Statistics
Summer 2023
Lecture 6

Feb 19-8:47 AM

Class QZ 6

Use the chart below

x	y
3	2
5	5
6	4
6	3
8	2

x→L1, y→L2

LinReg(a+bx)

Find

✓ 1) a = 3.45

2) b = −.05

} Round to 2-decimals

✓ 3) r^2 = 0%

} whole %.

✓ 4) r = −.063

} 3-decimals

Jun 20-11:03 AM

Suppose $\hat{y} = 8.8 - 2.5x$ and $\bar{y} = 6.5$

Predict y when $x = 1$.

1) Assume r is Significant

Use $\hat{y} = 8.8 - 2.5(1) = 8.8 - 2.5 = \boxed{6.3}$

2) Assume r is not Significant.

Use $\bar{y} = \boxed{6.5}$

Jun 21-7:34 AM

$x \rightarrow$ Score for exam 1

$y \rightarrow$ " " " 2

x	y
72	83
70	78
80	80
85	95
90	85

1) Find

$\Sigma x = 397$ $\quad \Sigma y = 421$

$\Sigma x^2 = 31809$ $\quad \Sigma y^2 = 35623$

$n = 5$ $\quad \Sigma xy = 33561$

2) Find

$a = 47.3$

$b = .5$ } 1-decimal

$\hat{y} = 47.3 + .5x$

$r^2 = 36\%$ } whole %

$r = .596$ } 3-decimal

36% of exam 2 Scores are explained by exam 1 Scores.

64% are unexplained.

Jun 21-7:37 AM

Predict exam 2 Score for someone with 76 on exam 1.

1) Assume r is Significant

$\hat{y} = 47.3 + .5(76) = 85.3 \rightarrow 85$

2) Assume r is not Significant.

Use $\bar{y}$ → 84

VARS | 5: Statistics | 5: $\bar{y}$ | Enter → 84.2

Jun 21-7:48 AM

Consider a standard deck of playing cards,

If we draw one card,

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

2) $P(\text{Red Ace}) = \frac{2}{52} = \frac{1}{26}$

3) $P(\text{Ace of diamonds}) = \frac{1}{52}$

Jun 21-7:54 AM

Some Properties of Probabilities:

1) $0 \le P(E) \le 1$

2) Sum of all Prob. is always 1.

3) $P(E) = 1 \iff$ Sure event

4) $P(E) = 0 \iff$ Impossible event

5) $0 < P(E) \le .05 \iff$ Rare event

Recall 95% was usual.

5% was unusual.

6) $\bar{E} \rightarrow$ $\bar{E}$ - Complement, Not E

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

Jun 21-7:59 AM

Given $P(E) = \frac{3}{40}$

1) write $P(E)$ in decimal.

3 ÷ 40 enter .075

2) write $P(E)$ in %.

.075 = 7.5%

3) Is E a rare event? explain.

NO because $P(E) > .05$

4) $P(\bar{E})$ in fraction.

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

5) $P(\bar{E})$ in %.

$P(\bar{E}) = 100\% - P(E) = 100\% - 7.5\% = 92.5\%$

37 ÷ 40 enter .925

Jun 21-8:04 AM

If we randomly select one person, find the Prob. that this person has

1) birthday today $\frac{1}{365}$

2) birthday this week $\frac{1}{52}$

3) birthday this month $\frac{1}{12}$

Jun 21-8:11 AM

Complete the chart below:

	Yes	NO	Total
Dem.	42	18	60
Rep.	10	30	40
Total	52	48	100

If we select one Prosen from this Survey,

$P(\text{Yes}) = \frac{52}{100} = \frac{13}{25} = .52$

$P(\text{Democrat}) = \frac{60}{100} = .6 = \frac{3}{5}$

$P(\text{Republican OR NO}) = \frac{58}{100} = .58 = \frac{29}{50}$

$P(\text{Demo. and Yes}) = \frac{42}{100} = .42 = \frac{21}{50}$

Jun 21-8:16 AM

I flip a coin 120 times. Suppose it landed 75 times tails.

$P(T) = \frac{75}{120} = \boxed{\frac{5}{8}}$

75 ÷ 120 MATH 1:▶Frac Enter

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

1 ⊟ 5 ÷ 8 MATH 1:▶Frac Enter

MATH 2:▶Dec Enter .375

Jun 21-8:23 AM

A 16-sided fair die is numbered 1, 2, 3, - - - , 16.

Find the prob. that we roll this die and we get

1) an even number
2, 4, 6, 8, 10, 12, 14, 16
$\frac{8}{16} = \boxed{\frac{1}{2}}$

2) a perfect square number.
1, 4, 9, 16
$\frac{4}{16} = \boxed{\frac{1}{4}}$

3) a multiples of 3 number.
3, 6, 9, 12, 15
$\boxed{\frac{5}{16}}$

SG 10

Jun 21-8:30 AM

Addition Rule

SG 11

Keyword OR

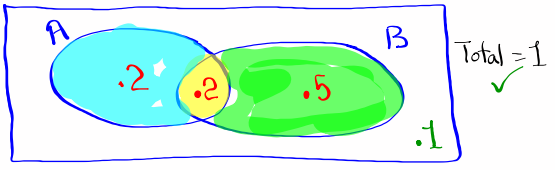
$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ ← overlap

Suppose $P(A) = .4$, $P(B) = .7$, $P(A \text{ and } B) = .2$

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

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

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



$P(A \text{ only}) = .4 - .2 = .2$

$P(B \text{ only}) = .7 - .2 = .5$

Jun 21-8:53 AM

$P(\text{Coffee}) = .8$ C → Coffee

$P(\text{Donut}) = .4$ D → Donut

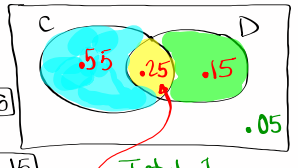
$P(\text{Coffee and Donut}) = .25$

1) $P(\overline{C}) = 1 - P(C)$
$= 1 - .8 = .2$

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

3) $P(C \text{ or } D) = P(C) + P(D) - P(C \text{ and } D)$ ← Addition Rule
$= .8 + .4 - .25 = .95$

4) Venn Diagram



$P(\text{Coffee only}) = .8 - .25 = .55$

$P(\text{Donut only}) = .4 - .25 = .15$

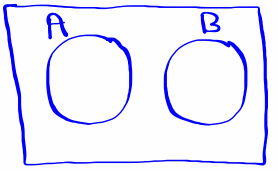
5) $P(\text{Coffee or Donut not both}) = .55 + .15$
$= .7$

Jun 21-9:00 AM

Mutually Exclusive Events

"Disjointed Events"

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



No overlap

$P(A) = .25$, $P(B) = .55$, A & B are M.E.E.

1) $P(\bar{A}) = 1 - P(A)$
$= 1 - .25 = .75$

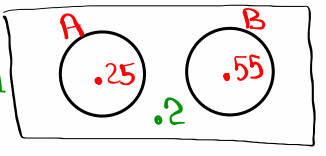
2) $P(\bar{B}) = 1 - P(B)$
$= 1 - .55 = .45$

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

4) $P(A \text{ or } B) =$
$P(A) + P(B) - P(A \text{ and } B) =$
$.25 + .55 - 0 = .8$

5) Draw Venn Diagram

Total = 1 ✓



Jun 21-9:10 AM

Consider a standard deck of playing cards, we draw one card,

"Do not reduce"

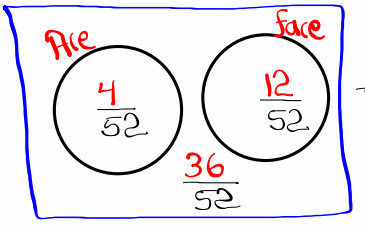
1) $P(\text{Ace}) = \frac{4}{52}$

2) $P(\text{face}) = \frac{12}{52}$

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

4) $P(\text{Ace or face})$
$P(\text{Ace}) + P(\text{face}) - P(\text{both})$
$= \frac{4}{52} + \frac{12}{52} - \frac{0}{52} = \frac{16}{52}$

5) Draw Venn Diagram



Total $= \frac{52}{52} = 1$ ✓

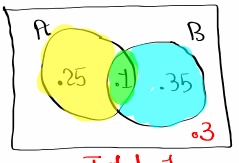
Jun 21-9:18 AM

De Morgan Law

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

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

Complete the Venn Diagram below



Total = 1

P(A and B) = .1

P(A only) = .25

P(B only) = .35

P(A) = .35

P(B) = .45

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

$= .35 + .45 - .1 = .7$

$P(\overline{A} \text{ and } \overline{B}) = P(\overline{A \text{ or } B}) = 1 - .7 = .3$

DeMorgan Law

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

Jun 21-9:24 AM

Given P(A) = .3 , P(B) = .6 , P(A and B) = .25

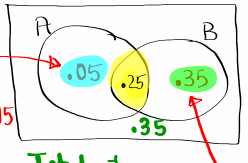
1) $P(\overline{A}) = 1 - P(A) = .7$

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

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

$= .3 + .6 - .25 = .65$

4) Make Venn Diagram



P(A only) = .3 − .25 = .05

Total = 1

5) P(A only or B only) = .05 + .35 = .4

P(B only) = .6 − .25 = .35

Use DeMorgan's Law

6) $P(\overline{A} \text{ and } \overline{B}) = P(\overline{A \text{ or } B}) = 1 - .65 = .35$

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

SG 11

Jun 21-9:35 AM

odds vs probability

SG 12

odds is the ratio of two numbers written in this format

$a : b$

a: # of times event E happens

b: # of times event E does not happen.

If you flip a coin 30 times, and land tails 17 times,

odds in favor of landing tails is

$17 : 13$

17: Tails

13: $\overline{\text{Tails}}$

Notation $a : b$ has to be reduced.

Jun 21-10:03 AM

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

odds in favor of getting

1) Ace is $4 : 48 \Rightarrow \boxed{1 : 12}$

4: # Aces; 48: # $\overline{\text{Aces}}$

2) face is $12 : 40 \Rightarrow \boxed{3 : 10}$

12: # face; 40: # $\overline{\text{face}}$

3) red color is $26 : 26 \Rightarrow 1 : 1$

26: # red; 26: # $\overline{\text{Red}}$

4) Ace or face is $16 : 36 \Rightarrow 4 : 9$

16: # Ace or face; 36: # $\overline{\text{Ace or face}}$

16 ÷ 36

Math | 1: ▶Frac | Enter

Jun 21-10:07 AM

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

odds against event E are $b : a$

$P(E) = \frac{a}{a+b}$ & $P(\bar{E}) = \frac{b}{a+b}$

Ex: Suppose odds in favor of event E are $3:5$

1) odds against event E. $\boxed{5:3}$

2) $P(E) = \frac{3}{3+5} = \boxed{\frac{3}{8}}$ 3) $P(\bar{E}) = \frac{5}{3+5} = \boxed{\frac{5}{8}}$

Jun 21-10:13 AM

Suppose a deck of cards has 40 cards and it has 2 Aces.

1) odds in favor of drawing ace.

#Aces : # $\overline{\text{Aces}}$ $2:38$

2) odds against drawing ace. $\Rightarrow \boxed{1:19}$ $\Rightarrow \boxed{19:1}$

3) $P(\text{Ace}) = \frac{2}{40} = \boxed{\frac{1}{20}}$ $\frac{1}{1+19}$

4) $P(\overline{\text{Ace}}) = \frac{38}{40} = \frac{19}{20}$ $\frac{19}{1+19}$

Jun 21-10:21 AM

How to find odds when $P(\bar{E})$ is given:

odds in favor of event E are

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

Always Simplify

$a : b$

$P(E) = .25$

1) $P(\bar{E}) = .75$

2) odds in favor of event E are

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

$.25 : .75$

$.25 \div .75$ Math 1:Frac Enter

$1 : 3$

3) **odds against E**

$3 : 1$

Jun 21-10:25 AM

Suppose Prob. that LA Dodgers win the World Series this year is .08.

1) $P(W) = .08$

2) $P(\bar{W}) = 1 - P(W)$

$= .92$

3) odds in favor of winning the W.S.

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

$.08 : .92 \Rightarrow 2 : 23$

4) odds against Dodgers winning W.S.

$23 : 2$

Jun 21-10:29 AM

Given $P(A)=.3$, $P(B)=.5$, $P(A \text{ or } B)=.65$

1) Find $P(\bar{A}) = 1 - P(A) = .7$

2) odds in favor of event A.

$P(A) : P(\bar{A})$ $\quad .3 : .7 \Rightarrow 3:7$

3) odds against event A. $\Rightarrow 7:3$

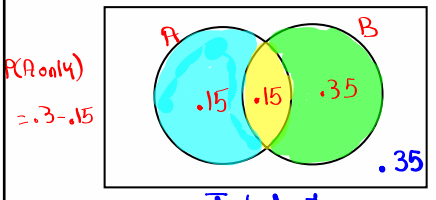
4) $P(A \text{ and } B)$

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

$.65 = .3 + .5 - P(A \text{ and } B)$

$P(A \text{ and } B) = .3 + .5 - .65 = .15$

5) Make Venn Diagram



P(A only) $= .3 - .15$

P(B only) $= .5 - .15$

Jun 21-10:35 AM

odds in favor of event A are 3:7

odds in favor of event B are 1:9.

1) odds against A $7:3$

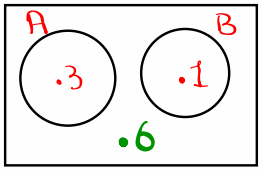
2) odds against B $9:1$

3) $P(A) = \frac{3}{3+7} = \frac{3}{10} = .3$ $\quad$ 4) $P(\bar{A}) = .7$

5) $P(B) = \frac{1}{1+9} = \frac{1}{10} = .1$ $\quad$ 6) $P(\bar{B}) = .9$

Suppose A & B are disjointed events,

Draw its Venn Diagram

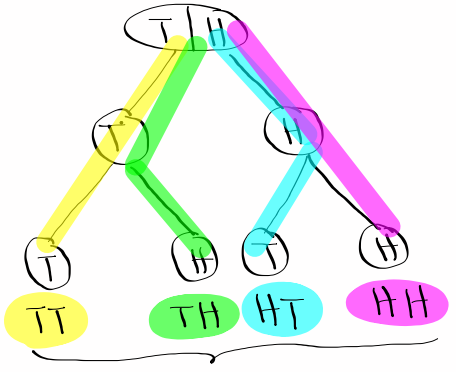


Jun 21-10:48 AM

Making Tree diagram

Suppose we flip a Coin twice

T → Tails, H → Heads



choices

First flip

Second flip

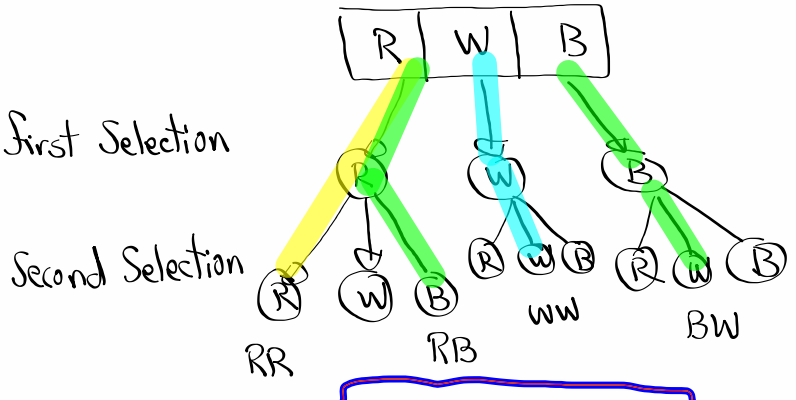
Sample Space

Complete list of all Possible outcomes

Jun 21-11:10 AM

A box has Colored balls, Red, White, Blue

Randomly Select 2 balls.



Sample Space →

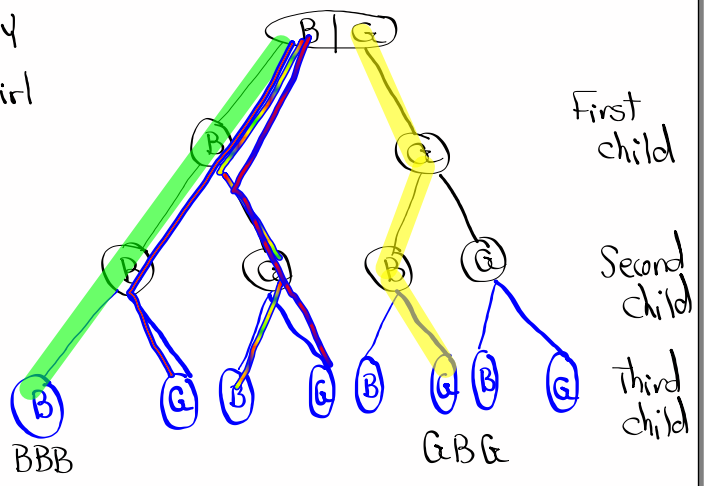
RR	RW	RB
WR	WW	WB
BR	BW	BB

Jun 21-11:14 AM

Consider a family with 3 kids.

B → Boy

G → Girl



Sample Space

{BBB, BBG, BGB, BGG, GBB, GBG, GGB, GGG}

Jun 21-11:20 AM

Using TI

Find 6!

6 [Math] → → → PRB ↓ [4:!] [Enter]

720

Find 60!

60 [MATH] PRB

[4:!] [Enter]

8.3×10^{81}

Find 100! overflow (Too big)

Jun 21-11:28 AM

$_{10}C_4$

10 MATH PRB 3:nCr 4 Enter

210

$_{50}C_5$

50 MATH PRB 3:nCr 5 Enter

2,118,760

$_{50}P_5$

50 MATH PRB 2:nPr 5 enter

254,251,200

Jun 21-11:32 AM

Class QZ 7

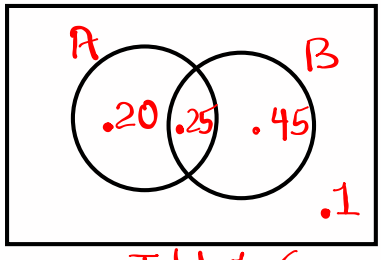
Given $P(A)=.45$, $P(B)=.7$ $P(A \text{ and } B)=.25$

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

2) $P(A \text{ or } B) = .45 + .7 - .25$

$= .9$

3) Make Venn Diagram



Jun 21-11:37 AM