Statistics

Lecture 5

Feb 19-8:47 AM

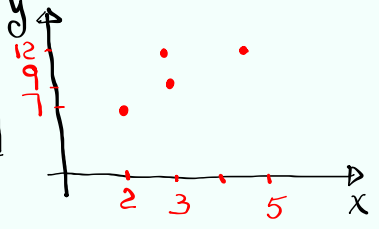
working with ordered-pairs

SG 9

(2,7) , (3,9) , (3,12) , (5,12)

x	y	x^2	y^2	xy
2	7	4	49	14
3	9	9	81	27
3	12	9	144	36
5	12	25	144	60

Draw Scatter Plot



Clear all lists

x → L1 , y → L2

quit & Clear Screen

STAT → CALC

2: 2-Var Stats

with Menu

xlist: L1

ylist: L2

FreqList: Clear

Calculate

No Menu

L1, L2

Enter

$\Sigma x = 13$ $\Sigma y = 40$

$\Sigma x^2 = 47$ $\Sigma y^2 = 418$

$n = 4$ $\Sigma xy = 137$

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Find eqn of the regression line

$y = a + bx$

STAT → CALC

8:LinReg(a+bx)

with Menu

Xlist: L1

Ylist: L2

Clear

Calculate

No Menu

L1 , L2 enter

ENTER

$a = 5.211$ ✓

$b = 1.474$ ✓

$r^2 = .573$

$r = .757$

If r & r^2 Missing,

2nd 0 ddd ---- ▶Diagnostic On

Enter Enter

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How to find a & b using formulas

$$a = \frac{\Sigma y \Sigma x^2 - \Sigma x \Sigma xy}{n\Sigma x^2 - (\Sigma x)^2} = \frac{40 \cdot 47 - 13 \cdot 137}{4 \cdot 47 - 13^2} = \frac{99}{19}$$

≈ 5.211

$\Sigma x = 13$ $\quad \Sigma y = 40$

$\Sigma x^2 = 47$ $\quad \Sigma y^2 = 418$

$n = 4$ $\quad \Sigma xy = 137$

$$b = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{4 \cdot 137 - 13 \cdot 40}{4 \cdot 47 - 13^2} = \frac{28}{19}$$

≈ 1.474

Regression line

$$y \approx 5.2 + 1.5x$$

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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:

$r = .757$ it is close to 1, → Linear Correlation is Significant

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Find r using formula:

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

$\Sigma x = 13$ $\Sigma y = 40$

$\Sigma x^2 = 47$ $\Sigma y^2 = 418$

$n = 4$ $\Sigma xy = 137$

4 ⊠ 47 − 13 x^2 Enter

$$r = \frac{4 \cdot 137 - 13 \cdot 40}{\sqrt{4 \cdot 47 - 13^2}\ \sqrt{4 \cdot 418 - 40^2}}$$

$$= \frac{28}{\sqrt{19}\ \sqrt{72}}$$

$$= \frac{28}{\sqrt{1368}}$$

28 ÷ 2nd x^2 1368 enter

$\approx .757$

what about r^2?

→ Always as whole %.

→ Coef. of determination

$r^2 = (.757)^2 \approx .573$ → $r^2 \approx 57\%$ 57% of Y-values are explained by x-values.

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Given $\Sigma x = 28$, $\Sigma x^2 = 166$, $n = 5$,
$\Sigma y = 68$, $\Sigma y^2 = 994$, $\Sigma xy = 405$

Find eqn of the regression line

$y = a + bx$

$$a = \frac{\Sigma y \Sigma x^2 - \Sigma x \Sigma xy}{n\Sigma x^2 - (\Sigma x)^2} = \frac{68 \cdot 166 - 28 \cdot 405}{5 \cdot 166 - 28^2}$$

$$= \frac{-52}{46}$$

$$\approx -1.130 \approx -1$$

$$b = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2} = \frac{5 \cdot 405 - 28 \cdot 68}{5 \cdot 166 - 28^2}$$

$$= \frac{121}{46} \approx 2.630 \approx 3$$

Regression line

$y \approx -1 + 3x$

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Find r

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\sqrt{n\Sigma y^2 - (\Sigma y)^2}} = \frac{5 \cdot 405 - 28 \cdot 68}{\sqrt{5 \cdot 166 - 28^2}\sqrt{5 \cdot 994 - 68^2}}$$

$\Sigma x = 28$, $\Sigma x^2 = 166$, $n = 5$,
$\Sigma y = 68$, $\Sigma y^2 = 994$, $\Sigma xy = 405$

$$= \frac{121}{\sqrt{46}\sqrt{346}}$$

121 ÷ [2nd] [x^2] 15916 [enter]

$$= \frac{121}{\sqrt{15916}}$$

$= .959$

$r^2 = (.959)^2 \approx 92\%$

92% of y-values are explained by x-values.

r is close to 1, Linear Correlation is Significant.

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How to make predictions:

If r is Significant,
use the regression line
Plug in x, find y

If r is not Significant,
use $\bar{y}$ $\quad \bar{y} = \frac{\Sigma y}{n}$

Sep 30-7:52 PM

Given $n = 8$, $y = 12 + 3x$, $\Sigma y = 50$

Predict y if $x = 2$.

1) Assume r is Significant

$y = 12 + 3(2) = 12 + 6 = \boxed{18}$

2) Assume r is not Significant.

use $\bar{y}$ $\quad \bar{y} = \frac{\Sigma y}{n} = \frac{50}{8} = \boxed{6.25}$

Sep 30-7:55 PM

I randomly selected 5 students,

QZ Scores	Exam Scores
8	90
7	82
9	95
10	90
6	75

Scatter Plot

QZ Score → x → L1, Exam Scores → y → L2

Use LinReg(a+bx) with L1 & L2.

a=52 ≈ 52

b=4.3≈4

r^2=.742 ≈74%

r=.861 is close to 1, Linear Correlation is Significant

$\hat{y} \approx 52 + 4x$

74% of exam Scores are explained by QZ Scores.

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Daisy got 8 on the quiz, Predict her exam Score.

1) Assume r is Significant.

$\hat{y} \approx 52 + 4(8) = 52 + 32 = 84$

2) Assume r is not Significant.

Use $\bar{y}$

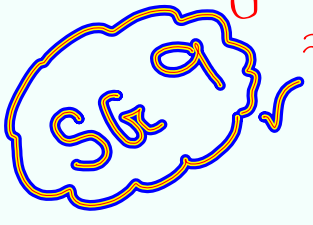
VARS

5: Statistics

5: $\bar{y}$ Enter

$\bar{y}$=86.4

≈86



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Introduction 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) Rounded to 3-dec. Places
3) Scientific notation

ex: 15 Females, 10 Males
we randomly select one person,

$$P(\text{Select a female}) = \frac{15 \text{ Females}}{25 \text{ Total}} = \frac{15}{25} = \boxed{\frac{3}{5}} = \boxed{.6}$$

Sep 30-8:22 PM

A standard deck of playing cards has 52 cards, 26 are red, 12 face cards, 4 aces.

draw one card

12 ÷ 52 Math 1:▶Frac Enter

Math 2:▶Dec Enter

1) P(draw a face card) $= \frac{12}{52} = \boxed{\frac{3}{13}} = \boxed{.231}$

2) P(draw a red face card) / 6 cards

$$= \frac{6}{52} = \boxed{\frac{3}{26}}$$

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I surveyed 100 voters. I asked them
Do you plan to vote Yes or No on Prop.50?

	Yes	NO	Total
Republican	10	30	40
Democrat	50	10	60
Total	60	40	100

If we select one of these People

$P(\text{Republican}) = \frac{40}{100} = .4$ $P(\text{Yes}) = \frac{60}{100} = .6$

$P(\text{Republican and Yes}) = \frac{10}{100} = .1$ $P(\text{Republican or Yes}) = \frac{90}{100} = .9$

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

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$E \rightarrow$ Desired Event

$\bar{E} \rightarrow$ E-bar, not E, E-Complement

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

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

Complement Rule

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

$P(\overline{\text{Rain}}) = 1 - P(\text{Rain}) = 1 - .15 = .85$

$P(E) = \frac{2}{17}$

1 ⊟ 2 ÷ 17 Math 1: ▸Frac Enter

$P(\bar{E}) = 1 - P(E) = 1 - \frac{2}{17} = \frac{15}{17} = .882$

Math 2: ▸Dec Enter

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Some Prob. Rules:

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.

If we randomly select one person,

P(he/she has a birthday this month) $= \frac{1}{12} = .083$ Not rare.

P(he/she has a birthday this week) $= \frac{1}{52} = .019$ Rare event

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Select a number from the list below

1 2 3 4 ..... 20 21 22 23 24

P(she picks 4) $= \frac{1}{24} = .042$

P(she picks 4 or below) $= \frac{4}{24} = \frac{1}{6} = .167$ (1,2,3,4)

P(she picks at least 20) $= \frac{5}{24} = .208$ (20, 21, 22, 23, 24)

P(she picks below 4 or above 20) $= \frac{7}{24}$ (1,2,3 / 21, 22, 23, 24)

P(she picks below 4 and above 20) $= \frac{0}{24} = 0$

P(she picks multiples of 4) $= \frac{6}{24} = \frac{1}{4} = .25$

4, 8, 12, 16, 20, 24

SG 10

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