

3.1 – OVERVIEW

This chapter explores measures of :

- * center (middle),
- * variation (how spread out the data is)
- * distribution
- * outliers
- * changing characteristics of data over time

Review chapter problem (page 83).

Manual calculations will be required as well as understanding and interpretation of the results.

3-2 MEASURES OF CENTER

MEASURE OF CENTER

value at the center or middle of a data set

MEAN (arithmetic mean)

The sum of the scores divided by the number of scores

– sample mean $\bar{x} = \frac{\sum x}{n} = \frac{\text{sum of all data values}}{\text{number of data values}}$

– population mean $\mu = \frac{\sum x}{N} = \frac{\text{sum of all data values}}{\text{population size}}$

– affected by low or high values

***** find the mean for the following scores on a statistics final exam:**

74.5 73.5 87.5 89.5 86 80.5 65 63.5 89.5 93.5

***** use the calculator to find the mean of the data in L₁**
Enter the data from problem #6 in a list called L₁

- In home screen do: **sum(L₁) ÷ 10**
2nd STAT(List), MATH, 5:sum(L₁), ÷, 10, ENTER
.....**Or**.....
- In home screen do: **mean(L₁)**
2nd STAT(List), MATH, 3:mean(L₁), ENTER

MEDIAN

Middle value when data is ***arranged in ORDER***

- if n is odd – exact middle
- if n is even – it is the mean of two middle numbers

***** find the median for the following scores on a statistics final exam:**
74.5 73.5 87.5 89.5 86 80.5 65 63.5 89.5 93.5

***** use the calculator to find the median of the data in L₁**
– In home screen do: **median(L₁)**
2nd STAT(List), MATH, 4:median(L₁), ENTER

MODE

The most frequent score

- Sometimes bimodal, multimodal, or no mode

***** find the mode for the amounts of weight change (in kilograms) for freshman:** 11 3 0 -2 3 -2 -2 5 -2 7 2 4 1 8 1 0 -5 2

***** use the calculator to find the mode of the data in L₁**
– Sort data, scroll down the list to find the most frequent score

MIDRANGE

Value midway between highest and lowest. $\frac{\text{highest value} + \text{lowest value}}{2}$

– not used much

***** find the midrange for the weight change (in kilograms) for**

freshman: 11 3 0 -2 3 -2 -2 5 -2 7 2 4 1 8 1 0 -5 2

***** use the calculator to find the midrange of the data in L_1**

– Sort data. Then, in the home screen do: $\frac{L_1(1) + L_1(18)}{2}$

ROUND-OFF RULE

Carry **one more decimal place** than is present in the original set of values

– Round off **only** on the final answer

MEAN FROM A FREQUENCY TABLE

Replace class limits with class midpoints and assume each class midpoint is repeated a number of times equal to the class frequency

$$\bar{x} = \frac{\sum (f \cdot x)}{\sum f} \quad \text{where } x \text{ is the class midpoint and } f \text{ is the frequency}$$

***** Find the mean age of cars owned by students at the author's college given the following frequency distribution:**

Pulse Rates of Females	Class Midpoint x	Frequency	$f \cdot x$
60 - 69		12	
70 - 79		14	
80 - 89		11	
90 - 99		1	
100 - 109		1	
110 - 119		0	
120 - 129		1	

*****do by hand**

*****to do in the calculator we will edit as follows:**

L_1	L_2	$L_3 = L_1 \times L_2$
$x, \text{ class midpoints}$	$f, \text{ frequencies}$	$x \cdot f$

- 1) Clear Lists 1, 2, and 3
- 2) Enter (x) class midpoints in L_1
- 3) Enter (f) frequencies in L_2
(make sure the two lists have the same length!!)
- 4) Now we need the product ($x \cdot f$) in L_3 .
Go to the top of list 3, type $L_1 \times L_2$, and ENTER

To calculate the mean:
$$\bar{x} = \frac{\sum (f \cdot x)}{\sum f} = \frac{\text{sum of list 3}}{\text{sum of list 2}}$$

the instructions to calculate the sums of lists 2 and 3 follow:

5) Calculate $\sum (f \bullet x) = \text{sum}(L_3)$ by doing the following:

2nd QUIT to go to the home screen

access 2nd STAT [List], choose MATH menu, choose sum(L₃

6) Calculate $\sum f = \text{sum}(L_2)$ by following the steps outlined above

7) Now use the formula to calculate the mean: $\bar{x} = \frac{\sum (f \bullet x)}{\sum f}$

*****using the calculator to find the mean of the data in L₁ and L₂**

– In the home screen do: **mean(L₁, L₂)**

2nd STAT(List), choose MATH, choose mean(

***** Use the frequency table, to find the mean.**

	List 1(<i>x</i>)	List 2 (<i>f</i>)	List 3 (<i>x</i> • <i>f</i>)
classes	midpoint	frequency	
96.5 – 96.8		1	
96.9 – 97.2		8	
97.3 – 97.6		14	
97.7 – 98.0		22	
98.1 – 98.4		19	
98.5 – 98.8		32	
98.9 – 99.2		6	
99.3 – 99.6		4	

WEIGHTED MEAN

Is the mean computed with different scores assigned different weights.

$$\frac{\sum(w*x)}{\sum w}$$

*** Find the grade point average for a student who earned the following grades: A (3 credit course), A (4 credit course), B (3 credit course), C (3 credit course) and F (1 credit).

THE BEST MEASURE OF CENTRAL TENDENCY

							mean	median	mode
Mr. A	90	93	94	95	96	100			
Ms. B	52	68	95	95	95	98			
Ms. C	70	79	85	95	99	99			

Each claimed his/her class "on average" did best. How?

SKEWNESS (see page 92)

A non-symmetric distribution that extends more to one side than another

- Skewed to the left (negatively skewed, lopsided to the right)
in general, the mean and median are to the left of the mode
- Symmetric (zero skewness, data not lopsided)
mean = median = mode
- Skewed to the right (positively skewed, lopsided to the left)
in general, the mean and median are to the right of the mode