Statistics

Lecture 7

Feb 19-8:47 AM

In - Person QZ 5

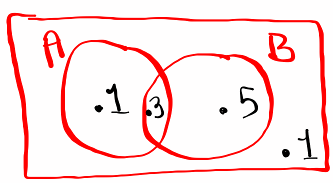
Given $P(A) = .4$, $P(B) = .8$, $P(A \text{ and } B) = .3$

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

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

$= .4 + .8 - .3 = \boxed{.9}$

3) Construct Venn Diagram.



Total = 1 ✓

Apr 5-10:47 AM

Some Review

Suppose $P(A) = .92$

1) Write $P(A)$ in Percent.

$.92(100)\% = \boxed{92\%}$

2) Write $P(A)$ in reduced fraction.

.92 [MATH] [1:▶Frac] [Enter] $\boxed{\frac{23}{25}}$

3) Find $P(\bar{A})$ in decimal.

$P(\bar{A}) = 1 - P(A)$ Complement Rule

$= 1 - .92 = \boxed{.08}$

4) Find odds in favor of event A.

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

$.92 : .08$ → .92 [÷] .08 [Math] [1:▶Frac] [Enter]

$\boxed{23:2}$

$\frac{23}{2}$

5) Find odds against event A.

$\boxed{2:23}$

Apr 12-8:06 AM

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

1) Find odds against event E.

$\boxed{37:3}$

2) Find P(E) in decimal. $P(E) = \frac{3}{3+37} = \frac{3}{40} = \boxed{.075}$

3) Find $P(\bar{E})$ in reduced fraction.

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

1 [−] 3 [÷] 40 [MATH] [1:▶Frac] [Enter]

Apr 12-8:14 AM

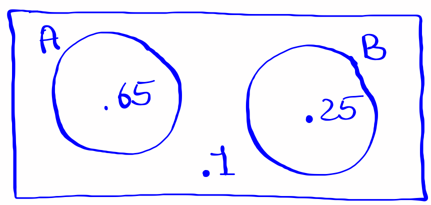
Suppose $P(A) = .65$, $P(B) = .25$, A & B are disjoint events.

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

2) $P(A \text{ and } B) = 0$ Since A & B are M.E.E

3) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .65 + .25 - 0 = \boxed{.9}$

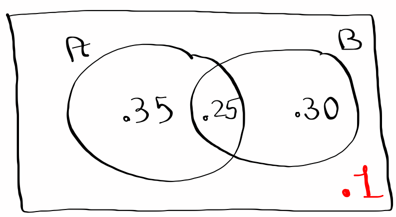
4) Venn Diagram



Total = 1

Apr 12-8:19 AM

Complete the Venn Diagram below



Total = 1

1) $P(A) = .35 + .25 = \boxed{.6}$

2) $P(B) = .25 + .30 = \boxed{.55}$

3) $P(A \text{ or } B)$
$= .35 + .25 + .30 = \boxed{.9}$

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

5) $P(A \text{ only}) = \boxed{.35}$

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

7) $P(\bar{A}) = \boxed{.4}$

8) $P(\bar{B}) = \boxed{.45}$

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

DeMorgan's Law

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

Apr 12-8:26 AM

Multiplication Rule

Keyword AND

Multiple - Action Event

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

A happens, then B happens — Given

1) Independent events

$\boxed{\text{If } A \,\&\, B \text{ are independent events, then } P(A \text{ and } B) = P(A) \cdot P(B)}$

what are independent events?

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

having multiple kids

$P(B) = .5$, $P(G) = .5$ on each birth.

Answering True/False questions by guessing

$P(T) = .5$, $P(F) = .5$

Suppose you are guessing on every question with multiple-choice (4 choices, only 1 correct choice)

$P(C) = \frac{1}{4}$, $P(\bar{C}) = \frac{3}{4}$

Suppose you draw cards from a standard deck of playing cards with replacement.

$P(\text{Ace}) = \frac{4}{52} = \boxed{\frac{1}{13}}$ on each draw

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

$P(3 \text{ Aces}) = \frac{1}{13} \cdot \frac{1}{13} \cdot \frac{1}{13} = \frac{1}{2197}$

Apr 12-8:38 AM

Suppose $P(A) = .8$, $P(B) = .4$, A & B are independent events.

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

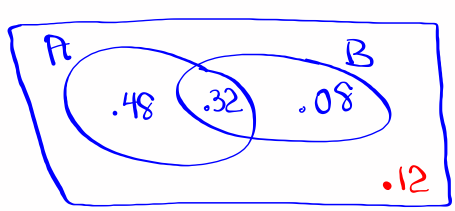
$P(\bar{B}) = .6$

$P(A \text{ and } B) = P(A) \cdot P(B) = (.8)(.4) = \boxed{.32}$

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

$= .8 + .4 - .32 = \boxed{.88}$

Construct Venn Diagram



Total = 1

Apr 12-8:50 AM

Suppose we flip a loaded coin twice.
$P(T)=.7$, $P(H)=.3$

TT
TH
HT
HH

Sample Space

$P(2 \text{ tails}) = P(TT) = (.7)(.7) = \boxed{.49}$

$P(1 \text{ tail}) = P(TH \text{ or } HT)$
$= 2(.7)(.3) = \boxed{.42}$

$P(\text{No tails}) = P(HH) = (.3)(.3) = \boxed{.09}$

# Tails	P(# Tails)
2	.49
1	.42
0	.09

Clear all lists
Tails → L1
P(# tails) → L2
use 1-Var Stats with L1 & L2
to find
$\bar{x} = 1.4$
$S_x =$ blank
$n = 1$ ← Total Prob. $= 1$

Apr 12-8:57 AM

A box has 4 dimes and 6 nickels.
Take 2 coins with replacement.

NN
ND
DN
DD

Sample Space

NN → 10¢ $P(10¢) = \frac{6}{10} \cdot \frac{6}{10} = \boxed{.36}$

ND
DN → 15¢ $P(15¢) = 2\left(\frac{6}{10}\right)\left(\frac{4}{10}\right) = \boxed{.48}$

DD → 20¢ $P(20¢) = \frac{4}{10} \cdot \frac{4}{10} = \boxed{.16}$

T(¢)	P(T(¢))
10¢	.36
15¢	.48
20¢	.16

T → L1
P(T) → L2
$\boxed{\text{1-Var Stats}}$ with L1 & L2
$\bar{x} = 14$
$S_x =$ Blank
$n = 1$ ← Total Prob.

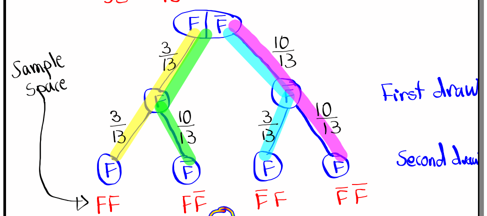
Apr 12-9:06 AM

Multiplication rule with Tree diagram:
A standard deck of playing cards has 52 cards and 12 face cards.

Suppose we draw 2 cards with replacement.

$P(F) = \frac{12}{52} = \frac{3}{13}$ on each draw

$P(\bar{F}) = \frac{40}{52} = \frac{10}{13}$ on each draw



$P(FF) = \frac{3}{13} \cdot \frac{3}{13} = \frac{9}{169}$

$P(F\bar{F}) = \frac{3}{13} \cdot \frac{10}{13} = \frac{30}{169}$

$P(\bar{F}F) = \frac{10}{13} \cdot \frac{3}{13} = \frac{30}{169}$

$P(\bar{F}\bar{F}) = \frac{10}{13} \cdot \frac{10}{13} = \frac{100}{169}$

#F	P(#F)
2	9/169
1	60/169
0	100/169

#F → L1
P(#F) → L2
1-Var Stat with L1 & L2
$\bar{x} \approx .462$
S_x = Blank
$n = 1$

Apr 12-9:27 AM

Now dependent events

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

Given

8 Females, 12 Males

Selecting 2 different people

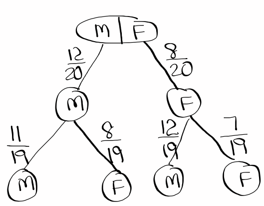
F F
F M
M F
M M

$P(FF) = \frac{8}{20} \cdot \frac{7}{19} = \frac{56}{380}$

$P(FM) = \frac{8}{20} \cdot \frac{12}{19} = \frac{96}{380}$

$P(MF) = \frac{12}{20} \cdot \frac{8}{19} = \frac{96}{380}$

$P(MM) = \frac{12}{20} \cdot \frac{11}{19} = \frac{132}{380}$



#F	P(#F)
2	56/380
1	192/380
0	132/380

L1, L2

Use 1-Var Stats with L1 & L2
$\bar{x} = .8$
S_x = blank
$n = 1$

Suppose we select 3 people

F F F

Some F & Some M

M M M

$P(FFF) = \frac{8}{20} \cdot \frac{7}{19} \cdot \frac{6}{18}$

$= \boxed{\frac{14}{285}}$

Apr 12-9:40 AM

Selecting 3 different people

F F F

Some F & Some M

M M M

$P(FFF) = \frac{8}{20} \cdot \frac{7}{19} \cdot \frac{6}{18} = \boxed{\frac{14}{285}}$

$P(MMM) = \frac{12}{20} \cdot \frac{11}{19} \cdot \frac{10}{18} = \boxed{\frac{11}{57}}$

$\boxed{P(\text{at least } 1) = 1 - P(\text{None})}$

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

$= 1 - P(\text{All Males})$

$= 1 - \frac{11}{57} = \boxed{\frac{46}{57}}$

F F F

Some F & Some M

M M M

$P(\text{at least one Male}) = 1 - P(\text{No males})$

$= 1 - P(\text{All Females})$

$= 1 - \frac{14}{285} = \boxed{\frac{271}{285}}$

Apr 12-9:53 AM

Multiplication Rule

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

with some algebra

$$\boxed{P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)}}$$

Conditional Prob.

$P(A) = .6$, $P(B) = .4$ $P(A \text{ and } B) = .3$

$P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{.3}{.6} = \boxed{.5}$

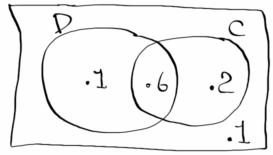
$P(A \mid B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{.3}{.4} = \boxed{.75}$

Apr 12-10:02 AM

$P(\text{Donut}) = .7$

$P(\text{Coffee}) = .8$

$P(\text{Donut and Coffee}) = .6$



$P(\text{Donut or coffee, not both}) = .1 + .2 = \boxed{.3}$

$P(\text{Donut} \mid \text{Coffee}) = \dfrac{P(C \,\&\, D)}{P(\text{Coffee})} = \dfrac{.6}{.8} = \dfrac{3}{4} = \boxed{.75}$

$P(\text{Coffee} \mid \text{Donut}) = \dfrac{P(C \,\&\, D)}{P(D)} = \dfrac{.6}{.7} = \dfrac{6}{7} = \boxed{.857}$

$P(\text{Donut}) = .7$, $P(\text{Coffee}) = .8$ $P(D \text{ or } C) = .9$

find $P(D \text{ and } C)$.

$P(D \text{ or } C) = P(D) + P(C) - P(D \text{ and } C)$

$.9 = .7 + .8 - P(D \text{ and } C)$

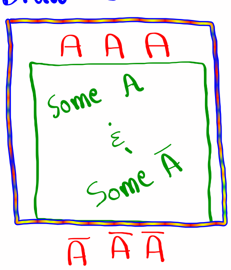
$P(D \text{ and } C) = .7 + .8 - .9 = \boxed{.6}$

Apr 12-10:08 AM

Consider a standard deck of playing cards.

52 cards, 4 Aces.

Draw 3 cards, No replacement.



$P(\text{All Aces}) = \dfrac{4}{52} \cdot \dfrac{3}{51} \cdot \dfrac{2}{50} = \boxed{\dfrac{1}{5525}}$

$P(\text{No Aces}) = \dfrac{48}{52} \cdot \dfrac{47}{51} \cdot \dfrac{46}{50} = \boxed{\dfrac{4324}{5525}}$

$P(\text{at least one Ace})$

$= 1 - P(\text{No Aces}) = 1 - \dfrac{4324}{5525} = \boxed{\dfrac{1201}{5525}}$

$P(\text{exactly 1 Ace}) = 3 \cdot \dfrac{4}{52} \cdot \dfrac{48}{51} \cdot \dfrac{47}{50} = \boxed{\dfrac{1128}{5525}}$

$A \; \bar{A} \; \bar{A}$

$\bar{A} \; \bar{A} \; A$

$\bar{A} \; A \; \bar{A}$

$P(\text{exactly 2 Aces}) = 3 \cdot \dfrac{4}{52} \cdot \dfrac{3}{51} \cdot \dfrac{48}{50} = \boxed{\dfrac{72}{5525}}$

$A \; A \; \bar{A}$

$A \; \bar{A} \; A$

$\bar{A} \; A \; A$

Apr 12-10:20 AM

# Aces	P(# Aces)
3	1/5525
2	72/5525
1	1128/5525
0	4324/5525

#Aces → L1

P(# Aces) → L2

1-Var stats with L1 & L2

$\bar{x} \approx .231$

$S_x =$ Blank

$n = 1$ Total Prob=1

Apr 12-10:33 AM

In-Person QZ 6

Given $P(E) = .6$

1) Find $P(\bar{E}) = 1 - P(E) = \boxed{.4}$

2) odds in favor of event E.

$P(E) : P(\bar{E})$ $.6 : .4 \Rightarrow \boxed{3:2}$

3) odds against event E.

$\boxed{2:3}$

Apr 12-10:39 AM