Statistics

Lecture 5

Feb 19-8:47 AM

Class QZ 2

Consider the chart below

class MP	class F
20	9
35	12
50	4

Class MP → L1

Class F → L2

STAT → CALC

1: 1-Var Stats

Menu
List: L1
FreqList: L2
Calculate

No Menu
1-Var Stats
L1 , L2
enter

Use class MP & class F to find

1) $\bar{x} = 32$

2) $s = 10.607 \approx 11$

3) $n = 25$

Round to whole #

4) $s^2 = \frac{225}{2}$

Reduced Fraction

VARS

5: Statistics

3: S_x

x^2 Math 1:▶Frac

Enter

Sep 26-7:37 AM

Working with ordered-Pairs SG 9

(x, y)

$(3,6)$, $(2,3)$, $(4,10)$, $(5,10)$

x	y	x^2	y^2	$x \cdot y$
3	6	9	36	18
2	3	4	9	6
4	10	16	100	40
5	10	25	100	50

$\sum x = 14$

$\sum x^2 = 54$

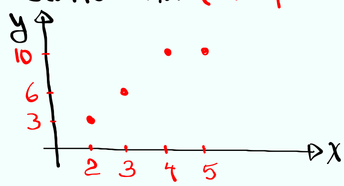
$n = 4$

$\sum y = 29$

$\sum y^2 = 245$

$\sum xy = 114$

Scatter Plot (Plot points)



Clear all lists

$x \to L1$, $y \to L2$

$\boxed{\text{STAT}}$ $\boxed{\to}$ CALC

$\boxed{\text{2: 2-Var Stats}}$

With Menu	No Menu
xlist: L1	2-Var Stats
ylist: L2	L1, L2
FreqList: $\boxed{\text{clear}}$	$\boxed{7}$ $\boxed{\text{enter}}$
$\boxed{\text{Calculate}}$	

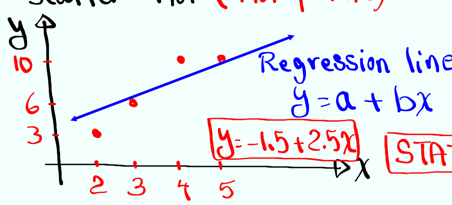
$\sum x = 14$ $\qquad \sum y = 29$

$\sum x^2 = 54$ $\qquad \sum y^2 = 245$

$n = 4$ $\qquad \sum xy = 114$

Sep 26-8:16 AM

Scatter Plot (Plot points)



$\boxed{\text{STAT}}$ $\boxed{\to}$ CALC

$\boxed{\text{8: LinReg(a+bx)}}$

$y = a + bx$

$a = -1.5$

$b = 2.5$

$r^2 = .899$ ✓

$r = .948$ ✓

With Menu	No Menu
xlist: L1	
ylist: L2	L1, L2
$\boxed{\text{clear}}$	$\boxed{7}$ $\boxed{\text{enter}}$
$\boxed{\text{Calculate}}$	

If r & r^2 missing:

$\boxed{\text{2nd}}$ $\boxed{0}$ ↓↓↓↓ ⋯ ↓ ▶DiagnosticOn

$\boxed{\text{Enter}}$

$\boxed{\text{Enter}}$

Sep 26-8:29 AM

$\sum x = 14$ $\qquad \sum y = 29$

$\sum x^2 = 54$ $\qquad \sum y^2 = 245$

$n = 4$ $\qquad \sum xy = 114$

Formulas for a & b

$$a = \frac{\sum y \sum x^2 - \sum x \sum xy}{n \sum x^2 - (\sum x)^2} = \frac{29 \cdot 54 - 14 \cdot 114}{4 \cdot 54 - 14^2} = \frac{-30}{20} = \boxed{-1.5}$$

$$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2} = \frac{4 \cdot 114 - 14 \cdot 29}{4 \cdot 54 - 14^2} = \frac{50}{20} = \boxed{2.5}$$

Sep 26-8:38 AM

$r \rightarrow$ Linear Correlation Coefficient

$$-1 \le r \le 1$$

when r is close to 1 or -1,
the linear Correlation is Significant.

when r is close to 0,
the linear Correlation is not Significant.

Formula for r:

From Last example
$\sum x = 14$, $\sum x^2 = 54$
$n = 4$, $\sum y = 29$
$\sum y^2 = 245$, $\sum xy = 114$

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

$$= \frac{4 \cdot 114 - 14 \cdot 29}{\sqrt{4 \cdot 54 - 14^2} \sqrt{4 \cdot 245 - 29^2}} = \frac{50}{\sqrt{20} \sqrt{139}} = \frac{50}{\sqrt{2780}}$$

$50 \boxed{\div} \underbrace{\boxed{2nd} \boxed{x^2}}_{\sqrt{\ }} 2780 \boxed{enter} \approx \boxed{.948}$ it is close to 1,

Linear regression is Significant

Sep 26-8:44 AM

$r^2 \rightarrow$ Coefficient of determination

Round to whole %.

r^2 tells us what % of y-values are explained by x-values.

From last example

$r^2 = (.948)^2 = .898704 \approx 90\%$

90% of y-values are explained by x-values.

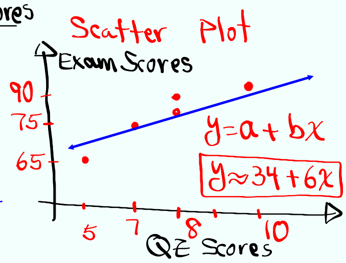
10% are unexplained.

Sep 26-8:54 AM

I randomly selected 5 students, chart below shows class QZ and exam scores.

QZ Scores	Exam Scores
7	75
8	90
8	85
5	65
10	95

Scatter Plot



QZ Scores $\rightarrow x \rightarrow$ L1, Exam Scores $\rightarrow y \rightarrow$ L2

$\boxed{\text{STAT}}\boxed{\rightarrow}$ CALC

$\boxed{\text{8:LinReg(a+bx)}}$

use L1 & L2

$a = 33.636 \approx 34$

$b = 6.364 \approx 6$

$r^2 = .922$

$r = .960$

$r^2(\%) \approx 92\%$

92% of exam scores are explained by QZ scores.

r is close to 1, Linear Correlation is significant.

Sep 26-8:58 AM

How to make prediction:

when r is significant,
use the regression line to make prediction

when r is not significant,
use $\bar{y}$ as the prediction value.

$\bar{y} = \frac{\sum y}{n}$ or $\boxed{\text{VARS}}$ $\boxed{\text{5: Statistics}}$ $\boxed{5: \bar{y}}$ $\boxed{\text{Enter}}$

$\bar{y} \approx 82$ ✓

Sep 26-9:10 AM

From last example, Predict exam Score for someone who got 9 on the QZ.

1) Assume r is significant
use regression line

$y = 34 + 6(9) = \boxed{88}$

2) Assume r is not significant.
use $\bar{y}$

$\bar{y} = \frac{\sum y}{n} = \frac{410}{5} = \boxed{82}$

Sep 26-9:15 AM

Intro to probabilities: SG 10

E → Desired event (outcome)

P(E) → Prob. that E happens

$$P(E) = \frac{\text{Total \# of all desired outcomes}}{\text{Total \# of all outcomes}}$$

Acceptable answers:

1) Reduced fraction
2) Round to 3-dec. Places
3) Scientific notations

ex: There are 10 females and 8 males. Select one person randomly. what is the prob. of selecting a male?

$$P(\text{Male}) = \frac{\text{\# males}}{\text{\# people}} = \frac{8}{18} = \boxed{\frac{4}{9}}$$

Sep 26-9:36 AM

A box has 8 nickels, 9 dimes, and 3 quarters. Randomly select one coin,

1) $P(\text{nickel}) = \frac{8}{20} = \boxed{\frac{2}{5}} = \boxed{.4}$

2) $P(\text{nickel or dime}) = \boxed{\frac{17}{20}} = \boxed{.85}$

3) $P(\text{nickel and dime}) = \frac{0}{20} = \boxed{0}$

Sep 26-9:43 AM

Consider a standard deck of playing Cards.

52 Cards, 26 Red, 12 Face, 4 Aces

Randomly draw one Card,

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

2) $P(\text{Face}) = \frac{12}{52} \approx \boxed{.231}$

3) $P(\text{Red Ace}) = \frac{2}{52} \approx \boxed{.038}$

Rare event

Sep 26-9:47 AM

I randomly Selected 100 Voters and asked them if they plan to Vote Yes or No on Prop. 50.

	Yes	NO	Total
Republican	10	30	40
Democrat	$\boxed{50}$	10	60
Total	60	40	100

If we randomly Select one of these Voters,

1) $P(\text{Yes}) = \frac{60}{100} = \boxed{.6}$

2) $P(\text{Democrat}) = \frac{60}{100} = \boxed{.6}$

3) $P(\text{Yes or Democrat}) = \frac{70}{100} = \boxed{.7}$

4) $P(\text{Yes } \boxed{\text{and}} \text{ Democrat}) = \frac{50}{100} = \boxed{.5}$

5) $P(\text{Democrat and Republican}) = \frac{0}{100} = \boxed{0}$

Sep 26-9:53 AM

Some rules and terminologies:

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

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

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

4) $0 < P(E) \le .05 \iff$ Rare event

5) Sum of all prob. is always 1.

Sep 26-10:01 AM

$\bar{E} \rightarrow$ E-bar $\rightarrow$ E-Complement

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

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

Complement Rule

ex: $P(\text{Rains}) = .1 \leftarrow 10\%$

$P(\overline{\text{Rain}}) = 1 - P(\text{Rain}) = 1 - .1 = \boxed{.9}$

90%

Sep 26-10:07 AM

If one person is randomly Selected,

P(he or She has a birthday next week)

$\frac{1 \text{ wk}}{52 \text{ weeks}} = \boxed{\frac{1}{52}}$

P(he or She does not have a birthday next month)

$= 1 - P(\text{he or She has a birthday next Month})$

$= 1 - \frac{1 \text{ mo.}}{12 \text{ Months}} = 1 - \frac{1}{12} = \boxed{\frac{11}{12}}$

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$P(\overline{\text{next month}}) = 1 - P(\text{Next month})$

Sep 26-10:10 AM

Consider the numbers below

1, 2, 3, 4, . . . , 30

Select one number

1) P(Selected 4) = $\boxed{\frac{1}{30}} \approx .033$ Rare event

2) P(Selected 4 or below) = $\frac{4}{30} = \boxed{\frac{2}{15}} = \boxed{.133}$

3) P(Selected 25 or above) = $\frac{6}{30} = \boxed{\frac{1}{5}} = \boxed{.2}$

25, 26, 27, 28, 29, 30

4) P(Selected below 4 or above 25) = $\frac{8}{30} = \boxed{\frac{4}{15}}$

1, 2, 3   26, 27, 28, 29, 30

5) P(Selected below 4 AND above 25) $= \frac{0}{30} = \boxed{0}$

6) P(Selected an even #) = $\frac{15}{30} = \boxed{.5}$

2, 4, 6, 8, 10,
12, 14, 16, 18, 20,
22, 24, 26, 28, 30

SG 10 ✓

Sep 26-10:17 AM

Addition Rule

Keyword OR

Single action event

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

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

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

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

$= .7 + .4 - .2 = \boxed{.9}$

SG 11

Sep 26-10:26 AM

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

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

$P(\text{Coffee and Donut}) = .1$

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

2) $P(\overline{\text{Donut}}) = 1 - .3 = \boxed{.7}$

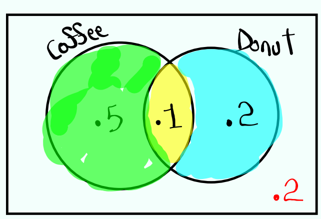
3) $P(\text{Coffee } \underset{\uparrow \text{ Addition}}{\text{or}} \text{ Donut}) = P(\text{Coffee}) + P(\text{Donut}) - P(\text{Coffee and Do.})$

$= .6 + .3 - .1 = \boxed{.8}$

Addition Rule with Venn Diagram

$.6 - .1 = .5$

$.3 - .1 = .2$



Total = 1

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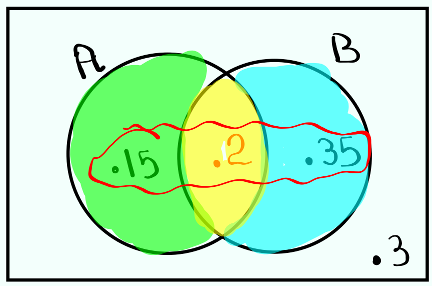
Complete the Venn Diagram below



Total = 1

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

$P(A) = .15 + .2 = \boxed{.35}$

$P(B \text{ only}) = .35$

$P(B) = .35 + .2 = \boxed{.55}$

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

$P(A \text{ or } B) = .15 + .2 + .35 = \boxed{.7}$

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

Using Formula

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

$= .35 + .55 - .2 = \boxed{.7}$

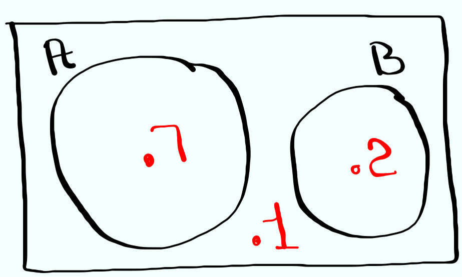
Sep 26-10:39 AM

Mutually Exclusive Events

Disjointed events

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

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



Total = 1

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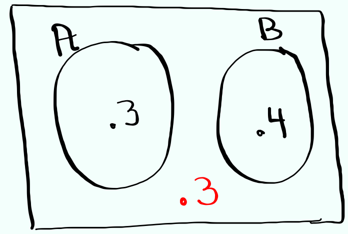
P(Grade A) = .3

P(Grade B) = .4



Total = 1

P(A) = .65 , P(B) = .25

A & B are disjointed events

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

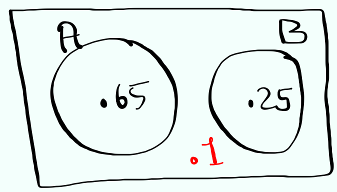
2) $P(\overline{B}) = 1 - P(B) = \boxed{.75}$

3) Construct Venn Diagram

3) P(A or B)

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

$= .65 + .25 - 0 = \boxed{.9}$



Total = 1

Sep 26-10:51 AM

De Morgan's Law

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

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

Make Sure to watch all videos on the right-hand Side of Study Guides.

Sep 26-10:59 AM