Statistics
Spring 2023
Lecture 5

Feb 19-8:47 AM

Working with ordered-Pairs:

SG 9

x	y	x^2	y^2	xy
2	7	4	49	14
3	10	9	100	30
1	5	1	25	5
3	8	9	64	24
4	12	16	144	48

1) $n = 5$

2) $\Sigma x = 13$

$\Sigma x^2 = 39$

$\Sigma y = 42$

$\Sigma y^2 = 382$

$\Sigma xy = 121$

Clear all lists

Reset all lists

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

STAT → CALC

2: 2-Var Stats

With Menu:

Xlist : L1

Ylist : L2

FreqList: Blank

Calculate

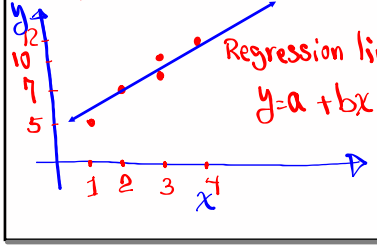
No Menu

L1 , L2

↵

Enter

Scatter Plot



Regression line

$y = a + bx$

Mar 7-6:51 PM

Use TI to find eqn of regression line:

STAT → CALC

8: LinReg(a+bx)

with Menu:
Xlist: L1
Ylist: L2
Clear
Calculate

No Menu:
L1, L2 Enter

a = 2.5 ✓
b = 2.269 ✓
r^2 = .917
r = .958 ✓

If r & r^2 missing:
2nd 0 ↓↓↓...↓ ▶Diagnostic On
Enter
Enter

Regression line
$y = a + bx$
$y \approx 2.5 + 2.3x$

Mar 7-7:01 PM

Regression line $y = a + bx$

$n = 5$ $\quad \Sigma y = 42$
$\Sigma x = 13$ $\quad \Sigma y^2 = 382$
$\Sigma x^2 = 39$ $\quad \Sigma xy = 121$

$$a = \frac{\Sigma y \cdot \Sigma x^2 - \Sigma x \cdot \Sigma xy}{n\Sigma x^2 - (\Sigma x)^2} = \frac{42 \cdot 39 - 13 \cdot 121}{5 \cdot 39 - (13)^2}$$

$$= \frac{65}{26} = 2.5 \qquad a = 2.5$$

$$b = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{5 \cdot 121 - 13 \cdot 42}{5 \cdot 39 - (13)^2} = \frac{59}{26} = 2.269$$

$b = 2.269$

Regression line
$y = a + bx$
$y \approx 2.5 + 2.3x$

Predict y if $x = 4.5$
$y \approx 2.5 + 2.3(4.5)$
$y \approx 12.85$ $\quad y \approx 13$

Mar 7-7:08 PM

r → Linear Correlation Coefficient

$-1 \le r \le 1$

when r is close to 1 or -1,

⇒ Linear Correlation is Significant.

when r is close to 0

⇒ Linear Correlation is not Significant.

From last example, $r = .958$

Since r is close to 1, then

linear Correlation is Significant.

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How to find r:

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

From Last example

$n = 5$ $\quad \Sigma y = 42$

$\Sigma x = 13$ $\quad \Sigma y^2 = 382$

$\Sigma x^2 = 39$ $\quad \Sigma xy = 121$

$$= \frac{5 \cdot 121 - 13 \cdot 42}{\sqrt{5 \cdot 39 - 13^2}\sqrt{5 \cdot 382 - 42^2}} = \frac{59}{\sqrt{26}\sqrt{146}} = \frac{59}{\sqrt{3796}}$$

$\approx .958$

59 [a b/c] [2nd] [x^2] 3796 [enter]

Mar 7-7:20 PM

Clear all lists

walk time	Blood Sugar level
20	125
25	120
20	115
10	135
15	120
5	140
30	110

walk time → X → L1

Blood Sugar level → y → L2

STAT → CALC

8:LinReg(a+bx)

L1 & L2

$a = 143.589$ $a \approx 144$

$b = -1.121$ $b \approx -1$

$r^2 = .812$

$r = -.901$

Regression line

$y = 144 - x$

r is close to -1 ⇒ Linear Correlation is Significant.

Mar 7-7:26 PM

what about r^2?

r^2 is Coeff. of determination

Always express as a whole %

$r^2 = .812$ $r^2 \approx 81\%$

what does it mean?

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

From last example $r^2 \approx 81\%$.

81% of Blood Sugar levels are explained by walking time. 19% are unexplained.

Mar 7-7:33 PM

How to make predictions:

If r is significant ⇒ Use the regression line

If r is not significant ⇒ Use $\bar{y}$

$\bar{y} = \frac{\Sigma y}{n}$ or

VARS | 5: Statistics

5: $\bar{y}$ | Enter

Assume r is significant,

Predict blood sugar level for 15-minute walk.

$y = 144 - x = 144 - 15 = 129$

From last example

$\bar{y} \approx 123.571 \approx 124$

Mar 7-7:37 PM

Clear all lists

QZ Score	Exam Score
8	85
9	90
6	75
6	80
10	98

Scatter Plot

QZ Scores → x → L1

Exam Scores → y → L2

Use LinReg(a+bx)

$a = 48.063$ $a \approx 48$

$b = 4.813$ $b \approx 5$

$r^2 = .935$

$r = .967$

Regression line

$y = 48 + 5x$

$r^2(\%) \approx 94\%$

94% of exam scores are explained by QZ Scores.

r is close to 1 ⇒ Linear Correlation is Significant.

Mar 7-7:44 PM

Predict exam score for someone that got 7 on the QZ.

1) Assume r is Significant.

Use Regression Line $y = 48 + 5x$

$= 48 + 5(7) \Rightarrow$ 83

2) Assume r is not Significant.

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

Enter 85.6 $\approx$ 86

SG 9

Mar 7-7:51 PM

Intro. to Probabilities: SG 10-13

E → Desired event (outcome)

P(E) → Prob. that E happens

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

Acceptable Answers:

1) Reduced fraction

2) Round to 3-decimal places

3) Scientific Notation

Mar 7-8:05 PM

There are 18 students in a Zoom meeting

12 Females and 6 males.

If we randomly select one student,

1) $P(\text{Female}) = \frac{12}{18} = \boxed{\frac{2}{3}} = \boxed{.667}$

2) $P(\text{male}) = \frac{6}{18} = \boxed{\frac{1}{3}} = \boxed{.333}$

Mar 7-8:09 PM

A standard deck of playing cards has

52 cards, 26 Red, 12 face, and 4 aces.

Randomly draw one card,

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

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

$P(\text{face}) = \frac{12}{52} = \boxed{\frac{3}{13}}$

Mar 7-8:12 PM

I surveyed 100 people, and asked them if they have been vaccinated for COVID?

	Yes	NO	Total
Males	15	35	50
Females	40	10	50
Total	55	45	100

If we randomly Select one of these people,

$P(\text{Male}) = \frac{50}{100} = \boxed{\frac{1}{2}}$ $P(\text{Yes}) = \frac{55}{100} = \boxed{\frac{11}{20}}$

$P(\text{Male and Yes}) = \frac{15}{100} = \boxed{.15}$ $P(\text{Male OR Yes}) = \frac{90}{100} = \boxed{.9}$

Mar 7-8:18 PM

Some rules & Terminologies:

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

2) Sum of all prob. $= 1$

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

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

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

$\bar{E}$ → E-bar → Not E → E-Complement

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

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

Mar 7-8:25 PM

Suppose $P(E) = .32$

1) Write $P(E)$ in reduced fraction.

.32 [MATH] [1:▶Frac] [Enter] $\frac{8}{25}$

2) Find $P(\bar{E})$

$P(\bar{E}) = 1 - P(E) = 1 - .32 = \boxed{.68}$

Mar 7-8:30 PM

For a randomly selected person,

P(He/she has birthday today) = $\boxed{\frac{1}{365}}$

P(He/She has birth month this month) = $\boxed{\frac{1}{12}}$

Mar 7-8:32 PM

Choose a number from 1 to 20.

$P(\text{Select } 4) = \frac{1}{20}$

$P(\text{Select at most } 4) = \frac{4}{20} = \frac{1}{5}$

1,2,3,4

$P(\text{Select at least } 15) = \frac{6}{20} = \frac{3}{10}$

15,16,17,18,19,20

$P(\text{Select at most } 4 \text{ or at least } 15) = \frac{10}{20} = \frac{1}{2}$

1,2,3,4 | 15,16,17,18,19,20

$P(\text{Select at most } 4 \text{ and at least } 15) = \frac{0}{20} = 0$

Impossible event

Mar 7-8:34 PM

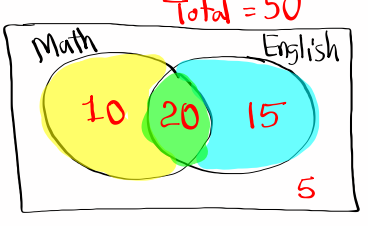
I Surveyed 50 Students.

10 taking Math only

15 " English only

20 " both Math and English

1) Make Venn Diagram



$P(\text{Math or English}) = \frac{45}{50} = .9$

$P(\text{Math and English}) = \frac{20}{50} = .4$

$P(\overline{\text{Math}}) = \frac{20}{50} = \frac{2}{5} = .4$

Mar 7-8:40 PM

Suppose $P(E) = .08$

1) write $P(E)$ in reduced fraction

.08 [MATH] [1:▶Frac] [Enter] $\frac{2}{25}$

2) find $P(\bar{E})$ in decimal

$P(\bar{E}) = 1 - P(E) = 1 - .08 = .92$

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

$\frac{.08}{.92} = \frac{2}{23}$ .08 [÷] .92 [MATH] [1:▶Frac] [Enter]

Mar 7-8:49 PM

Find 50!

50 [MATH] [→] PRB [4:!] [Enter]

3.041×10^{64}

E64

Find $50\,C_5$

50 [MATH] [→] PRB [↓] [3:nCr] 5 [Enter]

2,118,760

$\frac{4C_2}{52C_2} = \frac{6}{1326} = \frac{1}{221} = .005$

Mar 7-8:53 PM

Class QZ 1

x	y
5	13
6	18
8	18
8	20
10	25

Find

$a = 3.5$

$b = 2.1$

} Round to 1-decimal

$r^2 = 87\%$

} Round to whole %

$r = .931$

} Round to 3-decimals

Mar 7-9:01 PM