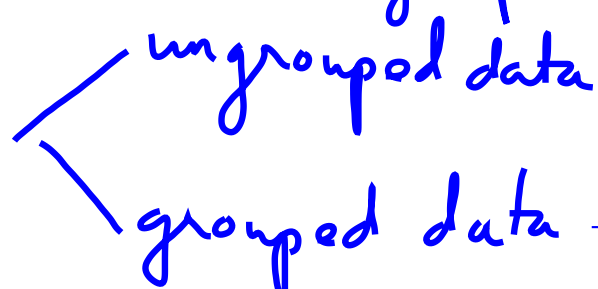


1.1.2. Measures of Central Tendency.

Goals: ① Calculate the mean 
ungrouped data
grouped data.

② Calculate the median 
ungrouped data
grouped data.

③ Calculate the mode

The mean is the sum of the numbers divided by the number of numbers.

E.g. 1, 2, 3, 4 . Mean = $\frac{1 + 2 + 3 + 4}{4} = 2.5$

E.g. Salaries of 5 employees (in thousands)

14, 17, 21, 18, 15.

Find the mean:

$$\frac{14 + 17 + 21 + 18 + 15}{5} = \frac{85}{5} = 17$$

Average Salary: \$17,000

Mean of grouped data

Class intervals	Mid point (x)	Frequency (f)	$x \cdot f$
$[0, 7)$	3.5	0	0
$[7, 14)$	10.5	2	21
$[14, 21)$	17.5	10	175
$[21, 28)$	24.5	21	514.5
$[28, 35)$	31.5	23	724.5
$[35, 42)$	38.5	14	539
$[42, 49)$	45.5	5	227.5
		75	2201.5

$$\frac{2201.5}{75} \approx 29.3533$$

Median of ungrouped data.

The median is the number that divides the bottom 50% of data from top 50% of data.

E.g. 14, 21, 17, 18, 15

Step 1: Arrange the data in ascending order.

14, 15, 17, 18, 21

Step 2: * If there are an odd number of numbers, the median is the number in the middle.

Median = 17.

* What if we have an even number of numbers.

E.g. 14, 15, 17, 19, 23, 25

Take the average of the 3rd & 4th number

$$\text{Median} : \frac{17 + 19}{2} = 18$$

Mode : the mode is the most frequently occurring value in a data set.

E.g. 45, 47, 68, 70, 72, 72, 72, 73, 75,
98, 98, 100, 100

$$\text{Mode} = 72$$

E.x. Find median and mode of the given data set.

(a) 4, 5, 5, 5, 5, 6, 7, 8, 12

Mode: 5
Median: 5

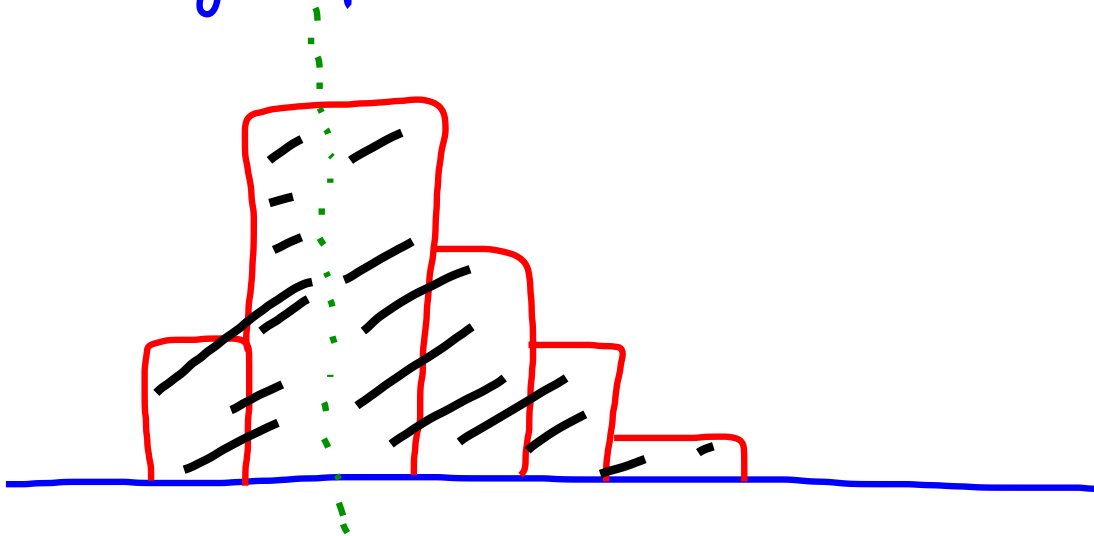
(b) 1, 2, 3, 3, 3, 5, 7, 7, 7, 23

Mode: 3, 7
Median: 4

(c) 1, 3, 5, 6, 7, 9, 11, 15

Mode: all the #'s
Median: 6.5

Median of grouped data.



E.g.

Class Interval	Frequency	Cumulative frequency
3.5 - 4.5	3	3
4.5 - 5.5	1	4
5.5 - 6.5	2	6
6.5 - 7.5	4	10
7.5 - 8.5	3	13
8.5 - 9.5	2	15

$$\text{Half of area} = \frac{15}{2} = 7.5$$

$$3 \cdot 1 + 1 \cdot 1 + 2 \cdot 1 + 4 \cdot (M - 6.5) = 7.5$$

$$4M = 27.5 \quad \left| \quad \begin{array}{l} 6 + (4M - 26) = 7.5 \\ 4M - 20 = 7.5 \end{array} \right. \quad M = \frac{27.5}{4} = 6.875$$

Interval:	frequency	cumulative frequency
1.5 - 4.5	3	3
4.5 - 7.5	4	7
7.5 - 10.5	6	13
10.5 - 13.5	2	15
13.5 - 16.5	10	25
16.5 - 19.5	9	34
19.5 - 22.5	8	42

→ M

$$\begin{aligned} \text{Area} &= 42 \cdot 3 \\ &= 126 \end{aligned}$$

Find median of this grouped data

$$45 + (M - 13.5) \cdot 10 = 63$$

$$\begin{aligned} (M - 13.5) \cdot 10 &= 18 \\ M - 13.5 &= 1.8 \end{aligned} \quad \left| \quad \begin{aligned} M &= 13.5 + 1.8 \\ \boxed{M} &= \boxed{15.3} \end{aligned} \right.$$

