

Summarizing Data

Lecture 3

A. Central tendency

B. Variability

C. Shape

Central tendency

The Average Bears



Mr. Mean



Mr. Median



Mr. Mode

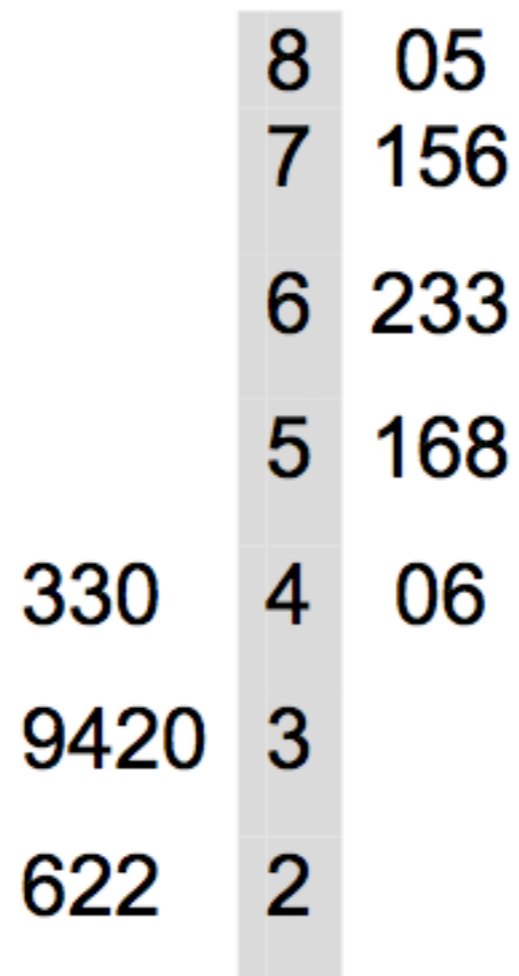
Central tendency

Three possible datasets for the 5-point make-up quiz.

Student	Dataset A	Dataset B	Dataset C
You	3	3	3
John's	3	4	2
Maria's	3	4	2
Shareecia's	3	4	2
Luther's	3	5	1

Central tendency

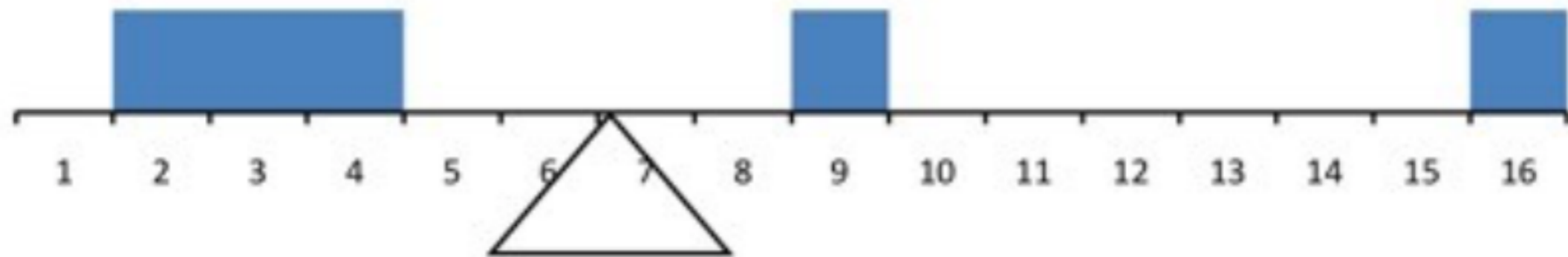
Back-to-back stem and leaf display. The left side shows the memory scores of the non-players. The right side shows the scores of the tournament players.



Definitions of Center

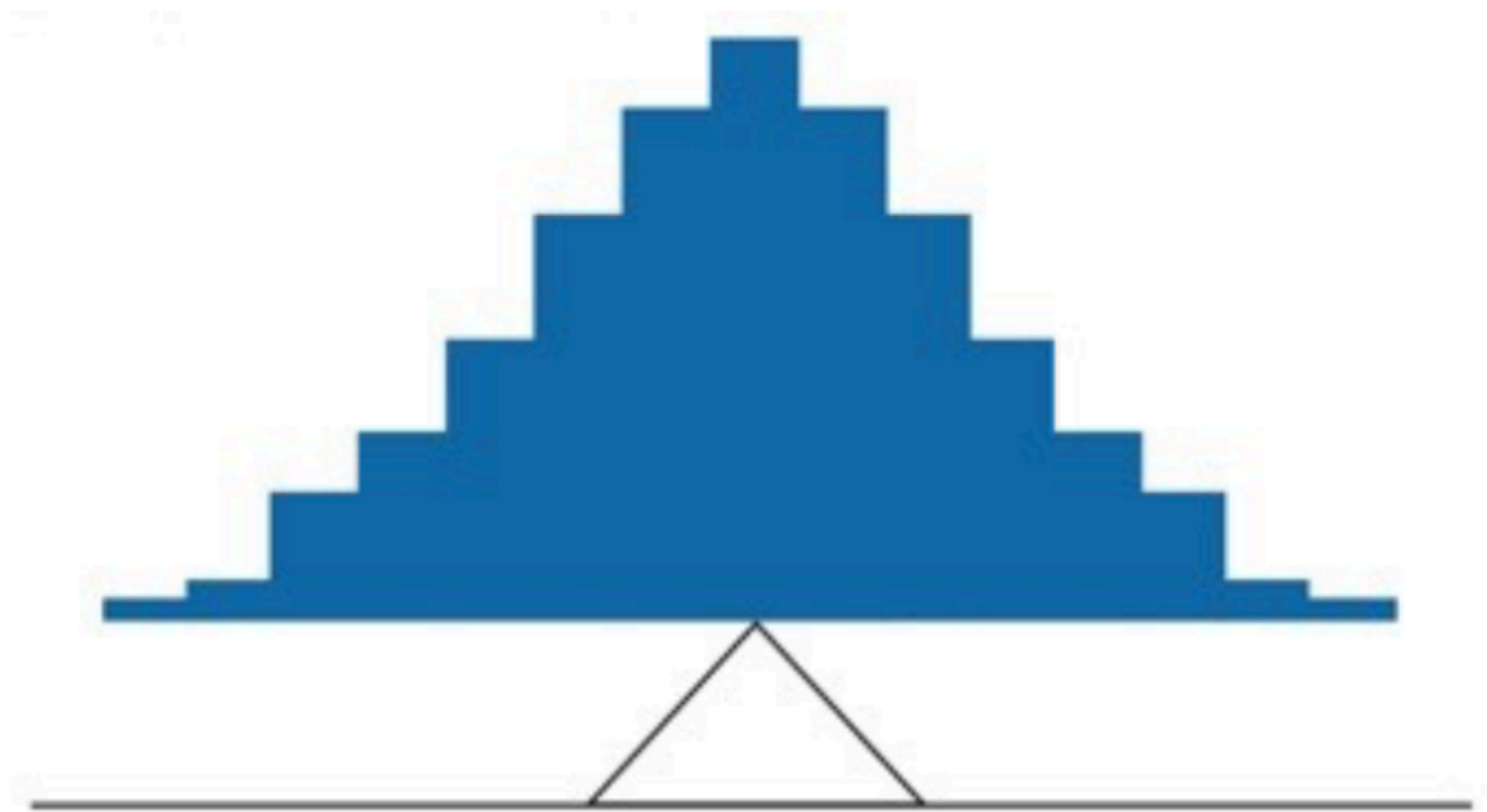
Definitions of Center

Balance scale



Definitions of Center

Balance scale



Definitions of Center

Smallest Absolute Deviation

An example of the sum of absolute deviations

Values	Absolute Deviations from 10
2	8
3	7
4	6
9	1
16	6
Sum	28

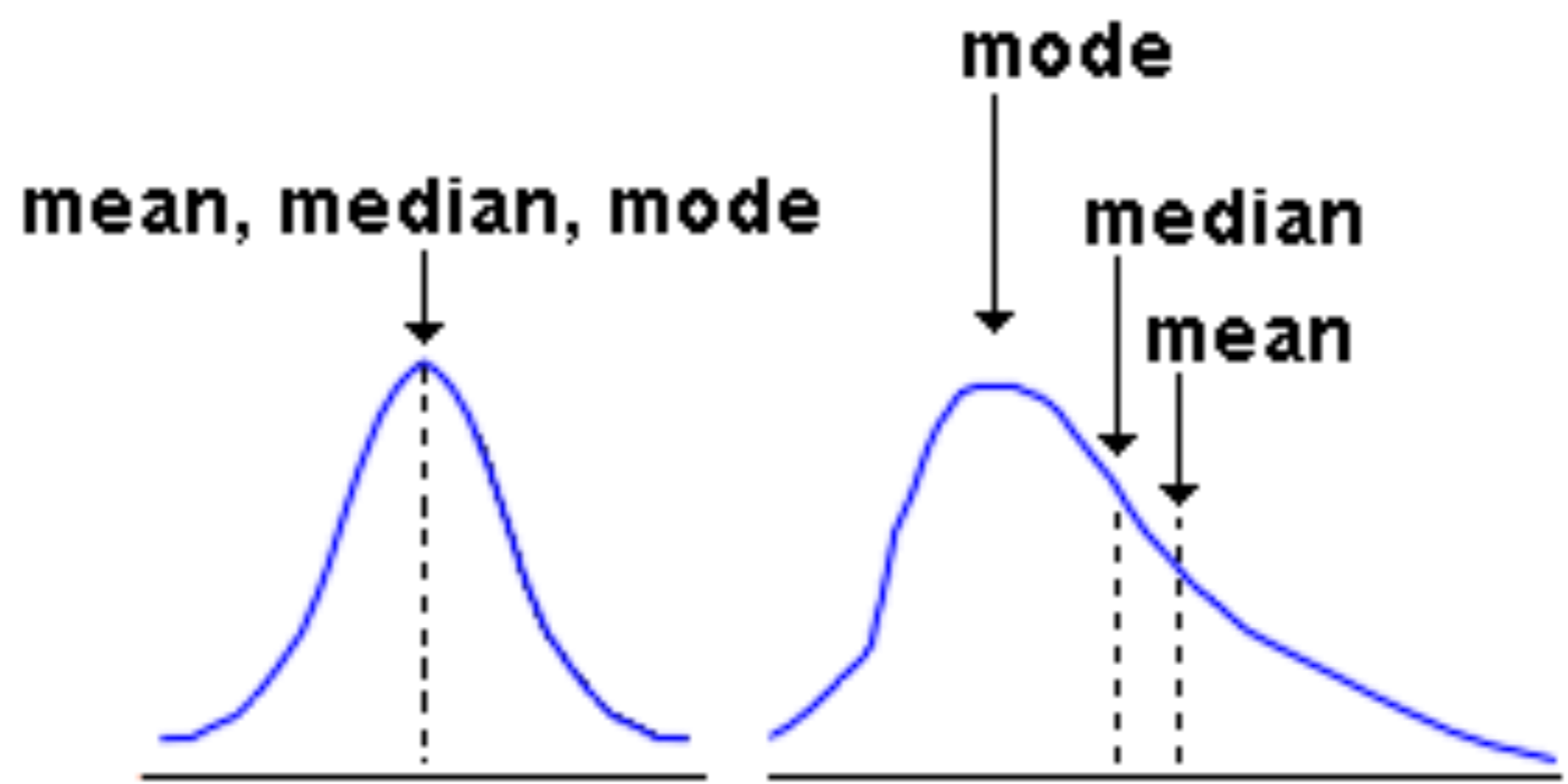
Definitions of Center

Smallest Squared Deviation

An example of the sum of squared deviations

Values	Squared Deviations from 10
2	64
3	49
4	36
9	1
16	36
Sum	186

Measures of Central Tendency



CENTRAL TENDENCY

1. **Mean** = Sum of scores divided by the number of scores (often referred to as the statistical average)

Pronounced "x-bar" → $\bar{X} = \frac{\sum X}{N}$ ← Capital Sigma for "Sum of"

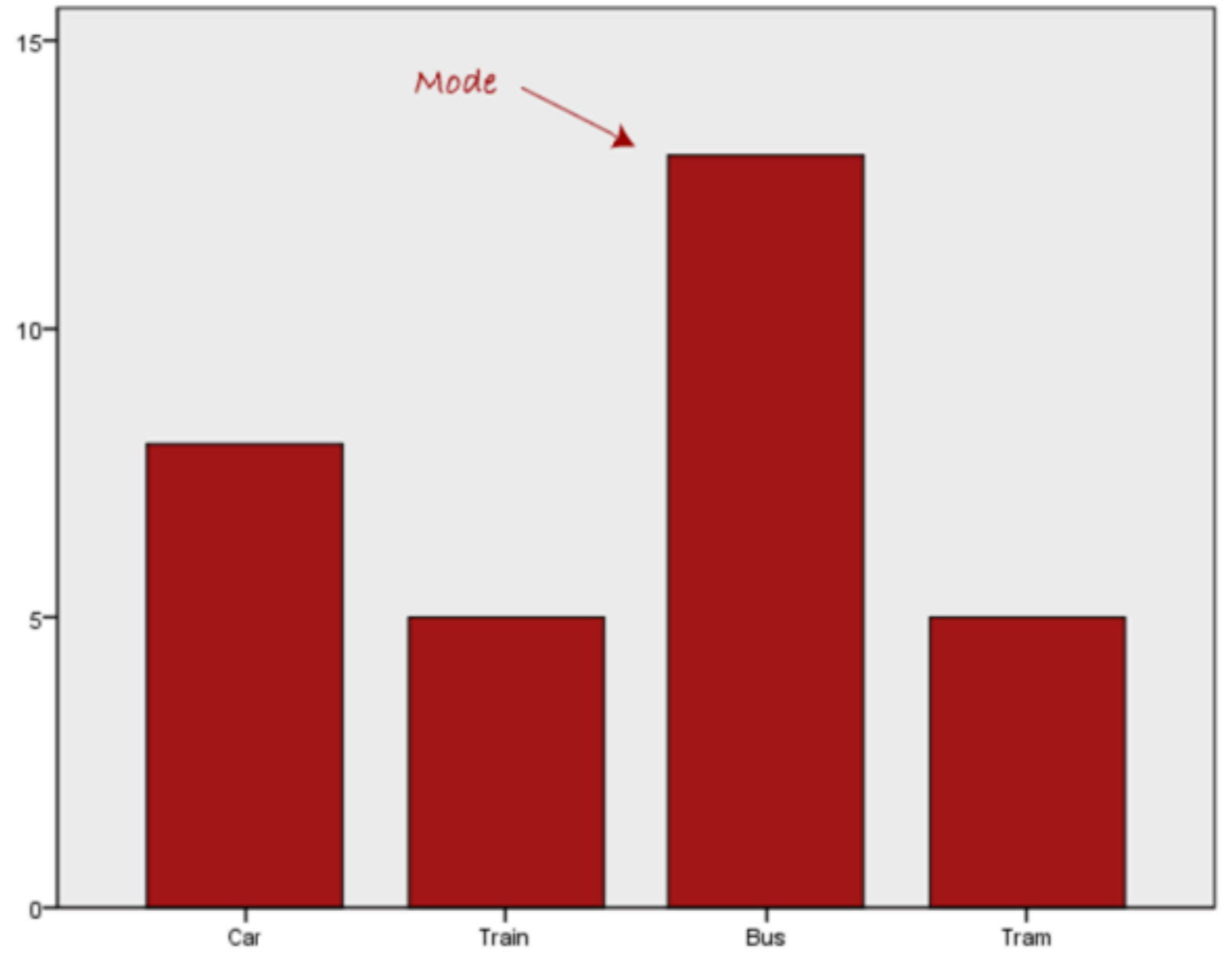
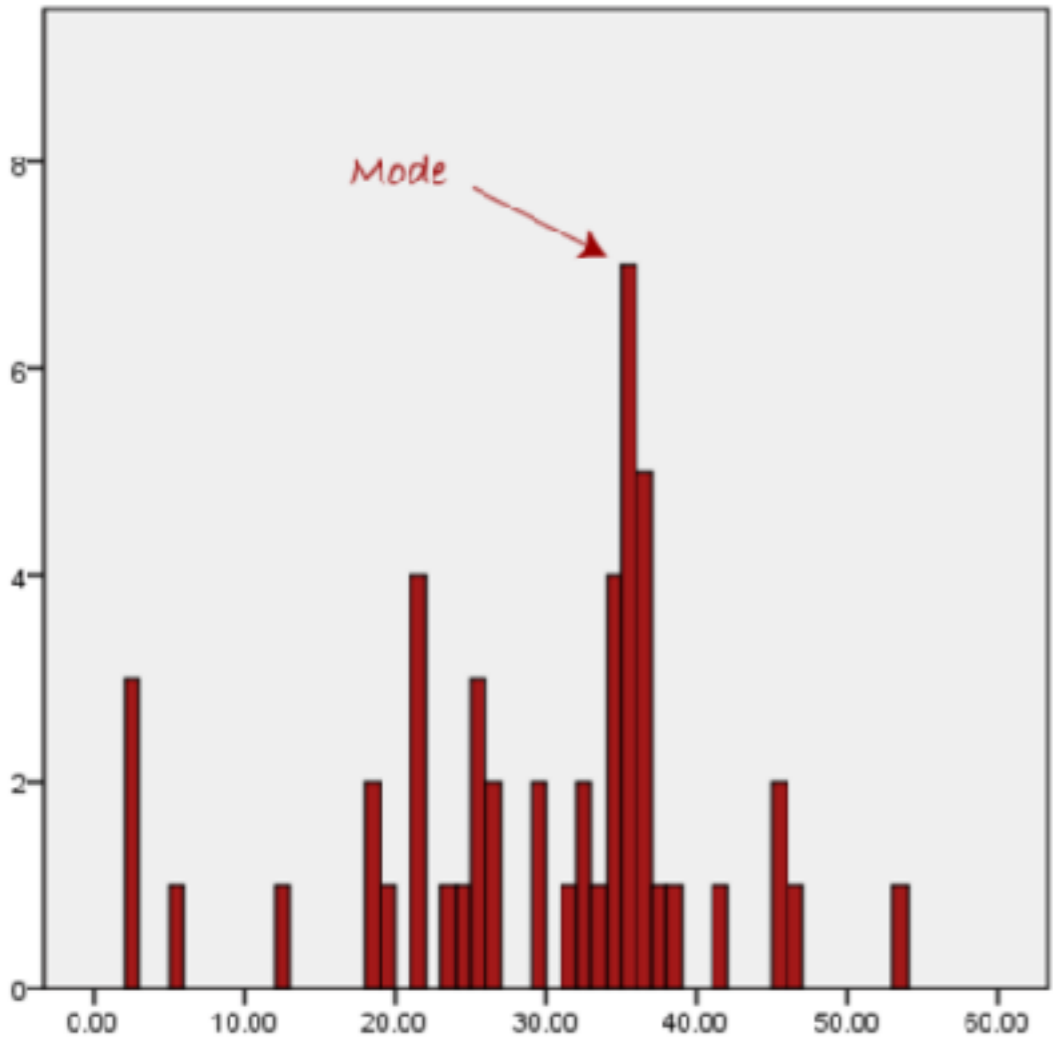
N represents the number of scores → N ← "x" represents each score

2. **Median** = Middle Most Number

$$M_d$$

3. **Mode** = Most Frequently Occurring Number

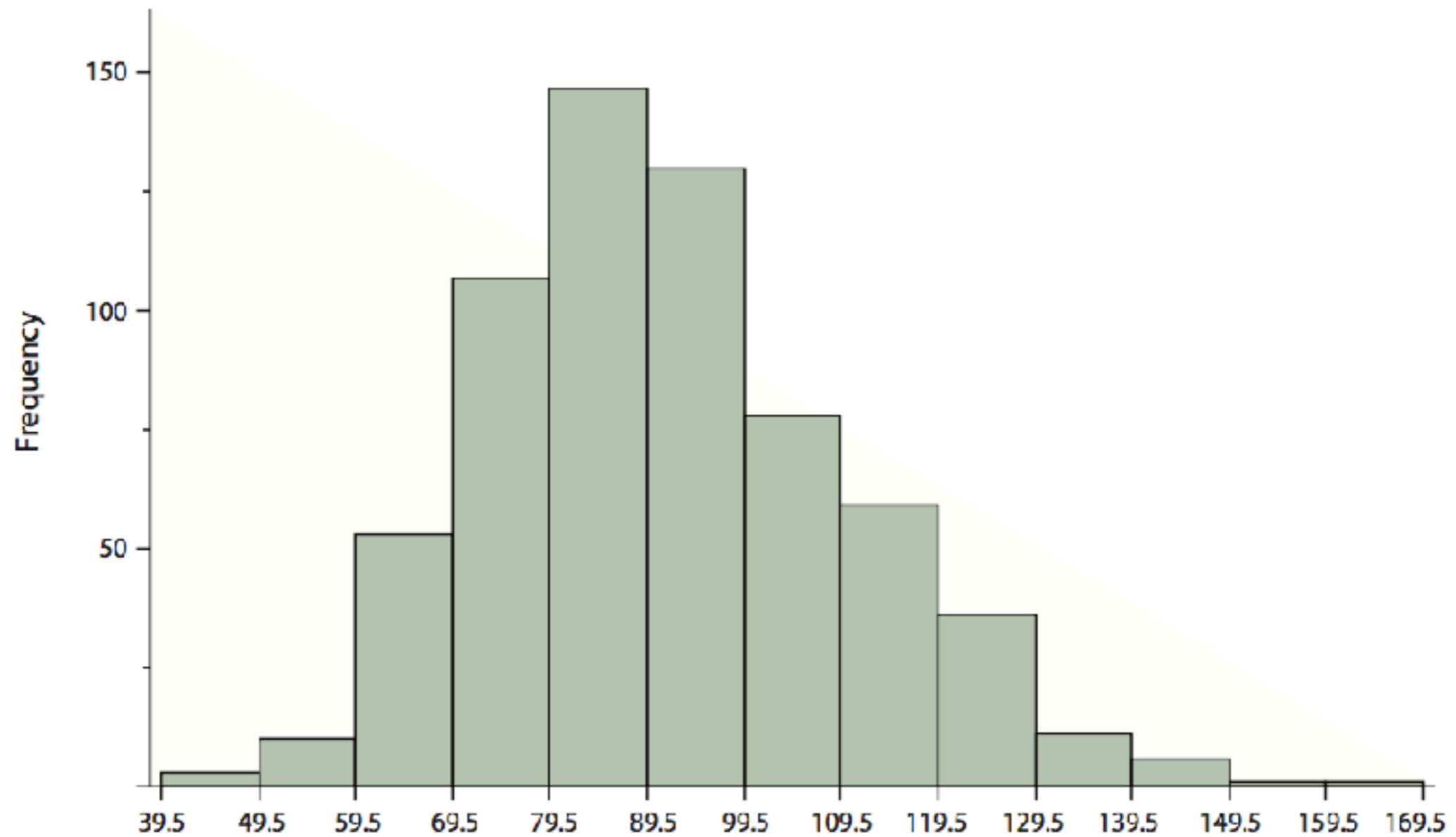
$$M_o$$



Geometric Mean

$$\left(\prod x\right)^{\frac{1}{N}}$$

Comparing Measures of Central Tendency



A distribution with a positive skew.

Comparing Measures of Central Tendency

Measure	Value
Mode	84.00
Median	90.00
Geometric Mean	89.70
Trimean	90.25
Mean trimmed 50%	89.81
Mean	91.58

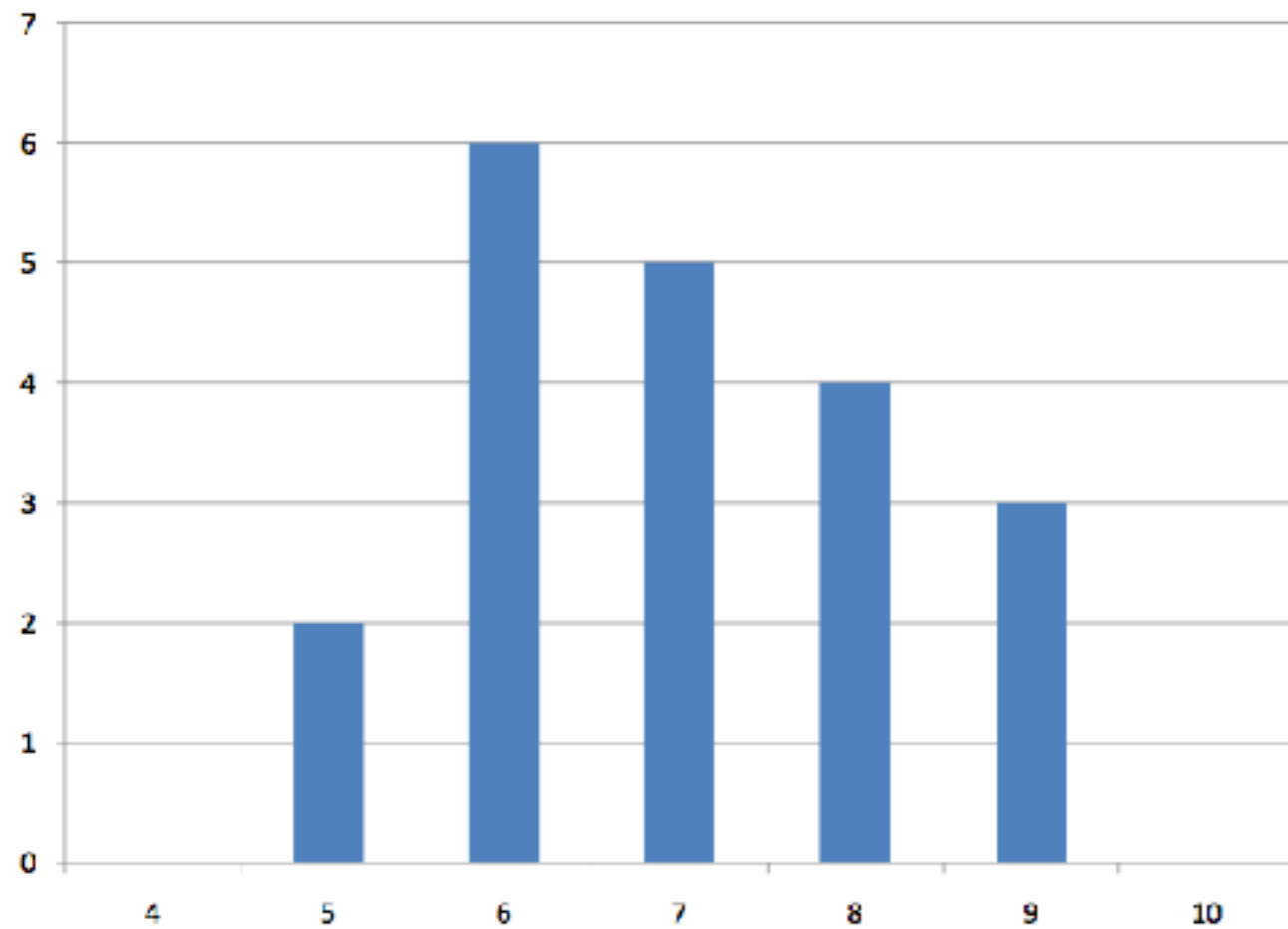
Measures of Variability



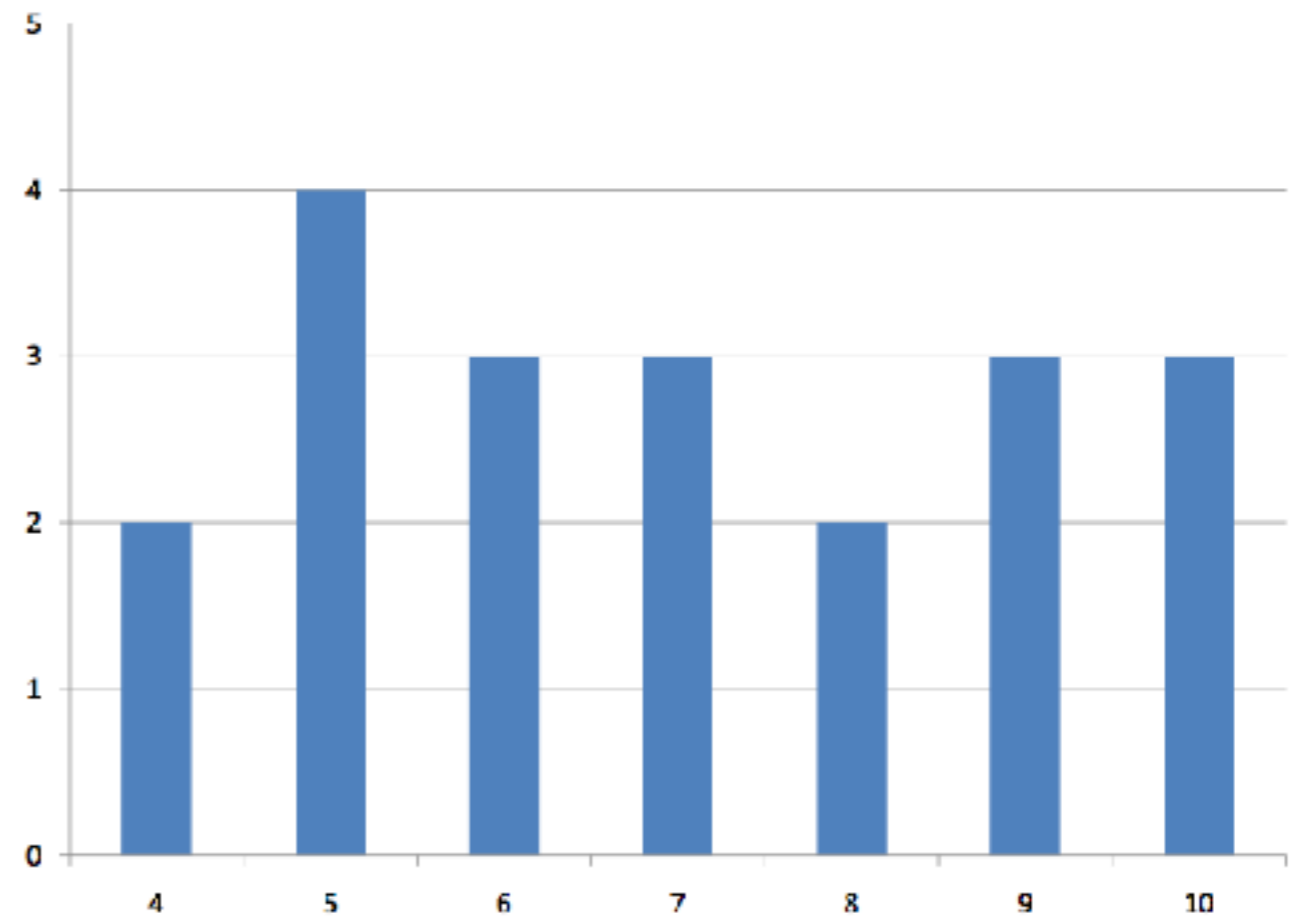
What is Variability

Measures of Variability

Quiz 1



Quiz 2



Measures of Variability



Range

Measures of Variability

Interquartile Range

$$\text{IQR} = 75\text{th percentile} - 25\text{th percentile}$$

Measures of Variability



Variance

Calculation of variance for Quiz 1

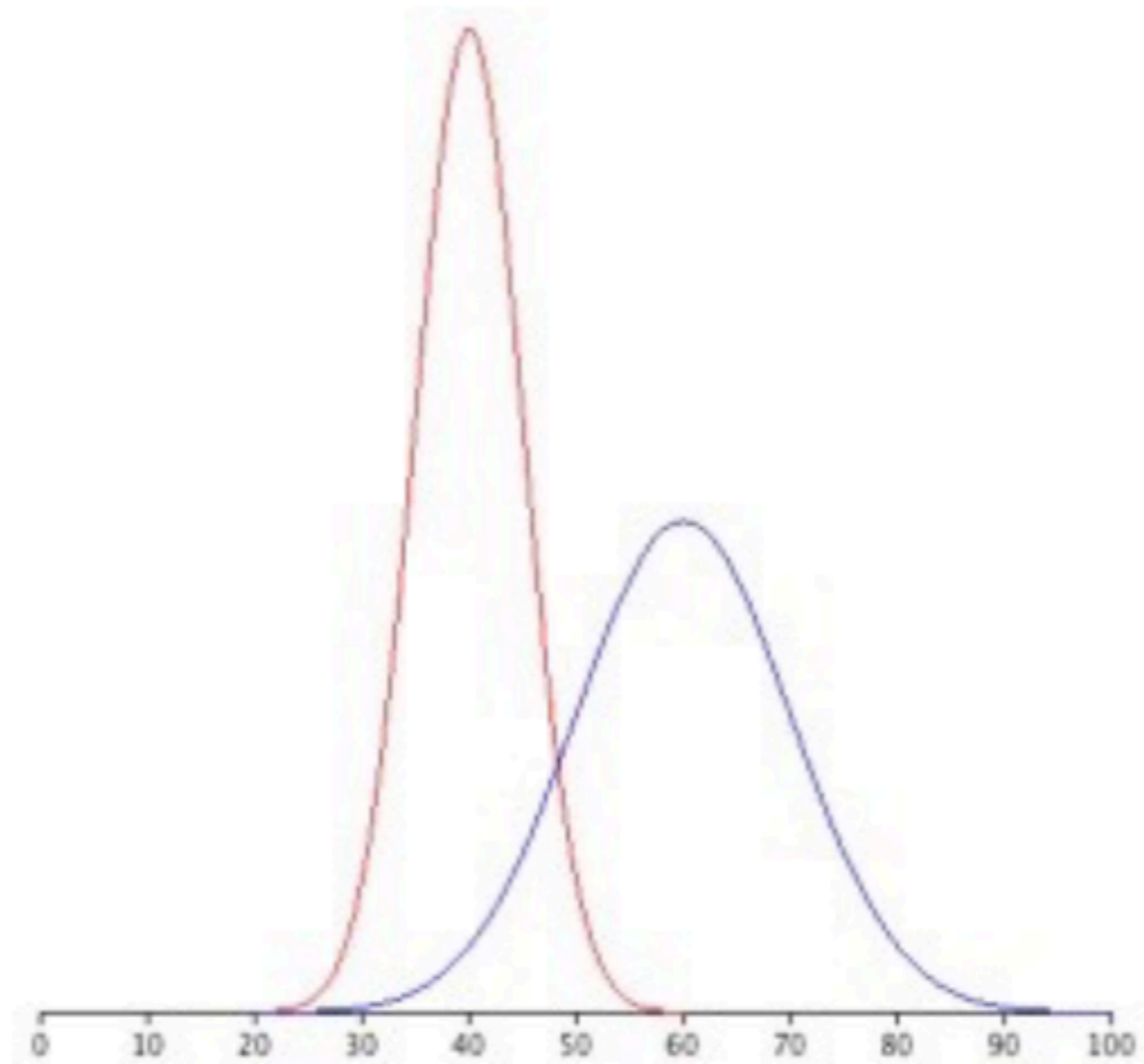
Scores	Deviation from Mean	Squared Deviation
9	2	4
9	2	4
9	2	4
8	1	1
8	1	1
8	1	1
8	1	1
7	0	0
7	0	0
7	0	0
7	0	0
7	0	0
6	-1	1
6	-1	1
6	-1	1
6	-1	1
6	-1	1
6	-1	1
5	-2	4
5	-2	4
Means		
7	0	1.5

$$\sigma^2 = \frac{\sum(X - \mu)^2}{N}$$

Calculation of variance for Quiz 1

$$s^2 = \frac{\sum(X - M)^2}{N - 1}$$

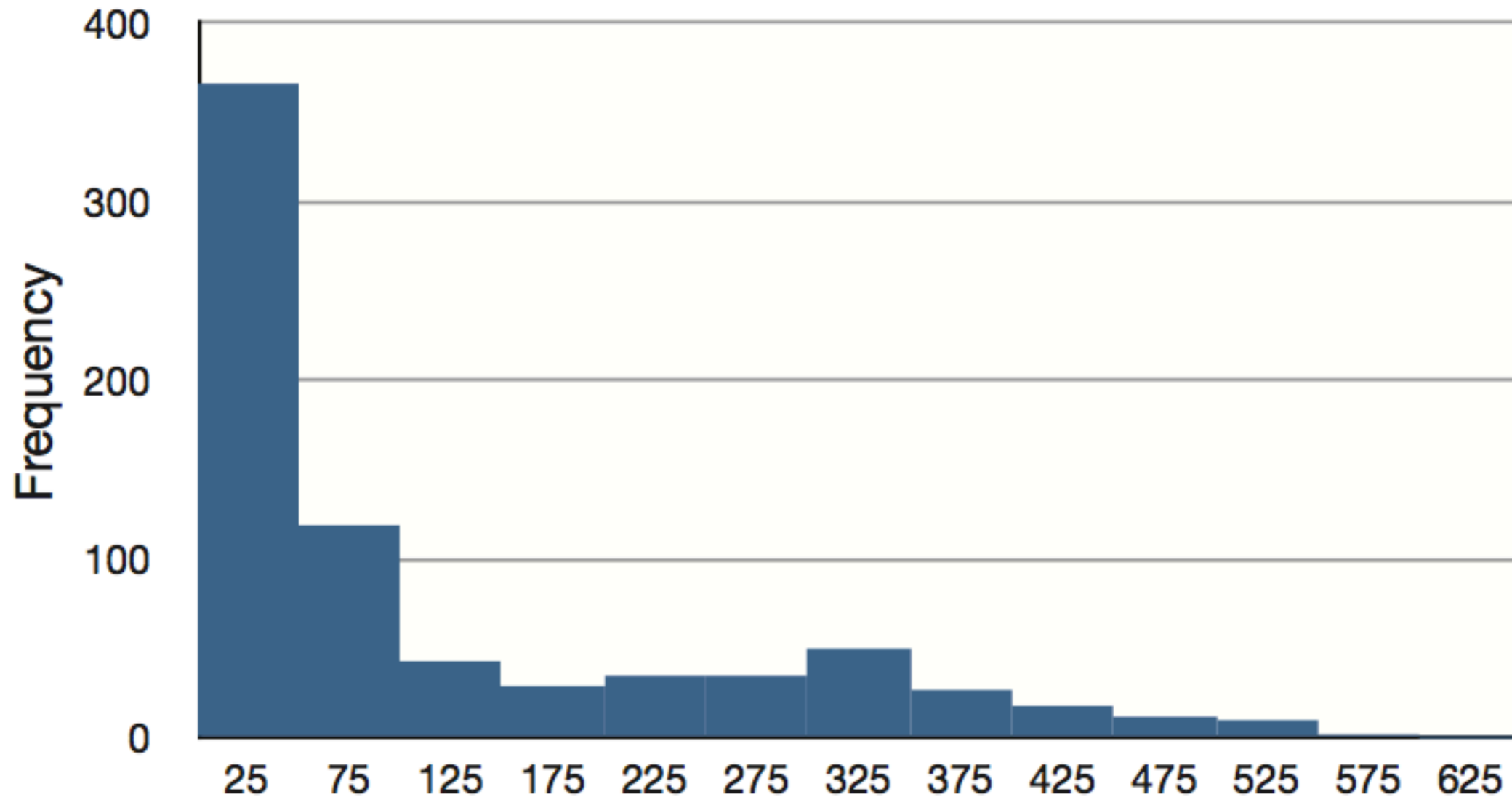
Standard deviation



Normal distributions with standard deviations of 5 and 10

Shapes of Distributions

Skew



A distribution with a very large positive skew. This histogram shows the salaries of major league baseball players (in thousands of dollars).

Shapes of Distributions

Skew

$$\frac{3(\text{Mean} - \text{Median})}{\sigma}$$

Shapes of Distributions

Skew

$$\sum \frac{(X - \mu)^3}{\sigma^3}$$

Shapes of Distributions

Kurtosis

$$\sum \frac{(X - \mu)^4}{\sigma^4} - 3$$

Variance Sum Law I

$$\sigma_{sum}^2 = \sigma_M^2 + \sigma_F^2$$

Variance Sum Law I

$$\sigma_{\textit{difference}}^2 = \sigma_M^2 + \sigma_F^2$$

Variance Sum Law I

$$\sigma_{X \pm Y}^2 = \sigma_X^2 + \sigma_Y^2$$

Happy Statistics

the end