Statistics

Fall 2022

Lecture 12

Feb 19-8:47 AM

A classroom has 18 females, and 12 males.

1) P(Selecting a female) = $\frac{\text{Total female}}{\text{Total people}} = \frac{18}{30} = \boxed{\frac{3}{5}}$

2) odds in favor of selecting a female

\# females : # females

18 : 12 → $\boxed{3:2}$

3) odds against selecting a female.

Reverse it

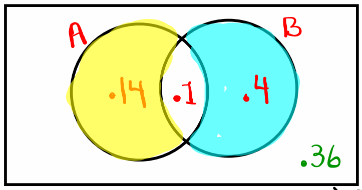
$\boxed{2:3}$

Nov 10-6:01 AM

Suppose $P(A) = .24$, $P(B) = .5$, $P(A \text{ and } B) = .1$

overlap

1) Construct Venn Diagram.



Total = 1

$1 - [.14 + .1 + .4] = .36$

2) $P(A \text{ only}) = .24 - .1 = \boxed{.14}$

3) $P(B \text{ only}) = .5 - .1 = .4$

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = .24 + .5 - .1 = \boxed{.64}$

Use DeMorgan's Law to find

5) $P(\bar{A} \text{ and } \bar{B}) = P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B) = 1 - .64 = \boxed{.36}$

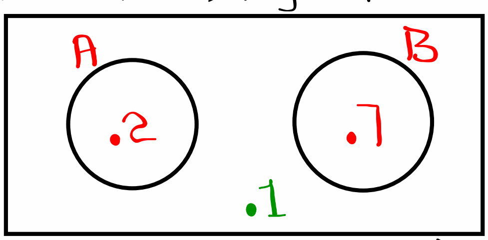
6) $P(\bar{A} \text{ or } \bar{B}) = P(\overline{A \text{ and } B}) = 1 - P(A \text{ and } B) = 1 - .1 = \boxed{.9}$

Nov 10-6:06 AM

Suppose $P(A) = .2$, $P(B) = .7$, A & B are M.E.E.

Mutually Exclusive Events

1) Construct Venn Diagram



Total = 1

$1 - [.2 + .7] = .1$

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

3) $P(\bar{B}) = 1 - P(B) = 1 - .7 = \boxed{.3}$

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

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = .2 + .7 - 0 = \boxed{.9}$

Nov 10-6:18 AM

Multiplication Rule (SG 12 & 13)

Key word : AND

It is a multiple Action event

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

A happens, then B happens — Given

When events are independent events,

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

What are independent events?

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

$P(\text{Boy}) = .5$ $P(\text{Girl}) = .5$

First child is Boy $\rightarrow P(\text{Boy}) = .5$

$P(\text{Next child is a boy}) = .5$

$P(\text{Next child is a girl}) = .5$

Roll a fair die twice.

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

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

Nov 10-6:25 AM

A standard deck of playing cards has 52 Cards, 26 Red, 12 face, 4 Aces.

Let's take 3 Cards with replacement

$P(\text{First card is Ace}) = \frac{4}{52} = \boxed{\frac{1}{13}}$

$P(\text{Second Card is Ace}) = \frac{4}{52} = \boxed{\frac{1}{13}}$

$P(\text{Third Card is face}) = \frac{12}{52} = \boxed{\frac{3}{13}}$

Any card selected will be placed back in the deck before the next selection.

A piggy bank has 4 quarters, 6 dimes, and 10 nickels. We take randomly 2 coins with replacement

QQ	DQ	NQ
QD	DD	ND
QN	DN	NN

Sample Space is a Complete list of all Possible outcomes

$P(\text{First Coin is Quarter}) = \frac{4}{20} = \boxed{\frac{1}{5}}$

$P(\text{Second Coin is Nickel}) = \frac{10}{20} = \boxed{\frac{1}{2}}$

Nov 10-6:34 AM

Class QZ 13

$P(A) = .85$ $\quad P(B) = .25$ $\quad P(A \text{ and } B) = .2$

1) $P(\bar{A}) = 1 - P(A) = 1 - .85 = \boxed{.15}$

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

$= .85 + .25 - .2 = \boxed{.9}$

Nov 10-6:48 AM

Multiplication Rule

Part I: A and B are independent events

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

Ex: $P(A) = .8$, $P(B) = .5$, A & B are independent events

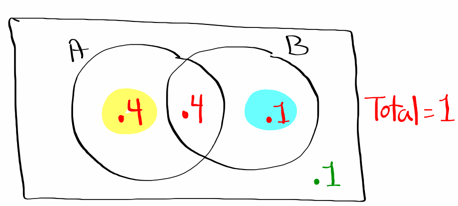
1) $P(\bar{A}) = 1 - P(A) = \boxed{.2}$

2) $P(\bar{B}) = 1 - P(B) = \boxed{.5}$

3) $P(A \text{ and } B) = P(A) \cdot P(B) = (.8)(.5) = \boxed{.4}$

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

$= .8 + .5 - .4 = \boxed{.9}$



Nov 10-7:13 AM

$P(A) = .7$

$P(B) = .4$

A & B are Independent Events

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

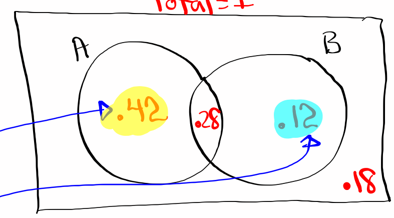
2) $P(\bar{B}) = 1 - P(B) = \boxed{.6}$

3) $P(A \text{ and } B) = P(A) \cdot P(B) = \boxed{.28}$

4) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .7 + .4 - .28 = \boxed{.82}$

5) make Venn Diagram

Total = 1



6) $P(A \text{ only OR } B \text{ only}) = .42 + .12 = \boxed{.54}$

$P(A \text{ or } B \text{ not both})$

Nov 10-7:21 AM

A box has 3 Red and 7 Blue balls.
Randomly Select 2 balls with replacement

Sample Space

RR   RB   BR   BB

$P(2 \text{ Red balls}) = \frac{3}{10} \cdot \frac{3}{10} = \frac{9}{100} = \boxed{.09}$

$P(1R \text{ \& } 1B) = P(RB \text{ or } BR) = 2\left(\frac{3}{10} \cdot \frac{7}{10}\right) = \frac{42}{100} = \boxed{.42}$

$P(2 \text{ Blue balls}) = \frac{7}{10} \cdot \frac{7}{10} = \frac{49}{100} = \boxed{.49}$

Verify that Total Prob. = 1

$.09 + .42 + .49 = 1 \checkmark$

Nov 10-7:32 AM

Standard deck of playing cards has 52 Cards, and 4 Aces.

Draw 2 Cards $\boxed{\text{with replacement.}}$

$A \to$ Ace

Sample Space

$AA \quad A\bar{A} \quad \bar{A}A \quad \bar{A}\bar{A}$

$P(2 \text{ Aces}) = P(AA) = \frac{4}{52} \cdot \frac{4}{52} = \frac{1}{13} \cdot \frac{1}{13} = \boxed{\frac{1}{169}}$

$P(1A \,\&\, 1\bar{A}) = P(A\bar{A} \text{ or } \bar{A}A) = 2\left(\frac{4}{52} \cdot \frac{48}{52}\right) = \text{——} = \boxed{\frac{24}{169}}$

$P(\text{No Aces}) = P(\bar{A}\bar{A}) = \frac{48}{52} \cdot \frac{48}{52} = \frac{12}{13} \cdot \frac{12}{13} = \boxed{\frac{144}{169}}$

Verify that Total Prob. = 1 ✓

1 $\boxed{\div}$ 169 $\boxed{+}$ 24 $\boxed{\div}$ 169 $\boxed{+}$ 144 $\boxed{\div}$ 169 $\boxed{\text{enter}}$ 1

Nov 10-7:43 AM

There 2 Dimes and 3 Nickels in a piggy bank.
randomly take 2 Coins $\boxed{\text{with replacement}}$

D → Dimes , N → Nickels

1) Sample Space

DD DN ND NN

2) $P(\text{Total is } 10¢) = P(NN) = \frac{3}{5} \cdot \frac{3}{5} = \frac{9}{25} = \boxed{.36}$ ✓

3) $P(\text{Total is } 15¢) = P(DN \text{ or } ND) = 2\left(\frac{2}{5} \cdot \frac{3}{5}\right) = \boxed{.48}$ ✓

4) $P(\text{Total is } 20¢) = P(DD) = \frac{2}{5} \cdot \frac{2}{5} = \frac{4}{25} = \boxed{.16}$ ✓

Verify that Total Prob. = 1

Total	P(Total)
10¢	.36
15¢	.48
20¢	.16

clear all lists

Total → L1

P(Total) → L2

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

$\bar{x} = 14$

$S_x =$ blank

$n = 1$ ← Total prob. = 1

Nov 10-7:55 AM

There are 4 Red, 6 Blue, and 10 white balls in a box.

1) P(Select a blue ball) $= \frac{6}{20} = \boxed{\frac{3}{10}} = \boxed{.3}$ ✓ ✓

2) Odds $\boxed{\text{in favor of}}$ Selecting blue ball.

$\#\,\text{Blue} : \#\,\overline{\text{Blue}}$

$6 : 14 \rightarrow \boxed{3:7}$

3) odds $\boxed{\text{against}}$ Selecting a red ball.

$\#\,\overline{\text{Red}} : \#\,\text{Red}$

$16 : 4 \rightarrow \boxed{4:1}$

4) odds $\boxed{\text{in favor}}$ of Selecting a white ball.

$\#\,\text{white} : \#\,\overline{\text{white}}$

$10 : 10 \rightarrow \boxed{1:1}$

Nov 10-8:11 AM

Suppose $P(A) = .04$

1) $P(\overline{A}) = 1 - P(A) = \boxed{.96}$

2) odds $\boxed{\text{in favor of}}$ event A.

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

$.04 : .96 \rightarrow \boxed{1:24}$

3) odds against event A. → Reverse it

$\boxed{24:1}$

Nov 10-8:22 AM

Suppose odds in favor of event A are

$$\underset{a}{3} : \underset{b}{47}$$

1) odds against A $\boxed{47:3}$

2) $P(A) = \frac{a}{a+b} = \frac{3}{3+47} = \boxed{\frac{3}{50}}$

$= \boxed{.06}$

3) $P(\overline{A}) = \frac{b}{a+b} = \frac{47}{3+47}$

$= \boxed{\frac{47}{50}}$

$= \boxed{.94}$

Nov 10-8:25 AM