Statistics

Lecture 3

Feb 19-8:47 AM

SG 5-3

Empirical Rule

Whenever   Mean = Mode = Median ⇒ Data dist.

will be   Symmetric & Bell-shape.

Mean
Mode
Median

68% Range ⇒ $\overline{x} \pm S$

95% Range ⇒ $\overline{x} \pm 2S$ **Usual Range**

99.7% Range ⇒ $\overline{x} \pm 3S$

Ex: exam scores have a bell-shape dist with

$\overline{x} = 84$ & $S = 7$.

68% Range ⇒ $\overline{x} \pm S = 84 \pm 7$ ⇒ 77 to 91

16%   68%   16% $\dfrac{100\% - 68\%}{= 32\%}$

77   91

95% Range ⇒ $\overline{x} \pm 2S = 84 \pm 2(7)$ ⇒ 70 to 98

2.5%   95%   2.5%

70   Usual   98
Unusual   Scores   Unusual

Jan 9-4:31 PM

I randomly Selected 60 nurses. their ages had a symmetric dist with mean of 42 Yrs & Standard dev. of 8 Yrs.

↳ **Mean = Mode = Median**   →**Bell-Shape dist.**

68% Range ⇒ $\bar{x} \pm S$ = 42 ± 8 ⇒ $\boxed{34 \text{ to } 58}$

16%   68%   16%
34   58

what % of them were at least 34 Yrs?
68% + 16% = 84%

How many of them were below 34 Yrs?
16% of 60 = 9.6 ≈ 10 nurses.

find the usual range.
95% Range $\bar{x} \pm 2S$
2.5%   95%   2.5%   = 42 ± 2(8) ⇒ $\boxed{26 - 58}$
26   58

How many of them have unusual age for a nurse?   5% of 60 = .05(60)
= $\boxed{3}$

Jan 9-4:40 PM

Z - Score (Standardize Score)

It is a value that indicates how many standard deviation is the data element from the mean.

$$Z = \frac{x - \bar{x}}{S}$$ Always round to 3-decimal places.

We can use Z-Score to compare data elements from different Samples.

Usual data
-2   0   2
unusual   **unusual**
Z < -2   -2 ≤ Z ≤ 2   Z > 2

Jan 9-4:49 PM

Suppose scores from exam 1 has $\bar{x} = 84$ & $S = 8$

Eric got 90.

$$Z = \frac{x - \bar{x}}{S} = \frac{90 - 84}{8} = \frac{6}{8} = \boxed{.75}$$

Since $-2 \leq Z \leq 2$ ⟹ Eric's score is a usual score.

Rahim had a Z-Score of -1.5.

$$Z = \frac{x - \bar{x}}{S} \qquad -1.5 = \frac{x - 84}{8}$$

Cross-Multiply

$$x - 84 = 8(-1.5)$$
$$x = 84 - 12 \rightarrow \boxed{x = 72}$$

My Score was 72.

Jan 9-4:54 PM

Larissa makes $3000/mo. as a Tutor.

Gaelen makes $5000/mo. as a teacher.

who is doing better?

Tutors ⟹ $\bar{x} = 2500$ & $S = 500$

Teachers ⟹ $\bar{x} = 4800$ & $S = 150$

Gaelen is doing slighty better.

$$Z_{Larissa} = \frac{3000 - 2500}{500}$$
$$= \boxed{1}$$

$$Z_{Gaelen} = \frac{5000 - 4800}{150}$$
$$= \frac{200}{150}$$
$$= \boxed{1.333}$$

Jan 9-5:00 PM

Jordyn got 88 on exam 1 and 75 in exam 2.

Exam 1: $\bar{x} = 85$ & $S = 5$ $\qquad Z = \dfrac{88-85}{5} = \boxed{.6}$

Exam 2: $\bar{x} = 72$ & $S = 2$ $\qquad Z = \dfrac{75-72}{2} = \boxed{1.5}$
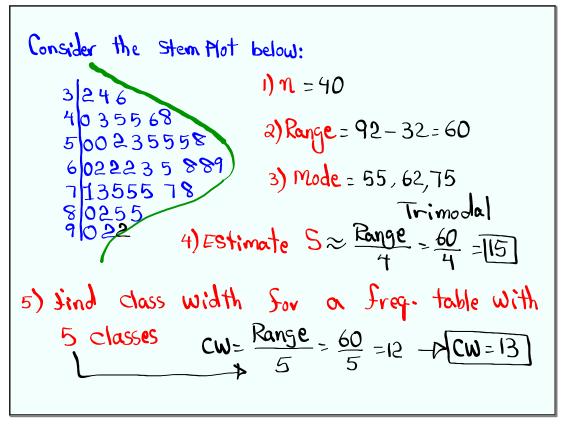
Both scores are usual. $-2 \le Z \le 2$

She did better in exam 2 relative to others.

Miki had a Z-Score of 2.4 on exam 1. Find her exam score.

$$Z = \frac{x - \bar{x}}{S}$$

$$2.4 = \frac{x - 85}{5}$$

Cross-Multiply
Find x
$$\boxed{x = 97}$$

Jan 9-5:07 PM

Consider the Stem Plot below:

```
3 | 2 4 6
4 | 0 3 5 5 6 8
5 | 0 0 2 3 5 5 5 8
6 | 0 2 2 2 3 5 8 8 9
7 | 1 3 5 5 5 7 8
8 | 0 2 5 5
9 | 0 2 2
```

1) $n = 40$

2) Range $= 92 - 32 = 60$

3) Mode $= 55, 62, 75$

Trimodal

4) Estimate $S \approx \dfrac{\text{Range}}{4} = \dfrac{60}{4} = \boxed{15}$

5) find class width for a freq. table with 5 classes

$$CW = \frac{\text{Range}}{5} = \frac{60}{5} = 12 \rightarrow \boxed{CW = 13}$$

Jan 9-5:14 PM

```
3 | 2 4 6
4 | 0 3 5 5 6 8
5 | 0 0 2 3 5 5 5 8
6 | 0 2 2 2 3 5 8 8 9
7 | 1 3 5 5 5 7 8
8 | 0 2 5 5
9 | 0 2 2
```

Find P_{30} n

$L = \dfrac{30}{100} \cdot 40 = 12$

$P_{30} = \dfrac{12\text{th element} + \text{next element}}{2}$

$= \dfrac{52 + 53}{2} = \boxed{52.5}$

30%   70%
_____
        52.5

82%   18%
_____
        78

find P_{82}

$L = \dfrac{82}{100} \cdot 40 = 32.8$

$L = 33$

$P_{82} = 33\text{rd element} = 78$

Jan 9-5:20 PM

```
3 | 2 4 6
4 | 0 3 5 5 6 8
5 | 0 0 2 3 5 5 5 8
6 | 0 2 2 2 3 5 8 8 9
7 | 1 3 5 5 5 7 8
8 | 0 2 5 5
9 | 0 2 2
```

Let's do reverse

find the percentile ranking
for 80.

$P_K = 80$

Below

$K = \dfrac{B}{n} \cdot 100$ Round to whole %.

Sample Size

$\boxed{P_{83} = 80}$

$K = \dfrac{33}{40} \cdot 100 = 82.5 \approx \boxed{83}$

83%   17%
_____
        80

Jan 9-5:25 PM

5

TI Instruction

1) To clear the Screen. [Clear]

2) To quit. [2nd] [Mode]

3) To clear all lists. [2nd] [+] [4: clear all lists] [Enter]

4) To reset all lists. [STAT] Edit [5: Setup Editor] [Enter]

5) To turn on the diagnostic key.

[2nd] [0] ↓↓↓↓ - - -↓ [▶ Diagnostic On] [Enter] [Enter]

Jan 9-5:31 PM

6) How to Store data in a list:

Store   [STAT] Edit   L1
8   12   5   4   10   [1: Edit]   8 [enter]
20 10   8 15 13   12
 in L1   5
  ↑   :
 List 1   Let's quit   13

              [2nd] [Mode]

         Let's clear the Screen [Clear]

How to view L1:

[2nd] [1] [Enter]

{8   12   5   4 - - - 13}
         [→] [→]
      [←] [←]

Jan 9-5:38 PM

6

How to Sort a list:

[STAT] Edit

L1

2:SortA([2nd] [1] [Enter]

Let's view L1

[2nd] [1] [Enter]

$\{ 4 \quad 5 \quad 8 \quad 8 \quad 10 \quad . \; . \; . \quad 20 \}$

Jan 9-5:44 PM

How to find $\overline{x}$ & S:

[2nd][1]

[STAT] [→] CALC

Menu   No Menu

[1: 1-Var Stats]

List: L1   L1

$\overline{x} = 10.5$

FreqList: [Clear] [Enter]

$S = S_x = 4.767$

[Calculate]

How to find S^2

[VARS] [5: Statistics] [3: S_x] [x^2][Enter] $22.7\overline{2}$

Convert to reduced fraction

[MATH] [1: ▶Frac][Enter] $\dfrac{409}{18}$

Jan 9-5:48 PM

I randomly selected 20 exams and here are the scores.

75	80	95	60
100	70	72	83
90	84	86	79
74	68	55	88
72	83	94	98

Store this in a list.

Clear all lists.

2nd + 4:Clear All Lists Enter

STAT Edit
1:Edit

L1
75 enter
80 "
95 "
⋮
98 "

Let's quit
2nd MODE

Clear Screen   Clear

Jan 9-6:07 PM

Make STEM Plot

Data must be sorted

STAT Edit
2:Sort A(2nd 1 Enter

Now view it
2nd 1 Enter

{ 55   60   68   70 ... }

5	5
6	0 8
7	0 1 2 2 5 9
8	0 3 3 4 6 8
9	0 4 5 8
10	0

Jan 9-6:14 PM

find $\overline{x}$ & S

STAT →▷ CALC   Menu   NO Menu

   1:1-Var Stats   List: L1   L1

                                     FreqList: Clear   Enter

$\overline{x} = 80.15$ Calculate

$S = S_x = 12.317$

$\Downarrow$ $n = 20$ find S^2 in reduced
                                                      fraction

$\Downarrow$ Min = 55   VARS 5: Statistics

$\Downarrow$ $Q_1 = 71.5$ ⎱ 5-Number   3: S_x χ^2 MATH
$\Downarrow$ Med = 81.5 ⎰ Summary
$\Downarrow$ $Q_3 = 89$ 1:▶Frac Enter $\dfrac{57651}{380}$
$\Downarrow$ Max = 100

Jan 9-6:18 PM

How to find $\overline{x}$ & S of a freq. table.

Class MP	Class F
15	8
22	12
29	15
36	5

Class MP → L1
Class F → L2

Clear all lists
2nd + 4: Clear all lists Enter

Reset all lists
STAT Edit
        5: Setup Editor Enter

L1	L2
15	8
22	12
29	15
36	5
▷	

STAT →▷ CALC   Menu   No Menu
   1:1-Var Stats List: L1   L1, L2

$\overline{x} = 24.975$ freq.list: L2   ⟋
$S = S_x = 6.704$ Calculate   Enter
$n = 40$

find S^2 in reduced fraction.

VARS 5: Statistics 3: S_x χ^2 Math 1:▶Frac Enter

$$\dfrac{23373}{520}$$

Jan 9-6:26 PM

Complete the table below

class limits	class BNDRS	class MP	class F	cum. F	Rel.F	% F
18 – 28	17.5 – 28.5	23	7	7	.14	14%
29 – 39	28.5 – 39.5	34	12	19	.24	24%
40 – 50	39.5 – 50.5	45	16	35	.32	32%
51 – 61	50.5 – 61.5	56	15	50	.30	30%

4 classes,   CW = 11 $n = 50$ Rel. F $= \frac{f}{n} = \frac{f}{50}$

Use <u>class MP</u> & <u>class F</u> to find $\overline{x}$ & S.
      L1   L2

L1	L2
23	7
34	12
45	16
56	15

[STAT] → CALC   L1 & L2

[1-Var Stats]

$\overline{x} = 42.58$ Find S^2 in

$S = S_x = 11.395$ reduced fraction

$n = 50$

$$S^2 = \frac{318109}{2450}$$

SG
5 – 8

Jan 9-6:40 PM