Statistics

Fall 2022

Lecture 15

Feb 19-8:47 AM

Class QZ 15:

Given $\boxed{P(E) = .2}$

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

2) odds in favor of event E.

$\boxed{P(E) : P(\bar{E})} \rightarrow .2 : .8 \rightarrow \boxed{1:4}$ ✓✓

3) odds against event E. $\longrightarrow \boxed{4:1}$ ✓✓✓

Nov 15-8:19 AM

Suppose the odds in favor of event A are $\boxed{\boxed{3}:\boxed{5}}$

1) Find odds against event A.

$5:3$

2) Find $P(A) = \frac{3}{3+5} = \boxed{\frac{3}{8}} = \boxed{.375} = 37.5\%$

3) Find $P(\overline{A}) = \frac{5}{3+5} = \boxed{\frac{5}{8}} = \boxed{.625} = 62.5\%$

$P(\overline{A}) = 1 - P(A) = 1 - \frac{3}{8} = \frac{5}{8}$

Nov 16-6:02 AM

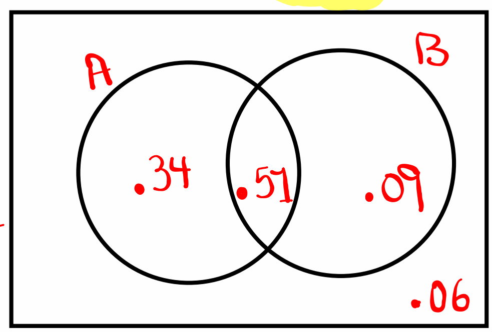
Given $P(A) = .85$ $P(B) = .6$ A & B are independent events.

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

2) $P(\overline{B}) = 1 - P(B) = \boxed{.4}$

Total $= 1$

3) Construct Venn Diagram



$P(A \text{ and } B) = P(A) \cdot P(B)$
$= (.85)(.6) = \boxed{.51}$

$P(A \text{ only}) = .85 - .51$
$= \boxed{.34}$

$P(B \text{ only}) = .6 - .51$
$= \boxed{.09}$

Nov 16-6:08 AM

A deck of cards has 40 cards, and 8 were face cards. Randomly select 2 cards without replacement

8F $\quad$ 32 $\bar{F}$

F → Face Card

$\bar{F}$ → Not Face Card

$FF \quad F\bar{F} \quad \bar{F}F \quad \bar{F}\bar{F}$

$P(\text{2 face cards}) = \frac{8}{40} \cdot \frac{7}{39} = \boxed{\frac{7}{195}}$

$P(\text{exactly 1 face card}) = P(F\bar{F} \text{ or } \bar{F}F) = 2 \cdot \frac{8}{40} \cdot \frac{32}{39} = \boxed{\frac{64}{195}}$

$P(\text{No face cards}) = P(\bar{F}\bar{F}) = \frac{32}{40} \cdot \frac{31}{39} = \boxed{\frac{124}{195}}$

# Face	P(# Face)
2	7/195
1	64/195
0	124/195

Face → L1

P(# Face) → L2

1-Var Stats with L1 & L2

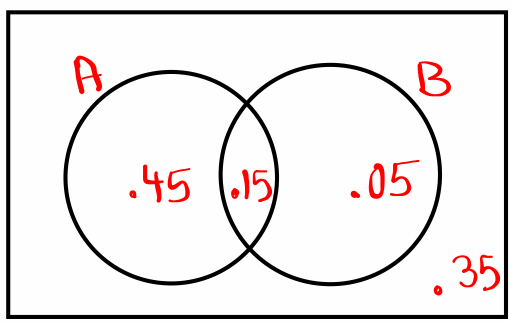
$\bar{x} = \boxed{.4}$ $\quad S_x =$ ↑ blank

$n = 1$ ← Total Prob. = 1

Nov 16-6:15 AM

$P(A) = .6 \qquad P(B) = .2 \qquad P(A \text{ and } B) = .15$

Construct Venn Diagram.



Total = 1

Given

$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.15}{.6} = \boxed{.25}$

$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.15}{.2} = \boxed{.75}$

Nov 16-6:28 AM

$P(A) = .5$, $P(B) = .3$ $P(B|A) = .5$

Find

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

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

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

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

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

Cross-Multiply

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

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

$= \dfrac{.25}{.3} = \boxed{.833}$

Nov 16-6:36 AM

A box has 2 quarters and 6 dimes

Take 2 coins with no replacement

Construct Tree diagram

Q → quarters

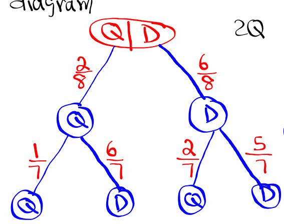
D → dimes

2Q 6 D

1Q 6 D

2Q 6 D

2Q 5 D



First Coin

$P(50¢) = P(QQ) = \frac{2}{8} \cdot \frac{1}{7} = \boxed{\frac{1}{28}}$

$P(35¢) = P(DQ \text{ or } QD) = 2 \cdot \frac{6}{8} \cdot \frac{2}{7} = \boxed{\frac{12}{28}} = \boxed{\frac{3}{7}}$

$P(20¢) = P(DD) = \frac{6}{8} \cdot \frac{5}{7} = \boxed{\frac{15}{28}}$

Total in ¢	P(Total in ¢)
50	1/28
35	3/7
20	15/28

Total in ¢ → L1

P(Total in ¢) → L2

Use 1-var stats with L1 & L2 to find

$\bar{x} = 27.5$

$S_x =$ blank

$n = 1$

Nov 16-6:44 AM

Use your calc to find

1) ${}_{12}C_5 = \boxed{792}$

2) ${}_{7}C_2 \cdot {}_{5}C_3 = \boxed{210}$

3) $\dfrac{{}_{7}C_2 \cdot {}_{5}C_3}{{}_{12}C_5}$ in reduced fraction

$= \dfrac{210}{792} = \boxed{\dfrac{35}{132}}$

Nov 16-6:57 AM

Consider a full-deck of playing cards.

52 Cards, 4 Aces. & $\overline{\text{Aces}}$ 48

Randomly draw 3 cards, No replacement.

1) How many ways can this be done?

${}_{52}C_3 = \boxed{22100}$

2) How many ways can we get 3 Aces?

${}_{4}C_3 = \boxed{4}$

3) $P(3\text{ Aces}) = \dfrac{{}_{4}C_3}{{}_{52}C_3} = \dfrac{4}{22100} = \boxed{\dfrac{1}{5525}}$ ✓

A A A

Some A & Some $\bar{A}$

$\bar{A}\,\bar{A}\,\bar{A}$

P(at least 1 Ace) = 1 − P(No Ace)

$= 1 - \dfrac{{}_{48}C_3}{{}_{52}C_3} = 1 - \dfrac{17296}{22100}$

$= \boxed{\dfrac{1201}{5525}} \approx .217$

Nov 16-7:12 AM

There are 12 people, 7 Males, 5 Females.
Select 3 different people.

M M M

Some M & Some F

F F F

P(at least 1 Male) =

$1 - P(\text{No Males}) =$

$1 - P(\text{All Females}) = 1 - \frac{{}_5C_3}{{}_{12}C_3}$

$= 1 - \frac{10}{220} = \boxed{\frac{21}{22}}$

P(at least 1 Female) = $1 - P(\text{No females})$

$= 1 - P(\text{All males}) = 1 - \frac{{}_7C_3}{{}_{12}C_3} = 1 - \frac{35}{220}$

$= \boxed{\frac{37}{44}}$

Nov 16-7:22 AM

P(2 Males & 1 Female) = $\frac{{}_7C_2 \cdot {}_5C_1}{{}_{12}C_3} = \frac{105}{220} = \boxed{\frac{21}{44}}$

M M F

M F M

F M M

P(1 Male & 2 Females) = $\frac{{}_7C_1 \cdot {}_5C_2}{{}_{12}C_3} = \frac{70}{220} = \boxed{\frac{7}{22}}$

M F F

F M F

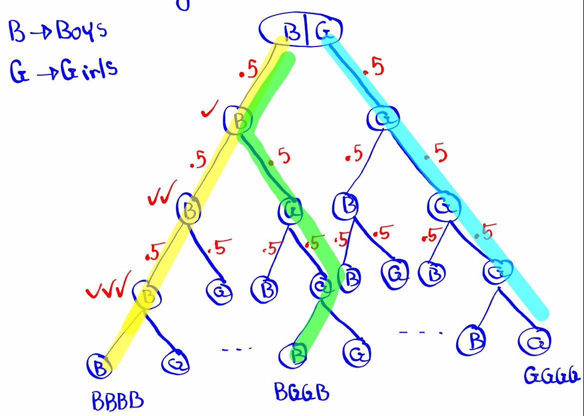
F F M

Nov 16-7:29 AM

Consider Selecting 4 newborn babies

B → Boys

G → Girls



P(All Boys) = (.5)(.5)(.5)(.5) = $\boxed{.0625}$

P(at least 1 Girl) = 1 − P(No girls)

= 1 − P(All boys)

= 1 − .0625 = $\boxed{.9375}$

= $\boxed{\frac{15}{16}}$

$\boxed{\text{SG 13}}$ ✓✓✓

Nov 16-7:34 AM

Complete the chart below

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.2	.2	.2
2	.5	1.0	2.0
3	.3	.9	2.7

1) $\sum P(x) = 1$

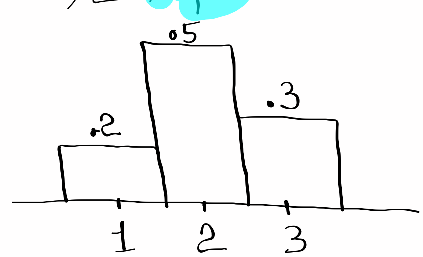
2) $\sum xP(x) = 2.1$

3) $\sum x^2P(x) = 4.9$

take x as midpoint &

P(x) as rel. Freq.

Draw histogram



Nov 16-7:45 AM

Complete the chart below

x	$P(x)$	$xP(x)$	$x^2P(x)$
1	.1	.1	.1
2	.2	.4	.8
3	.3	.9	2.7
4	.4	1.6	6.4

1) $\sum P(x) = 1$

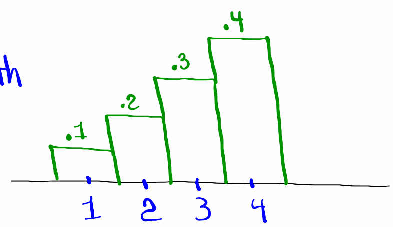
2) $\sum xP(x) = 3$

3) $\sum x^2P(x) = 10$

take x as midpoint & $P(x)$ as rel. F., Draw histogram

$x \to L1$, $P(x) \to L2$

Use 1-Var Stats with L1 & L2 to find



$\bar{x} = 3$

$S_x =$ Blank

$n = 1 \leftarrow$ Total Prob.

Nov 16-7:53 AM

Consider the chart below

x	$P(x)$
1	.1
2	.2
3	.3
4	.3
5	.1

1) $P(X=5)$

Recall $\sum P(x) = 1$

$P(X=5) = 1 - [.1 + .2 + .3 + .3] = 1 - .9 = \boxed{.1}$

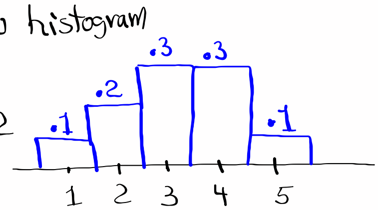
2) $x \to$ as midpoint

$P(x) \to$ as Rel. F.

Draw histogram

3) $x \to L1$, $P(x) \to L2$

Use 1-Var Stats with L1 & L2 to find



$\bar{x} = 3.1$

$S_x =$ Blank

$n = 1 \leftarrow$ Total Prob.

Nov 16-8:03 AM

Given odds in favor of event E are $\boxed{3:37}$

1) odds against E $\boxed{37:3}$

2) $P(E) = \frac{3}{3+37} = \frac{3}{40}$

3) $P(\bar{E}) = 1 - P(E) = \boxed{\frac{37}{40}}$

A loaded coin is tossed twice

$P(\text{Tails}) = .7$, $P(\text{Heads}) = .3$

T→Tails , H→Heads

TT
TH
HT
HH

$P(\text{both tails}) = (.7)(.7) = \boxed{.49}$

$P(\text{at least 1 tail}) = 1 - P(\text{No tails})$

$= 1 - P(HH)$

$= 1 - \underbrace{(.3)(.3)}_{.09} = \boxed{.91}$

P(exactly 1 Tail) =

$P(TH \text{ or } HT) = 2(.7)(.3) = \boxed{.42}$

$P(2 \text{ Tails}) = .49$ ✓
$P(1 \text{ Tail}) = .42$ ✓
$P(0 \text{ tails}) = .09$ ✓

L1	L2
2	.49
1	.42
0	.09

Total Prob

Find

$\bar{x} = 1.4$ S_x = Blank $n = 1$