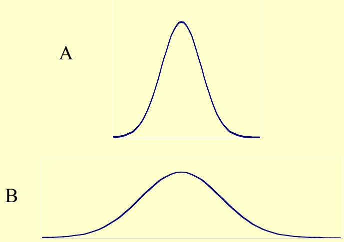
Psychological Statistics

Measures of Variability

What We Will Cover in This Section

- What variability is.
- Range.
- Interquartile range.
- Variance and Standard deviation.

Two Normal Distributions with the Same Mean



Overview

The Mean describes the 'typical' score; measures of variability show how much the rest of the scores in the distribution are spread out around the mean.

Range

- The distance between the lowest and highest score.
- Formula

  Range = Highest Score – Lowest Score
- Example

1	3	4	6	8	12	15	16	18	19
1	3	4	6	8	12	15	16	18	79

Properties of the Range

1. Gross descriptive statistic.
2. Highly sensitive to extreme scores.
3. Relatively unstable.
4. Insensitive to the shape of the distribution between the two scores.

Range Assumptions

1. Scores represent interval or ratio scales.

Semi-Interquartile Range

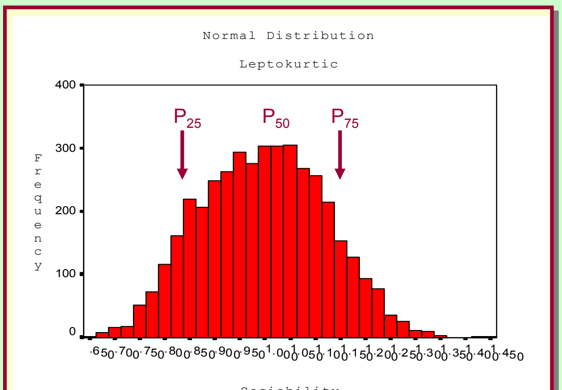
- Computation

$$Interquartile\ Range\ (IQ) = P_{75} - P_{25}$$

$$Semi-Interquartile\ Range(SIQ) = \frac{P_{75} - P_{25}}{2}$$

- Interpretation

  The distance between the middle 50% of the scores.



Interquartile Range: Properties

1. Not sensitive to extreme scores.
2. Relatively stable.
3. Does not consider the shape of the distribution.
4. Ignores all but two of the scores.

Interquartile Range Assumptions

1. Scores represent interval or ratio scales.

Deviation Score

	Score	$X - \overline{X}$	$(X - \overline{X})^2$
	5	-2.5	6.25
	6	-1.5	2.25
	7	-.5	.25
	8	.5	.25
	9	1.5	2.25
	10	2.5	6.25
Sum	45	0	**17.50**
Mean	7.5		**2.92**

Sum of Squares

Sum of Squares

Sum of the squared deviation scores around the mean.

$$SS = \sum (X - \overline{X})^2$$

Variance

Mean squared deviation score

Sample Formula

$$S_X^2 = \frac{\Sigma\left(X - \overline{X}\right)^2}{N}$$

Population Formula

$$s_X^2 = \frac{\Sigma\left(X - \overline{X}\right)^2}{N - 1}$$

Degrees of freedom (df)

Standard Deviation

Square root of the variance.

Sample Formula

$$S_X = \sqrt{\frac{\Sigma\left(X - \overline{X}\right)^2}{N}}$$

$$S_X = \sqrt{S_X^2}$$

Population Formula

$$s_X = \sqrt{\frac{\Sigma\left(X - \overline{X}\right)^2}{N - 1}}$$

$$s_X = \sqrt{s_X^2}$$

Population Parameters

Statistic	Sample	Sample (used to estimate the population)	Population symbol
Variance	S^2	s^2	σ^2
Standard Deviation	S	s	σ

Properties of the Standard Deviation

1. Sensitive to the location of each score in the distribution.
2. Sensitive to extreme scores.
3. Resistant to sampling fluctuation.
4. Is used in most higher order statistical computations.

Assumptions

1. The variables are measured on an interval or ratio scale.
2. There are no outliers in the distribution.

Interpretation and Use

- How much difference is there in a set of scores.
  - Are the scores similar?
- Provides input to other statistical procedures.

Key Learning Points, Part 1

1. The *Range* is a rough estimate of variability.
2. The *Variance* represents the mean squared deviation score.
3. The *Standard Deviation* is the square root of the variance.
4. The higher the standard deviation the more spread out the scores will be.

Key Learning Points, Part 2

5. S is the symbol used to represent the sample standard deviation.
6. s^2 is the unbiased estimate of the population variance σ^2.
7. s is the unbiased estimate of the population standard deviation σ.


THE END
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