Statistics

Lecture 5

Feb 19-8:47 AM

Class Qz 3

Consider the Sample below

20	23	18	25
30	25	19	24
32	28		

68% Range

$\bar{x} \pm s$

$= 24 \pm 5 \rightarrow$ [19 to 29]

95% Range

$\bar{x} \pm 2s$

$= 24 \pm 2(5) \rightarrow$ [14 to 34]

Find

1) $\bar{x} = 24.4 \approx \boxed{24}$ } Round to whole #

2) $s = 4.648 \approx \boxed{5}$ } Round to whole #

3) $s^2 = \boxed{\frac{108}{5}}$ } Reduced Fraction

Find Z-Score for data element 30.

$z = \frac{x - \bar{x}}{s} = \frac{30 - 24}{5} = \frac{6}{5}$

$= \boxed{1.2}$

$-2 \leq z \leq 2$

Usual element

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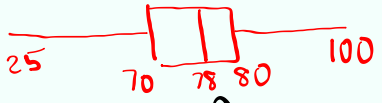
Class QZ 4

Consider the 5-Number Summary below

Min	Q_1	Med	Q_3	Max
25	70	78	80	100

1) Draw box Plot



2) Find IQR

$IQR = Q_3 - Q_1 = 10$

3) Find upper fence

$UF = Q_3 + 1.5(IQR)$

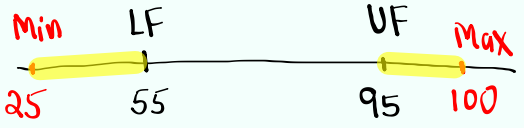
$= 80 + 1.5(10) = \boxed{95}$

4) Find lower fence

$LF = Q_1 - 1.5(IQR)$

$= 70 - 1.5(10)$

$= \boxed{55}$



Outliers 25 to 55 or 95 to 100

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Find $\bar{x}$, S, and S^2 for the group data below.

1) Find class MP

class limits	class F	class MP
18 – 30	5	24
31 – 43	8	37
44 – 56	10	50
57 – 69	7	63

2) class MP → L1

3) class F → L2

4) STAT → Calc

1: 1-Var Stats

List L1

freq List L2

Calculate

$\bar{x} = 45.2\overline{3}$

$S = 13.434$

$n = 30$

for S^2

VARS 5: Statistics 3: S_x

x^2 Math 1: ▶ Frac Enter

$S^2 = \frac{157001}{870}$

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Below data are Scores for 25 randomly Selected exams.

58	63	65	69
70	72	74	75
75	78	80	82
82	82	85	86
88	90	93	95
96	97	100	100
105			

1) $n = 25$

2) STEM Plot

5	8
6	359
7	024558
8	0222568
9	03567
10	005

Find P_{15}

$L = \frac{15}{100} \cdot 25 = 3.75 \nearrow L = 4$

P_{15} = 4th element = 69

15% | 85%

69

Find P_{50} (Median)

$L = \frac{50}{100} \cdot 25 = 12.5 \nearrow L = 13$

P_{50} = 13th element = 82

50% | 50%

82

Find P_{80}

$L = \frac{80}{100} \cdot 25 = 20$

$P_{80} = \frac{20\text{th element} + \text{Next one}}{2}$

$= \frac{95 + 96}{2} = 95.5$

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5	8
6	359
7	024558
8	0222568
9	03567
10	005

Find K Such that $P_K = 75$

$K = \frac{B}{n} \cdot 100$, whole% (B: Below)

$= \frac{7}{25} \cdot 100 = 28$

$P_{28} = 75$

28% | 72%

75

Find K Such that $P_K = 80$

$K = \frac{B}{n} \cdot 100$, whole% (B: Below)

$= \frac{10}{25} \cdot 100 = 40$

$P_{40} = 80$

40% | 60%

80

SG 5-8 ✓

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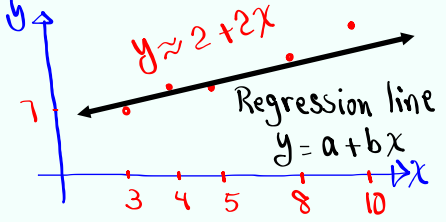
Consider the chart below

x	y
3	7
4	10
5	10
8	15
10	20

1) Scatter Plot



Clear all lists

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

STAT → CALC

2: 2-Var Stats

$\Sigma x = 30$ $\quad \Sigma y = 62$

$\Sigma x^2 = 214$ $\quad \Sigma y^2 = 874$

$n = 5$ $\quad \Sigma xy = 431$

STAT → CALC

8: LinReg(a+bx)

$a = 1.988 \approx 2$

$b = 1.735 \approx 2$

$r^2 = .973 \approx 97\%$

$r = .987$

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How to find a & b:

$$a = \frac{\Sigma y \, \Sigma x^2 - \Sigma x \, \Sigma xy}{n \Sigma x^2 - (\Sigma x)^2} = \frac{62 \cdot 214 - 30 \cdot 431}{5 \cdot 214 - 30^2}$$

$$= \frac{338}{170} \approx \boxed{1.988}$$

$\Sigma x = 30$ $\quad \Sigma y = 62$

$\Sigma x^2 = 214$ $\quad \Sigma y^2 = 874$

$n = 5$ $\quad \Sigma xy = 431$

$$b = \frac{n \Sigma xy - \Sigma x \Sigma y}{n \Sigma x^2 - (\Sigma x)^2} = \frac{5 \cdot 431 - 30 \cdot 62}{5 \cdot 214 - 30^2} = \frac{295}{170}$$

$$= \boxed{1.735}$$

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r^2 Coef. of determination

Always in whole %

It tells us what % of y-values are explained by x-values

from Last example $r^2 \approx 97\%$.

97% of y-values are explained by x-values, 3% are unexplained.

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r Linear Correlation Coef.

$-1 \leq r \leq 1$

when r is close to ± 1,

Linear Correlation is Significant.

when r is close to 0,

Linear Correlation is not Significant.

from Last example $r = .987$

very close to 1 → Significant.

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How to compute r:

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

$\Sigma x = 30$ $\quad \Sigma y = 62$

$\Sigma x^2 = 214$ $\quad \Sigma y^2 = 874$

$n = 5$ $\quad \Sigma xy = 431$

$$= \frac{5 \cdot 431 - 30 \cdot 62}{\sqrt{5 \cdot 214 - 30^2}\ \sqrt{5 \cdot 874 - 62^2}}$$

$$= \frac{295}{\sqrt{170}\ \sqrt{526}}$$

$$= \frac{295}{\sqrt{89420}} = .987$$

295 $\div$ 2nd x^2 89420 enter

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Making Predictions:

If r is Significant $\Rightarrow$ use regression Line

If r is not Significant $\Rightarrow$ use $\bar{y}$

using last example, Predict y when $x = 6$

1) Assume r is Significant

$y \approx a + bx = 2 + 2(6) \approx 14$

2) Assume r is not Significant.

use $\bar{y} = \frac{\Sigma y}{n} = \frac{62}{5} = 12.4$

SG 9

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SG 10-13

Introduction to probabilities

chances for an event to happen.

E → Desired event

P(E) → Prob. that E happens.

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

12 Students

8 Females

Select one Student

$P(\text{Select a female}) = \frac{8}{12} = \boxed{\frac{2}{3}}$

A standard deck of playing cards have 52 cards, 26 Red, 4 aces.

$P(\text{Select a red card}) = \frac{26}{52} = \boxed{\frac{1}{2}} = \boxed{.5}$

$P(\text{Select an ace}) = \frac{4}{52} = \boxed{\frac{1}{13}}$

4 ÷ 52 Math ▶Frac Enter

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Acceptable answers:

1) Reduced fraction

2) Decimal but rounded to 3-dec. places when needed

3) Scientific Notation.

A standard deck of playing cards has 52 cards, 12 face cards, 4 Aces.

Draw one card,

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

$P(\text{Draw face and Ace}) = \frac{0}{52} = \boxed{0}$

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Some rules and terminology

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

2) Sum of all probabilities is 1.

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

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

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

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If we randomly select one person, find the prob. that he/she has a birthday

1) today $\frac{1}{365} \approx .003$

Rare event

2) this month $\frac{1}{12} = .083$

not a rare event

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E → Desired event

$P(E)$ → Prob. that E happens

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

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

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

Complement Rule

Suppose $P(E) = .004$

1) write $P(E)$ is % notation

$.004 = .4\%$

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

$.004$ [Math] [1:▸Frac] [Enter] $\frac{1}{250}$

3) find $P(\bar{E})$

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

$= 1 - .004 = .996$

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Select one number from

1 2 3 4 . . . 36 37 38 39 40

1) $P(\text{select } 5) = \frac{1}{40}$

2) $P(\text{select below } 5) = \frac{4}{40} = \frac{1}{10}$

3) $P(\text{select } 35 \text{ or above}) = \frac{6}{40} = \frac{3}{20}$

4) $P(\text{select below } 5 \text{ or at least } 35)$

$= \frac{4+6}{40} = \frac{10}{40} = \frac{1}{4}$

5) $P(\text{select below } 5 \text{ and at least } 35)$

$= \frac{0}{40} = 0$

Impossible event.

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I Surveyed 100 Voters.
Chart below shows outcome.
Question was Do You Support ICE operation?

	Yes	NO	Total
Democrat	15	35	50
Republican	40	10	50
Total	55	45	100

Select one of them

1) $P(\text{Yes}) = \frac{55}{100} = .55$ 2) $P(\text{Democrat}) = \frac{50}{100} = .5$

3) $P(\text{Yes and Democrat}) = \frac{15}{100} = .15$

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

SG 10

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Addition Rule:
Keyword OR
one action event

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

(Both)

$P(A) = .7$, $P(B) = .6$, $P(A \text{ and } B) = .4$

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

2) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
$= .7 + .6 - .4 = .9$
(addition Rule)

3) $P(\overline{A \text{ or } B}) = 1 - P(A \text{ or } B)$
$= 1 - .9 = .1$

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$P(HB) = .35$

$P(FF) = .45$

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

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

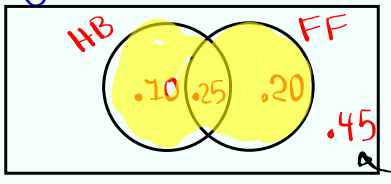
2) $P(\overline{FF}) = 1 - .45 = \boxed{.55}$

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

$= .35 + .45 - .25$

$= \boxed{.55}$

Using Venn Diagram



$1 - .55 = .45$

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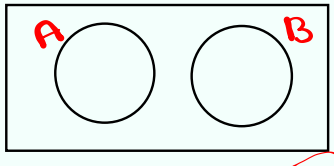
Mutually Exclusive Events

Disjointed events

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



$P(A) = .6$ $P(B) = .3$

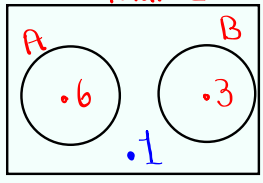
A & B are M.E.E.

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

2) $P(\overline{B}) = 1 - P(B) = \boxed{.7}$

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

Total = 1



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

$= .6 + .3 - 0 = \boxed{.9}$

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Class QZ 5

x	y
2	5
3	9
5	12
6	12
8	15

Use LinReg(a+bx) to find

1) $a = 3.316 \approx 3$

2) $b = 1.518 \approx 2$

} Round to whole

3) $r^2 = .918 \approx 92\%$ } whole %

4) $r = .958$ } 3-dec.

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