Measures of Central Tendency

Mean – the average

Ex: Math grades (all worth the same amount)

91, 68, 72, 86, 60

To calculate the mean, add them up and divide by the number of data values: 60 68 72 86 91

Mean = $\frac{(91 + 68 + 72 + 86 + 60)}{5} = \frac{377}{5} = 75.4$

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Mean of a Frequency Distribution

1, 1, 1, 2, 2, 2, 2, 3, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5

Ex.

Value (x)	Frequency (F)	F • x
1	3	1·3 = 3
2	5	2·5 = 10
3	1	3·1 = 3
4	7	4·7 = 28
5	4	5·4 = 20

$\Sigma F = 20$ $\Sigma Fx = 64$

NB: Σ means sum of.

$$\bar{x} = \frac{Sum\ of\ Fx}{Sum\ of\ F} = \frac{\Sigma Fx}{\Sigma F} = \frac{64}{20} = 3.2$$

$\bar{x}$ =

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Mean of Data grouped into classes

If the data are grouped into **classes**, then the mean is calculated using the midpoint of each class multiplied by the frequency.

Ex. The heights of ~~40~~ 14 students are shown below. Find the average height.

Height (cm)	Frequency
[140, 150[145	~~5~~ 0
[150, 160[155	~~17~~ 3
[160, 170[	~~12~~ 3
[170, 180[	~~4~~ 6
[180, 190[	~~2~~ 2

$\frac{140+150}{2}$ | III | III | IIIII | II

Midpoint (x)	Frequency (F)	F • x
145	~~5~~ 0	0
155	~~17~~ 3	465
165	~~12~~ 3	495
175	~~4~~ 6	1050
185	~~2~~ 2	370

$\Sigma F = 14 \quad \Sigma Fx = 2380$

$$\bar{x} = \frac{Sum\ of\ Fx}{Sum\ of\ F} = \frac{\sum Fx}{\sum F} = \frac{2380}{14} = 170\text{cm}$$

$\bar{x}$ =

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Weighted Mean

If the values are not worth the same amounts, the mean is called the **weighted mean**.

Ex. A Math course has 3 terms and each term is worth :

Term	Grade (%)	Weight (%)	
1	70	20	$\frac{20}{100} = 0.2$
2	72	~~30~~ 20	$\frac{20}{100} = 0.2$
3	80	~~50~~ 60	$\frac{60}{100} = 0.6$
		100 %	

Final grade = $70(0.2) + 72(0.2) + 80(0.6)$

$14 + 14.4 + 48 = 76.4$

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Median – the middle number
(when all values are in increasing order)

- ***Case 1*** *– an <u>odd</u> number of data*

5 6 10 10 11 15 15

Use the formula **(n + 1) / 2** formula; where **n** is the number of data, to determine the LOCATION of the median.

$\frac{(7+1)}{2}$ = 4th number → 5 6 10 **10** 11 15 15

- ***Case 2*** *– an <u>even</u> number of data*

32 38 46 49 50 52

Use the formula **(n + 1) / 2** formula; where **n** is the number of data, to determine the LOCATION of the median.

$\frac{(6+1)}{2}$ = 3.5th number → 32 38 46 49 50 52

3.5th number
= 47.5

Since the median is in between two number, take the average of the two numbers on either side of the line.

$\frac{(46+49)}{2}$ = 47.5

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Median of Data grouped into classes

The class that contains the median is called the median class.

The middle value of the median class can be used an estimate of the median.

Ex.

	Height (cm)	Frequency	
	[140, 150[	5	5
→	[150, 160[	17	22
	[160, 170[	12	34
	[170, 180[	4	
	[180, 190[	2	

$\sum F = 40$

$\frac{n+1}{2} = \frac{40+1}{2} = \frac{41}{2} = 20.5^{th}$

Median class [150, 160[

Median is ~ $\frac{150+160}{2} = 155$

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Mode – the most frequent data value

Ex. 25 95 82 95 38 46 82 82 ➡ 82 is the **mode**

- If we would have added another 95, there would have been two modes or bimodal (82 & 95) 25 38 46 82 82 95 95 95
- If every number shows up only once, there is NO MODE

- If the data are grouped into **classes**, then the class with the highest frequency is called the **modal class**

Ex. The heights of ~~40~~ 15 students are shown below.

Height (cm)	Frequency
[140, 150[	~~5~~ 0
[150, 160[	~~17~~ 3 4
[160, 170[	~~12~~ 3
[170, 180[	~~4~~ 6
[180, 190[	2

[170, 180[

The modal class is ~~[150, 160[~~

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Range – is not a measure of central tendency

Range = Largest Number – Lowest Number

Ex. 25 95 82 95 38 46 82 82

95-25 = 70 The range is 70.

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Stem and Leaf Plot

Can be used to represent one or two distributions.

The center column is the **STEM**; it indicates the first digit(s) of the data values

Each line has the **LEAVES**; the last digit of each data value

Ex: Heartbeats of 30 individuals

70 73 73 76 78 81 82 85 85 87 88 88 89

90 92 92 96 97 99 101 101 101 104 106 106 107

112 114 115 118

Cardiac rates (beats/min)

Stem	Leaf
7	0 3 3 6 8
8	1 2 5 5 7 8 8 9
9	0 2 2 6 7 9
10	1 1 1 4 6 6 7
11	2 4 5 8

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Or you can see TWO distributions on one table:

Ex. Lengths of male and female salmon (in millimetres)

Males (Leaf)	Stem	Females (Leaf)
95 90 80 54 48 15	1	05 12 36 47 52 80 81
73 73 59 58 32 32 25 18	2	58 59 71 71 76
90 85 69 43 42 15 11 06	3	32 41 62 63 69 70 99
73 62 50 46 45 44 35	4	07 19 89
70 76 66 55 38	5	00 25 31

$\frac{n+1}{2} = \frac{34+1}{2} = 17.5^{th}$

$\frac{17^{th} + 18^{th}}{2}$

$\frac{315 + 342}{2}$

$\frac{657}{2} = 328.5$

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Practice

Textbook 1:

P. 73 #1, 3, 4 & 5

P. 74 #6 & 7

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