Measurement Types
Dispersion

PIERIAN DATA

Measures of Dispersion (range, variance, standard deviation)

9 10 11 13 15 16 19 19 21 23 28 30 33 34 36 39

- In this sample the mean is 22.25
- How do we describe how “spread out” the sample is?

Range

9 10 11 13 15 16 19 19 21 23 28 30 33 34 36 39

$$Range = max - min$$

$$= 39 - 9$$

$$= 30$$

Variance

- Calculated as the sum of square distances from each point to the mean
- There's a difference between the SAMPLE variance and the POPULATION variance
- subject to Bessel's correction ($n-1$)

Variance

SAMPLE VARIANCE: $$s^2 = \frac{\Sigma(x-\bar{x})^2}{n-1}$$

POPULATION VARIANCE: $$\sigma^2 = \frac{\Sigma(X-\mu)^2}{N}$$

Sample Variance

$$s^2 = \frac{\Sigma(x - \bar{x})^2}{n - 1}$$

4 7 9 8 11

$$\bar{x} = \frac{4 + 7 + 9 + 8 + 11}{5} = \frac{39}{5} = 7.8$$

sample mean

$$s^2 = \frac{(4-7.8)^2+(7-7.8)^2+(9-7.8)^2+(8-7.8)^2+(11-7.8)^2}{5-1}$$

$$= 6.7$$

sample variance

Standard Deviation

- square root of the variance
- benefit: same units as the sample
- meaningful to talk about

> *"values that lie within one standard deviation of the mean"*

Sample Standard Deviation

$$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$$

Sample:

4 7 9 8 11

$$\bar{x} = \frac{4 + 7 + 9 + 8 + 11}{5} = \frac{39}{5} = 7.8$$

sample mean

$$s = \sqrt{\frac{(4 - 7.8)^2 + (7 - 7.8)^2 + (9 - 7.8)^2 + (8 - 7.8)^2 + (11 - 7.8)^2}{5 - 1}}$$

$$= \sqrt{6.7} = 2.59$$

sample standard deviation

PIERIAN DATA

Population Standard Deviation

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

Population:

4	7	9	8	11

$$\mu = \frac{4+7+9+8+11}{5} = \frac{39}{5} = 7.8$$

population mean

$$\sigma = \sqrt{\frac{(4-7.8)^2 + (7-7.8)^2 + (9-7.8)^2 + (8-7.8)^2 + (11-7.8)^2}{5}}$$

$$= \sqrt{5.36} = 2.32$$

population standard deviation