STATISTICS

COMPUTER SCIENCE

AGENDA

01 Chapter 3 (review)

02 Chapter 4

03 Online Quiz

STATISTICS

COMPUTER SCIENCE

lec.3 notes

Measures of Central Tendency

Measures of Central Tendency

Statistic that represents the center point or typical value of a dataset. These measures indicate where most values in a distribution fall and are also referred to as the central location of a distribution.

- DEFINITION
- HOW TO COMPUTE
- PROPERTIES

DEFINITIONS

Mean	• **The sum of values divided by the number of data points.**
Median	• **The middle value when the data arranged.**
Mode	• **The value that occurs most frequency**

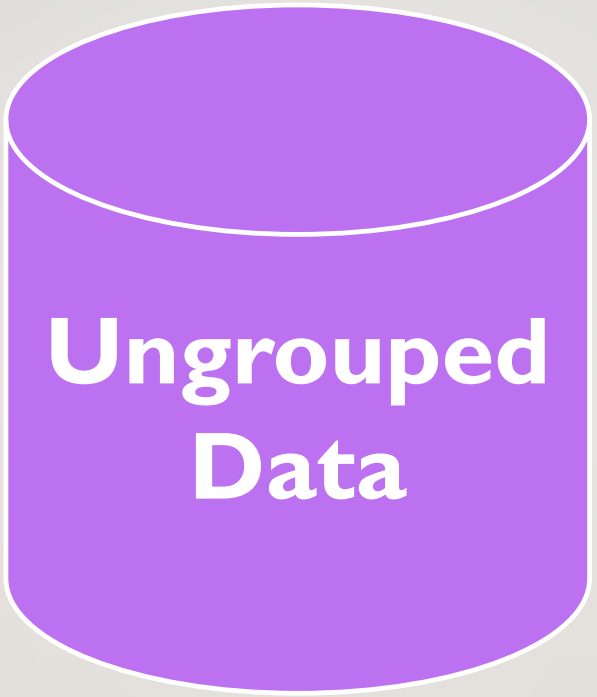
HOW TO COMPUTE

Ungrouped Data

height
130
100
90
115
105
120
80
70

Grouped Data

Height (in cm)	No of students
159-162	1
163-166	4
167-170	11
171-174	12
175-178	6
179-182	4
183-186	2


Ungrouped
Data

Mean

Ungrouped data

Arithmetic Mean $\bar{x} = \frac{\sum x_i}{n}$

	Height
1	130
2	100
3	90
4	115
5	105
6	120
7	80
8	70
Total	810

n=8

mean=810/8= 101.25

median

Ungrouped data

**Put the observation in ascending order(lowest first to highest last)

	Height
1	130
2	100
3	90
4	115
5	105
6	120
7	80
8	70

1-Ascending order

n=8

	Height
1	70
2	80
3	90
4 →	100
5 →	105
6	115
7	120
8	130

When the number of observations (n) is even:

1. Find the value at position $\left(\frac{n}{2}\right)$

2. Find the value at position $\left(\frac{n}{2}+1\right)$

n/2= 4 v1= 100

(n/2)+1= 5 v2= 105

median=(v1+v2)/2= (100+105)/2 102.5

	Weight
1	62
2	55
3	48
4	90
5	52
6	60
7	40
8	50
9	60

1-Ascending order

n=9

	Weight
1	40
2	48
3	50
4	52
5 →	55
6	60
7	60
8	62
9	90

When the number of observations (n) is odd: the median is the value at position

$$\left(\frac{n+1}{2}\right)$$

(n+1)/2= 5

median=55

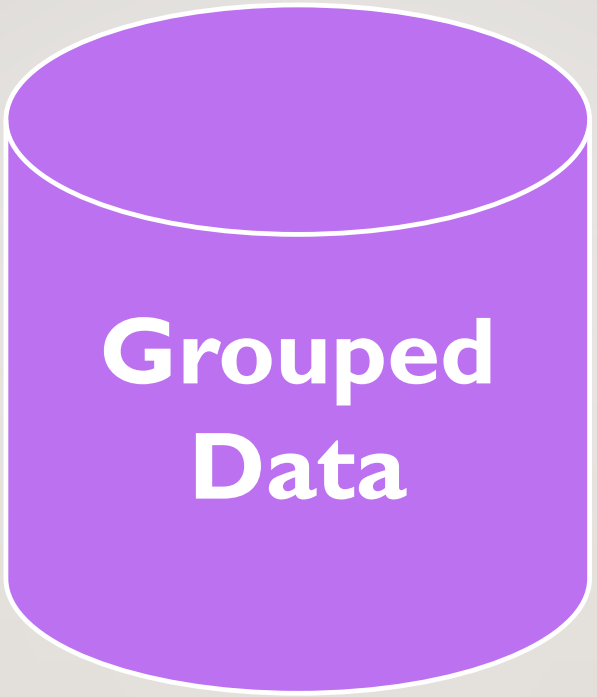
The value that occurs most frequency

Mode

Grouped data

	Height	Weight
1	130	62
2	100	55
3	90	48
4	115	90
5	105	52
6	120	60
7	80	40
8	70	50
9		60

height mode=	nan
weight mode=	60


Grouped
Data

Mean, median and mode

Grouped data

Class	frequency(f)
16-	4
24-	8
32-	9
40-	13
48-	10
56-	5
64-72	1
Total	50.00

Mean

Grouped data

$$\text{Arithmetic Mean} = \frac{\sum (f_i * x_i)}{\sum f_i}$$

Class	frequency(f)	Mid-Point(x)	f * x
16-	4	20	80
24-	8	28	224
32-	9	36	324
40-	13	44	572
48-	10	52	520
56-	5	60	300
64-72	1	68	68
Total	50.00		2088

$$\bar{X} = \frac{\sum fx}{\sum f} = \frac{2088}{50} = 41.76$$

Median

Grouped data

Class	frequency(f)
16-	4
24-	8
32-	9
40-	13
48-	10
56-	5
64-72	1
Total	50.00

1-Ascending cumulative frequency distribution table

Upper limits	CF
Less than 24	4
Less than 32	=4+8=12
Less than 40	=12+9=21
Less than 48	34
Less than 56	44
Less than 64	49
Less than 72	50

2-Find the position of median= $\frac{\sum f}{2} = \frac{50}{2} = 25$

3-Median class = (40-48)

Lower limit of median class (M_o)=40

Width of median class (l)=8

$f_1 = 21$

$f_2 = 34$

$$median = M_o + \frac{pos. - f_1}{f_2 - f_1} * l$$

$$= 40 + \frac{25 - 21}{34 - 21} * 8 = 42.46$$

Mode

Grouped data

l=8 equal width

Class	frequency(f)
16-	4
24-	8
32-	9
40-	13
48-	10
56-	5
64-72	1
Total	50.00

M_o=40

Δ_1=13-9=4

Δ_2=13-10=3

$$mode = M_o + \frac{\Delta_1}{\Delta_1 + \Delta_2} * l$$

$$mode = 40 + \frac{4}{4 + 3} * 8$$

$$mode = 42.46$$

Mode

Grouped data

unequal width

Class	frequency (f)	The length of the class	modified frequency
0-	3	5	3/5=0.60
5-	8	7	8/7=1.14
12-	16	8	2.00
20-	11	10	1.10
30-	7	15	0.47
45-50	5	5	1.00
total	50		

M_o=12

l=8

Δ_1=2-1.143=0.857

Δ_2=2-1.1=0.9

$$mode = M_o + \frac{\Delta_1}{\Delta_1 + \Delta_2} * l$$

$$mode = 12 + \frac{0.857}{0.857 + 0.9} * 8$$

$$mode = 15.9$$

Properties

Mean

outliers

$\sum(x_i - \bar{x}) = 0$

Median

unique

Not affected by outliers

Preferred in case of ranked data

Mode

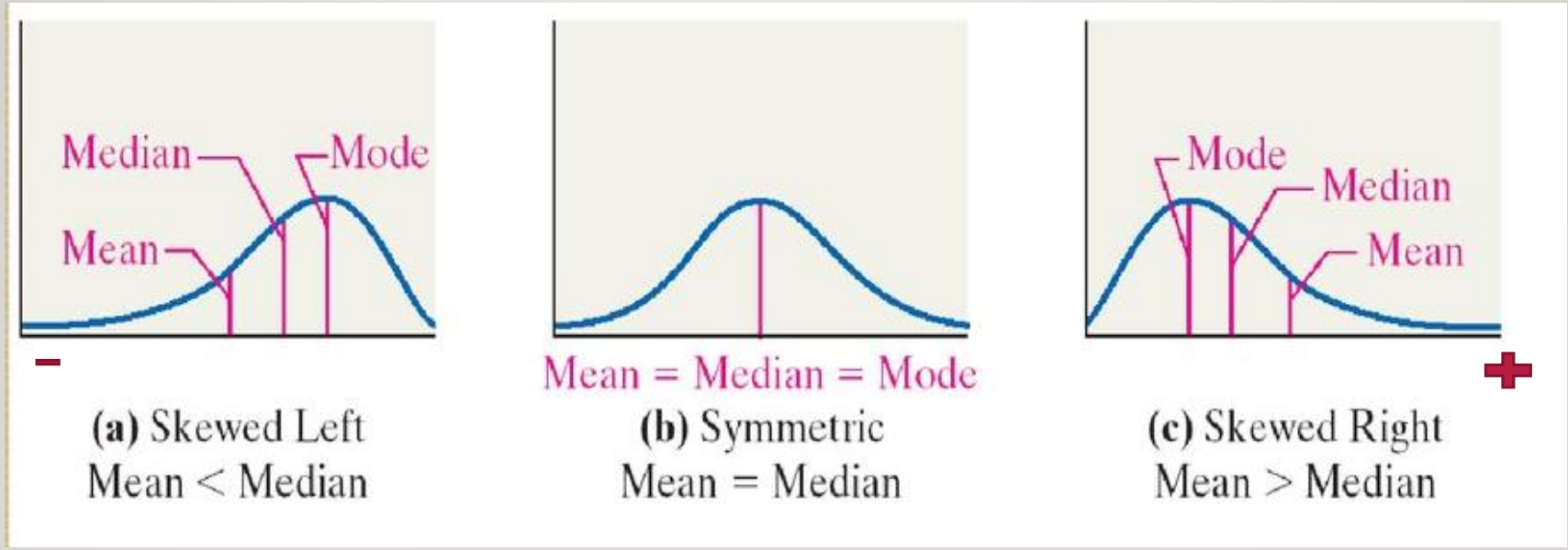
Not unique

Preferred in case of qualitative data

Which measure is best

There in no best, but using only one is definitely the worst!!!

Relationships between Mean Median Mode



(a) Skewed Left
Mean < Median

(b) Symmetric
Mean = Median

(c) Skewed Right
Mean > Median

Skewness

Positive (right)

Dataset 1
1
1
1
1
2
2
2
2
2
2
3
3
3
4
4
5
5
7

Interval	Frequency
0 to 1	4
1 to 2	6
2 to 3	4
3 to 4	2
4 to 5	2
5 to 6	0
6 to 7	1

Mean	Median	Mode
2.79	2.00	2.00

Zero (no skew)

Dataset 2
1
1
2
2
3
3
3
4
4
4
4
4
5
5
5
6
6
7
7

Interval	Frequency
0 to 1	2
1 to 2	2
2 to 3	3
3 to 4	5
4 to 5	3
5 to 6	2
6 to 7	2

Mean	Median	Mode
4.00	4.00	4.00

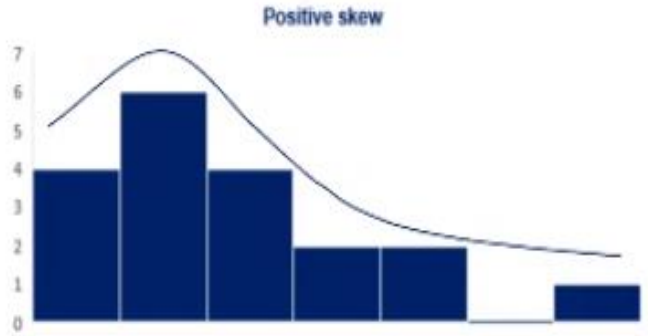
Negative (left)

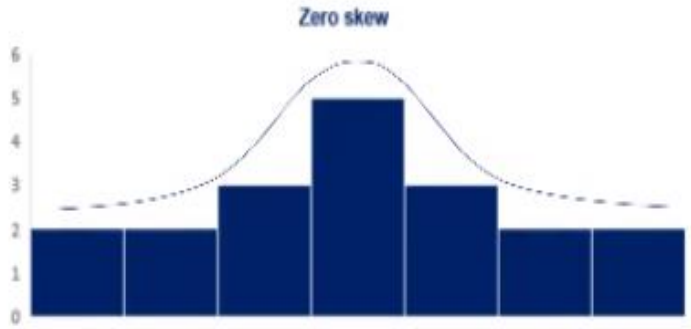
Dataset 3
1
2
3
3
4
4
4
5
5
5
5
6
6
6
6
6
7
7
7

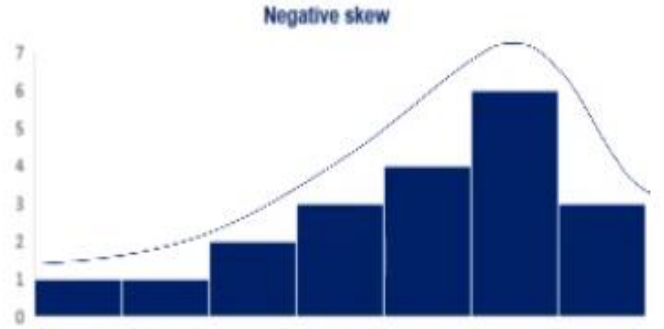
Interval	Frequency
0 to 1	1
1 to 2	1
2 to 3	2
3 to 4	3
4 to 5	4
5 to 6	6
6 to 7	3

Mean	Median	Mode
4.90	5.00	6.00

mean < median







THANKS

Any questions?