E

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

$.025 : .975$

$1 : 39$

.025 ÷ .975 MATH 1:▶Frac Enter $\frac{1}{39}$

odds against 39:1

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P(Lakers win championship this year) = .24

$P(W) = .24$ $P(\overline{W}) = .76$

odds in favor of W

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

$.24 : .76 \rightarrow \boxed{6 : 19}$

Place $6 bet

If they win, you get $19 Profit

odds against

19 : 6

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How to find P(E) if odds in favor are given

$a : b$

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

ex: Suppose odds in favor of event E are $4 : 21$.

1) $P(E) = \frac{4}{4+21} = \boxed{\frac{4}{25}}$

2) $P(\overline{E}) = \frac{21}{4+21} = \boxed{\frac{21}{25}}$

3) odds against E. $\boxed{21 : 4}$

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Multiplication Rule

Key word AND

Event requires more than one action

Consider a deck of playing cards,

Draw 2 Cards

R → Red

B → Black

RR RB BR BB

Sample Space

A family with 3 kids

B → Boy

G → Girl

BBB
BBG
BGB
BGG
GBB
GBG
GGB
GGG

Sample Space

Complete list of all possible outcomes

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Independent events

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

$P(A \text{ and } B) = P(A) \cdot P(B)$ when A & B are independent events

Draw 2 Cards

P(both are aces) = P(Ace) · P(Ace)

with replacement $= \frac{4}{52} \cdot \frac{4}{52} = \frac{1}{13} \cdot \frac{1}{13} = \boxed{\frac{1}{169}}$

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You are taking a quiz with two questions.
Each question is multiple-choice.
4 choices one correct choice
You make random guesses.

$P(\text{both correct}) = P(\text{correct}) \cdot P(\text{correct})$

$= \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16}$

$P(\text{both incorrect}) = P(\overline{\text{correct}}) \cdot P(\overline{\text{correct}})$

$= \frac{3}{4} \cdot \frac{3}{4} = \frac{9}{16}$

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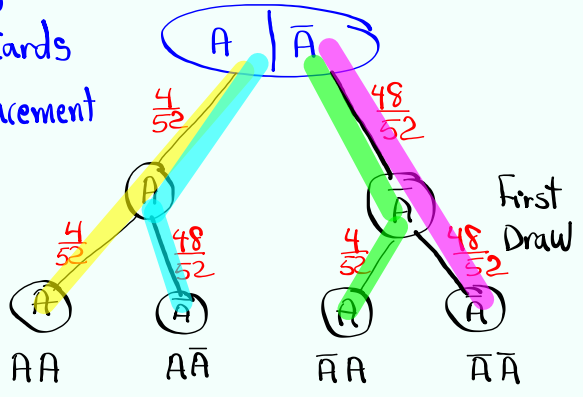
Tree Diagram
Draw 2 Cards
with replacement
A → Ace
$\overline{A}$ → $\overline{\text{Ace}}$



$P(\overline{A}\,\overline{A}) = \frac{48}{52} \cdot \frac{48}{52} = \frac{144}{169}$

48 ÷ 52 × 48 ÷ 52 MATH 1:▶Frac Enter

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