

# Statistics

## Lecture 7



Feb 19-8:47 AM

Consider the Chart below

x	y
2	7
3	10
4	10
5	12
6	15

1) Scatter Plot

Regression line  
 $y = a + bx$   
 $y = 3.6 + 1.8x$

clear all lists [2nd] + [4: clear all lists] [Enter]

Store  $x \rightarrow L1$  ;  $y \rightarrow L2$

[STAT] [→] CALC

2: 2-Var Stats

xlist: L1

ylist: L2

freq-list: [clear]

[Calculate]

$\sum x = 20$        $\sum y = 54$

$\sum x^2 = 90$        $\sum y^2 = 618$

$n = 5$            $\sum xy = 234$

Mar 23-1:48 PM

$\sum x = 20$        $\sum y = 54$       Formulas for a & b.  
 $\sum x^2 = 90$        $\sum y^2 = 618$   
 $n = 5$        $\sum xy = 234$

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

$$a = \frac{54 \cdot 90 - 20 \cdot 234}{5 \cdot 90 - 20^2}$$

$$= \frac{180}{50} = \boxed{3.6} \checkmark$$
  

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

$$b = \frac{5 \cdot 234 - 20 \cdot 54}{5 \cdot 90 - 20^2}$$

$$= \frac{90}{50} = \boxed{1.8} \checkmark$$

Regression line

$y = 3.6 + 1.8x$

Mar 23-1:57 PM

STAT → CALC  
8: LinReg(a+bx)  
xlist: L1  
ylist: L2  
clear  
Calculate

$a = 3.6 \checkmark$   
 $b = 1.8 \checkmark$   
 $r^2 = .931 \checkmark$   
 $r = .965 \checkmark$

If r & r<sup>2</sup> missing:

2nd 0 ↓ ↓ ↓ ↓ ... ↓ ▶ Diagnostic On  
Enter Enter

Mar 23-2:06 PM

$\sum x = 20$        $\sum y = 54$       now formula for r:  
 $\sum x^2 = 90$        $\sum y^2 = 618$   
 $n = 5$        $\sum xy = 234$

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

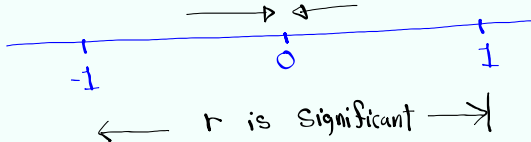
$$r = \frac{5 \cdot 234 - 20 \cdot 54}{\sqrt{5 \cdot 90 - 20^2} \sqrt{5 \cdot 618 - 54^2}} = \frac{90}{\sqrt{50} \sqrt{174}}$$

$$= \frac{90}{\sqrt{8700}} \quad 90 \div [\text{end}] [x^2] 8700 [\text{Enter}] \approx .965$$

for  $r^2$

$$r^2 = .965^2 \approx .931$$

Mar 23-2:11 PM

$r \rightarrow$  Linear Correlation Coefficient  
 $-1 \leq r \leq 1$   
 $r$  is not significant  
  
 $\leftarrow r \text{ is significant} \rightarrow$

from last example  $\rightarrow r = .965$ , it is close to 1, therefore it is significant.

$r^2 \rightarrow$  Coefficient of determination  
 Always express as whole%.  
 it tells us what% of y-values are explained by x-values.

from last example  $r^2 \approx 93\%$   
 93% of y-values are explained by x-values.

Mar 23-2:18 PM

Study time	Exam Score
8	85
7	80
10	95
10	100
6	70
5	65

Study time  $\rightarrow X \rightarrow L1$   
 Exam Score  $\rightarrow Y \rightarrow L2$   
 use 8: LinReg(a+bx)  
 with L1 & L2  
 $a = 32.188 \approx 32$   
 $b = 6.563 \approx 7$   
 $r^2 = .98$   
 $r = .990$

Regression Line  
 $y \approx 32 + 7x$   
 Pos. slope

Coef. of determination  $r^2 = 98\%$   
 98% of exam scores are explained by study time

Linear Correlation  $r = .990$   
 It is close to 1,  
 It is significant.

Mar 23-2:24 PM

How to make prediction:

1) If  $r$  is significant,  
 use the regression line, Plug in  $x$ , Calculate  $y$ .

2) If  $r$  is not significant,  
 use  $\bar{y}$   $y = \frac{\sum y}{n}$  or

Mario wishes to study 6 hrs.

IF  $r$  is significant

$y = 32 + 7x$   
 $= 32 + 7(6) = 32 + 42 = 74$

IF  $r$  is not significant

use  $\bar{y} = 82.5 \approx 83$

Calculator steps:  
 VARS  
 5: statistics  
 5:  $\bar{y}$   
 Enter

Calculator steps:  
 VARS  
 5:  $\bar{y}$   
 5:  
 Enter

Mar 23-2:33 PM

walk time	BS level
10	135
20	110
15	120
5	140
30	100

walk time  $\rightarrow x \rightarrow L1$   
 BS level  $\rightarrow y \rightarrow L2$

Use RegLin ( $a+bx$ ) with  
 $L1 \& L2$   
 $a = 148.243 \approx 148$   
 $b = -1.703 \approx -2$   
 $r^2 = .958$   
 $r = -.979$

Regression line  
 $y \approx 148 - 2x$   
 negative Slope

Coef. of determination  
 $r^2 \approx 96\%$   
 96% of my BS level are explained by walk time.

$r$  is close to  $-1$   
 Linear correlation is significant.

Mar 23-2:40 PM

Predict my BS level if I walk 15 minutes.

1) Assume  $r$  is significant  
 Use  $y = 148 - 2x$   
 $= 148 - 2(15) = 148 - 30 = 118$

2) Assume  $r$  is not significant.  
 Use  $\bar{y}$   
 121

VARs
5: statistics
5: $\bar{y}$ Enter

SG9

Mar 23-2:51 PM

SG 10

### Introduction to Probability

$E \rightarrow$  Desired event or outcome

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

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

15 Females & 10 males, we randomly  
Select 1 person.

$$P(\text{select a Female}) = \frac{15 \text{ Females}}{25 \text{ people}}$$

$$= \frac{15}{25} = \frac{3}{5} = .6$$

15  $\div$  25 Math 1:  $\rightarrow$  Frac Enter  
Math 2:  $\rightarrow$  Dec Enter

Mar 23-3:11 PM

A box has 8 nickels, 7 dimes, and 5 quarters.  
Randomly take 1 coin.

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

$$P(\text{Dime}) = \frac{7}{20} = .35$$

$$P(\text{Nickel or Dime}) = \frac{15}{20} = \frac{3}{4} = .75$$

$$P(\text{nickel and Dime}) = \frac{0}{20} = 0$$

Do not use  $\emptyset$  for 0.

Acceptable Answers

- 1) Reduced Fraction
- 2) Round to 3-dec. Places
- 3) Scientific Notation

Mar 23-3:17 PM

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

**Draw 1 Card**

$$1) P(\text{Red}) = \frac{26}{52} = \frac{1}{2} = .5 \quad 2) P(\text{Face}) = \frac{12}{52} = \frac{3}{13} \approx .231$$

$$3) P(\text{Red Face}) = \frac{6}{52} = \frac{3}{26} = .115$$

$$4) P(\text{Face or Ace}) = \frac{12 + 4}{52} = \frac{16}{52} = \frac{4}{13} \approx .308$$

$$5) P(\text{Face and Ace}) = \frac{0}{52} = 0$$

Mar 23-3:24 PM

Some rules & Definitions

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

2) Sum of all probabilities is always 1.

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

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

$$5) 0 < P(E) \leq .05 \iff \text{Rare event}$$

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

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

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

Mar 23-3:34 PM

Draw one card from a standard deck of playing cards.

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

$$P(\overline{\text{Ace}}) = 1 - P(\text{Ace}) = 1 - \frac{1}{13} = \frac{12}{13}$$

1 = 1 ÷ 13 Math 1: Frac Enter

If we randomly select 1 person, find

1)  $P(\text{he/she has a birthday this month})$   
 $= \frac{1}{12}$

2)  $P(\text{he/she does not have a birthday this month})$   
 $= 1 - P(\text{has birthday this month})$   
 $= 1 - \frac{1}{12} = \frac{11}{12} \approx .917$

Mar 23-3:41 PM

Do you support war in middle East?

100 were surveyed

	Yes	No	Total
Democrats	20	40	60
Republicans	30	10	40
Total	50	50	100

If we select one of these people,

$$P(\text{Dem.}) = \frac{60}{100} = .6$$

$$P(\text{Yes}) = \frac{50}{100} = .5$$

$$P(\text{Dem. and Yes}) = \frac{20}{100} = .2$$

$$P(\text{Dem. or Yes}) = \frac{90}{100} = .9$$

Mar 23-3:48 PM

Select 1 number from

1 2 3 4 . . . . . 38 39 40

$$1) P(\text{at most } 4) = \frac{4}{40} = \frac{1}{10}$$

$$2) P(\text{at least } 4) = \frac{37}{40} = .925$$

$$3) P(\text{it is } 4) = \frac{1}{40} = .025$$

$$4) P(\text{it is multiple of } 5) = \frac{8}{40} = \frac{1}{5} = .2$$

5 10 15 20 25 30 35 40

Mar 23-3:57 PM

class QZ 5

x	y
3	10
4	15
4	14
5	18
6	21

Find

$$1) a = -.308 \approx \boxed{-.3} \quad \left. \vphantom{a} \right\} \text{Round to}$$

$$2) b = 3.615 \approx \boxed{3.6} \quad \left. \vphantom{b} \right\} \text{1-dec.}$$

$$3) r^2 = .982 \approx \boxed{98\%} \quad \text{whole \%}$$

$$4) r = \boxed{.991} \quad \text{3-dec.}$$

Mar 23-4:03 PM