Stat 104 – Lecture 6

Summary Measures

- Dispersion or spread
  - Sample range
  - Sample mean absolute deviation
  - Sample standard deviation

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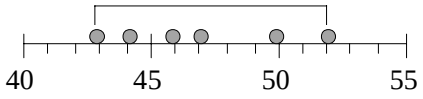
9-hole Golf Scores

46, 44, 50, 43, 47, 52

Sample Range = maximum – minimum
= 52 – 43 = 9 strokes



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Measures of Spread

- Based on the deviation from the sample mean.
- Deviation from the mean:

$$\left(y - \bar{y}\right)$$

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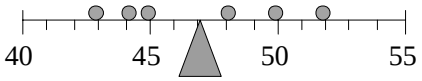
9-hole Golf Scores

45, 44, 50, 43, 48, 52

$$\bar{y} = \frac{282}{6} = 47 \text{ strokes}$$



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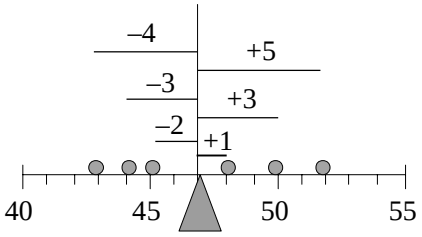
Deviations from the Mean



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Sample Mean Absolute Deviation

$$MAD = \frac{\left(\sum |y - \bar{y}|\right)}{n}$$

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Sample Mean Absolute Deviation

$$MAD = \frac{(\mathbf{4+3+2+5+3+1})}{\mathbf{6}} = \frac{\mathbf{18}}{\mathbf{6}}$$

$$MAD = \mathbf{3.0\ strokes}$$

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Sample Variance

Almost the average squared deviation

$$s^2 = \frac{\left(\sum (y-\bar{y})^2\right)}{n-1}$$

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Sample Variance: Golf Scores

$$s^2 = \frac{(\mathbf{16+9+4+25+9+1})}{\mathbf{5}} = \frac{\mathbf{64}}{\mathbf{5}}$$

$$= \mathbf{12.8\ strokes^2}$$

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Sample Standard Deviation: Golf Scores

$$s = \sqrt{s^2} = \sqrt{\frac{\left(\sum (y - \bar{y})^2\right)}{n - 1}}$$

$$s = \sqrt{12.8} = 3.58 \text{ strokes}$$

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Sample Standard Deviation: Body Mass of *Canidae*

$$s = \sqrt{s^2} = \sqrt{\frac{\left(\sum (y - \bar{y})^2\right)}{n - 1}}$$

$$s = \sqrt{64.36} = 8.02 \text{ kg}$$

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Standard Score

Look at the number of standard deviations the score is from the mean.

$$z = \frac{y - \bar{y}}{s}$$

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Summary Measures

- Position
  - Sample quartiles
    - Five number summary
    - Sample interquartile range
    - Box and whiskers plot

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Sample Quartiles

- Medians of the lower and upper halves of the data.
- Trying to split the data into fourths, quarters.

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Sample Quartiles

Body Mass (kg) of *Canidae*

0 | **1,3,3,3,4,4,4** ← Q_1= (4+5)/2
0* | **5,5,5,5,5,5,6,6**,6,7,8,9,9 = 4.5 kg
1 | 0,0,1,2,3
1* |
2 | 2,3 ← Q_3= (10+11)/2
2* | 5 = 10.5 kg
3 |
3* | 6

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Measure of Spread

- InterQuartile Range (IQR)
  - The distance between the quartiles.
    IQR = 10.5 – 4.5 = 6 kilograms
  - The length of the interval that contains the central 50% of the data.

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Five Number Summary

- Minimum 1 kilogram
- Q_1 4.5 kilograms
- Median 6 kilograms
- Q_3 10.5 kilograms
- Maximum 36 kilograms

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Box Plot

- Establish an axis with a scale.
- Draw a box that extends from Q_1 to Q_3.
- Draw a line from the Q_1 to the minimum and another line from the Q_3 to the maximum.

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Outlier Box Plots

- Establishes boundaries on what are "usual" values based on the width of the box.
- Values outside the boundaries are flagged as potential outliers.

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