Statistics

Fall 2021

Lecture 10

Consider the chart below

x	y
5	13
7	18
8	20
4	10
6	15
5	15

1) $n = 6$

2) Find

$\Sigma x = 35$

$\Sigma x^2 = 215$

$\Sigma y = 91$

$\Sigma y^2 = 1443$

$\Sigma xy = 556$

Clear all lists

Reset all lists

$x \to L1$

$y \to L2$

STAT → CALC

2: 2-Var Stats

x list: L1

Y list: L2

Freq List: Clear

Calculate

No Menu

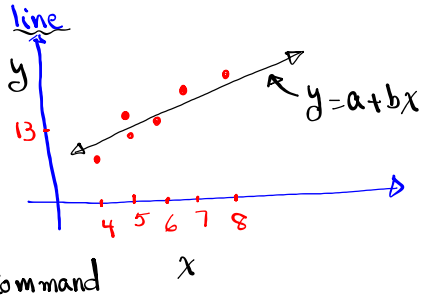
L1, L2 Enter

↑ 1 ↑

2nd 1 2nd 2

x	y
5	13
7	18
8	20
4	10
6	15
5	15

Scatter Plot, draw the regression line



Now use LinReg(a+bx) command with L1 & L2 to find

a = 1.615
b = 2.323
r^2 = .930
r = .965

$a \approx 1.6$
$b \approx 2.3$
$\Rightarrow \boxed{y = 1.6 + 2.3x}$

$r^2(\%) \approx 93\%$ Coef. of Determination

93% of Y-values are explained by x-values.

Linear correlation Coef. $r = .965$

r is close to 1 $\Rightarrow$ Linear Correlation is Significant.

Predict y when $x = 4.5$

1) Assume r is Significant.

When r is Significant Use the regression line $\Rightarrow$ $y = 1.6 + 2.3x$

$= 1.6 + 2.3(4.5)$

$y = 11.95$

$\boxed{y \approx 12}$

2) Assume r is not Significant.

When r is not Significant Use $\bar{y}$ $\Rightarrow$ $\bar{y} = \frac{\Sigma y}{n} = \frac{91}{6} = 15.1\overline{6}$ $\boxed{\bar{y} \approx 15}$

VARS 5: Statistics 5: $\bar{y}$ Enter

Regression line

$$y = a + bx$$

$$a = \frac{\Sigma y \cdot \Sigma x^2 - \Sigma x \cdot \Sigma xy}{n\Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

Linear Correlation Coef:

$$r = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\ \sqrt{n\Sigma y^2 - (\Sigma y)^2}}$$

Class QZ 10

Use the chart below to find

x	y
3	10
2	8
3	12
4	15
5	18

$a = .962$

$b = 3.423$ } 3-decimals

$r^2 = 96\%$ } whole %.

$r = .982$ } 3-decimals

Cont. working with probabilities:

Consider $1, 2, 3, \ldots, 18, 19, 20$

Suppose I select one number randomly.

$P(\text{Select less than } 3) = \frac{2}{20} = \boxed{\frac{1}{10}} = \boxed{.1}$

$P(\text{Select at least } 18) = \boxed{\frac{3}{20}} = \boxed{.15}$

$P(\text{Select } \underbrace{\text{less than } 3}_{2} \text{ or } \underbrace{\text{at least } 18}_{3}) = \frac{2+3}{20} = \frac{5}{20} = \boxed{\frac{1}{4}} = \boxed{.25}$

$P(\text{Select less than } 3 \text{ and at least } 18) = \frac{0}{20} = \boxed{0}$
(less than 3: 1, 2; at least 18: 18, 19, 20)

$P(\text{Select an even number}) = \frac{10}{20} = \boxed{\frac{1}{2}} = \boxed{.5}$
(2, 4, 6, 8, 10, 12, 14, 16, 18, 20)

$P(\text{Select a number divisible by } 5) = \frac{4}{20} = \boxed{\frac{1}{5}} = \boxed{.2}$
(5, 10, 15, 20)

$E \rightarrow$ Desired event/outcome

$P(E) \rightarrow$ Prob. that E happens

$\bar{E} \rightarrow$ Not E, E complement

$P(\bar{E}) \rightarrow$ Prob. that E does not happen.

Complement Rule

$P(E) + P(\bar{E}) = 1 \quad , \quad P(\bar{E}) = 1 - P(E)$

Ex:

$P(\text{Rains}) = .15$

$P(\overline{\text{Rain}}) = 1 - P(\text{Rains})$

$= 1 - .15$

$= .85$

Ex: Suppose $P(A) = .125$

1) write $P(A)$ in %.

$P(A) = .125 = .125(100)\% = \boxed{12.5\%}$

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

$P(A) = .125 = \frac{.125}{1} = \frac{.125(1000)}{1(1000)} = \frac{125}{1000}$

$= \frac{\cancel{5}\cdot 25}{\cancel{5}\cdot 200} = \frac{\cancel{5}\cdot 5}{\cancel{5}\cdot 40} = \frac{\cancel{5}\cdot 1}{\cancel{5}\cdot 8} = \boxed{\frac{1}{8}}$

.125 [MATH] [1: ▶Frac] [Enter]

3) Find $P(\bar{A})$

$P(\bar{A}) = 1 - P(A) = 1 - .125 = \boxed{.875}$

Suppose $P(A) = \frac{7}{40}$

1) write $P(A)$ in decimals.

7 [÷] 40 [Enter] $\boxed{P(A) = .175}$

2) Find $P(\bar{A})$ in reduced fraction

$P(\bar{A}) = 1 - P(A) = 1 - \frac{7}{40} = \boxed{\frac{33}{40}}$

1 [−] 7 [÷] 40 [Math] [1: ▶Frac] [Enter]

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

$P(\bar{A}) = \frac{33}{40}$

33 [÷] 40 [MATH] [2: ▶Dec] [×] 100 [Enter]

$\boxed{P(\bar{A}) = 82.5\%}$

Addition Rule

Keyword OR

Single Action event

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

(Both overlap)

Ex: $P(A) = .7$

$P(B) = .6$

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

$P(\overline{A}) = 1 - P(A) = 1 - .7 = \boxed{.3}$

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

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

$= .7 + .6 - .5$

$= \boxed{.8}$

Suppose $P(\text{coffee}) = .75$

$P(\text{Donut}) = .35$

$P(\text{coffee and Donut}) = .3$

$P(\overline{\text{coffee}}) = 1 - P(\text{coffee}) = 1 - .75 = \boxed{.25}$

$P(\overline{\text{Donut}}) = 1 - P(\text{Donut}) = 1 - .35 = \boxed{.65}$

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

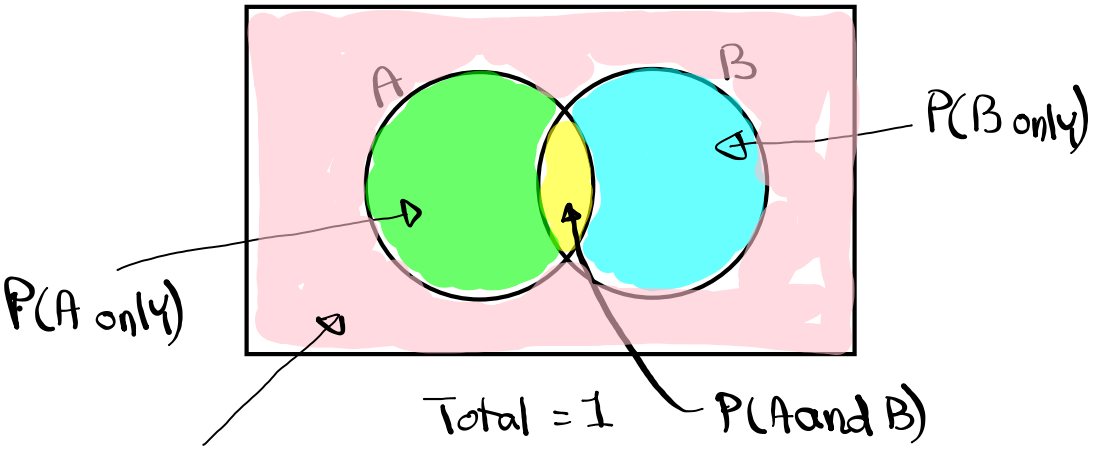
↑ Addition Rule $= .75 + .35 - .3$

$= \boxed{.8}$

$P(\overline{\text{coffee OR Donut}})$

$= 1 - P(\text{coffee OR Donut}) = 1 - .8 = \boxed{.2}$

Addition Rule with Venn Diagram:



$P(\overline{A \text{ or } B})$ $\quad$ $P(A \text{ or } B)$ = inside of Circles

Ex:

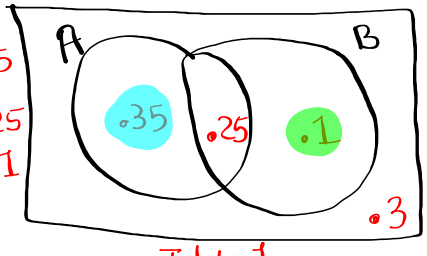
$P(A) = .6$

$P(B) = .35$

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

.6 − .25 = .35

.35 − .25 = .1



Total = 1

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

$P(\overline{B}) = 1 - P(B) = 1 - .35 = \boxed{.65}$

P(A only) = .35

P(B only) = .1

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

↑ Addition Rule

$= .6 + .35 - .25 = \boxed{.7}$

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

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

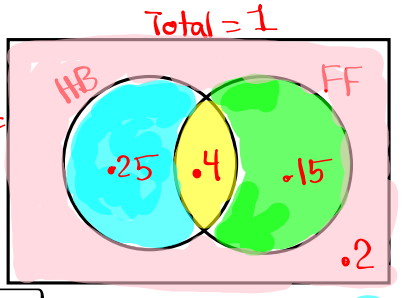
$P(HB) = .65$

$P(FF) = .55$

$P(HB \text{ and } FF) = .4$

$.65 - .4 = .25$

$.55 - .4 = .15$



$P(\overline{HB}) = 1 - P(HB) = .35$

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

$P(HB \text{ only}) = .25$

$P(FF \text{ only}) = .15$

$P(HB \text{ OR } FF) = P(HB) + P(FF) - P(HB \text{ and } FF)$

$= .65 + .55 - .4 = .8$

$P(HB \text{ only} \text{ or } FF \text{ only}, \text{ not both}) = .25 + .15$

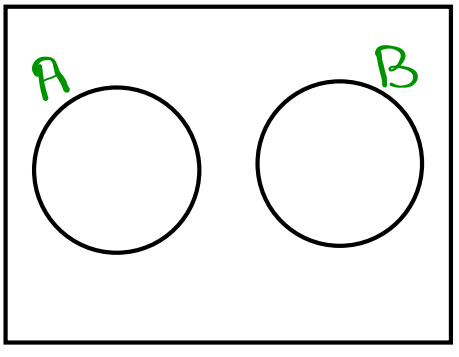
$= .4$

Mutually Exclusive Events

These are events that they do not happen together.

NO overlap.

It is also called Disjoint Events



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

A and B are M.E.E.

Ex: $P(A) = .7$

$P(B) = .2$

A and B are mutually exclusive events.

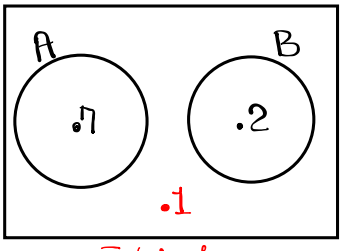
$P(\bar{A}) = 1 - P(A) = .3$ $\quad$ $P(\bar{B}) = 1 - P(B) = .8$

$P(A \text{ and } B) = 0$ $\quad$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$= .7 + .2 - 0$

$= .9$

Construct Venn Diagram



Total = 1

I surveyed 100 students.

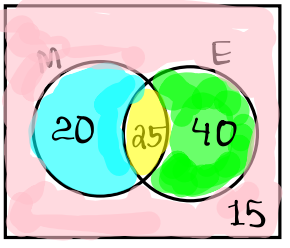
45 were taking Math

65 " " English

25 were taking both classes.

$45 - 25 = 20$

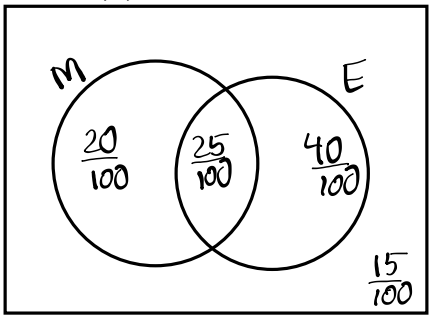
$65 - 25 = 40$

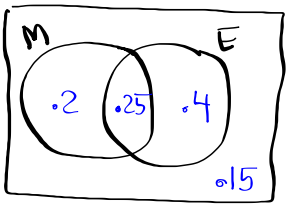


Construct its Venn Diagram

# of students

Prob.





Class QZ 11

Given $P(A) = .85$

$P(B) = .35$

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

Find

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

2) $P(A \text{ or } B)$

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

$= .85 + .35 - .3$

$= \boxed{.9}$