

**Author: Alina Prynkevych**

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## 3.1 Outliers

1) Greater than  $65 + 1.5 \times (65 - 50) = 87.5\%$

Smaller than  $50 - 1.5 \times (65 - 50) = 27.5\%$

a)  $12\% < 27.5\% \therefore$  outlier

b)  $27.5\% < 71\% < 87.5\% \therefore$  not an outlier

c)  $90\% > 87.5 \therefore$  outlier

2)  $6.2 \times 2 = 12.4$

Upper bound:  $14.5 + 12.4 = 26.9$

Lower bound:  $14.5 - 12.4 = 2.1$

a) 12.5 lies between bounds (2.1 and 26.9)  $\therefore$  not an outlier

b) 27.1 greater than the upper bound (26.9)  $\therefore$  outlier

c) 26.9 equal to the upper bound  $\therefore$  not an outlier

3)  $Sd = \sqrt{0.04} = 0.2$

(2)  $Sd = 0.2 \times 2 = 0.4$

Upper bound =  $1.5 + 0.4 = 1.9\text{ m}$

Lower bound =  $1.5 - 0.4 = 1.1\text{ m}$

a) 2.1 is greater than the upper bound  $\therefore$  it is an outlier

b) smallest length 1.1 m

largest length 1.9 m

c) NO: it could be legitimate data value, for example a very mature adult snake

$$4) IQR = 46 - 22 = 24$$

$$a) (1.5 \times 24) + 46 = 82 \text{ (maximum age)}$$

$$22 - (1.5 \times 24) = -14 \text{ (ages can't be negative } \therefore \text{ min age is } 0)$$

b) There are people that live to be 103 years old

$$5) a) \sigma^2 = \frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2 \quad \text{mean} = \frac{\sum x}{n}$$

$$\sigma^2 = \frac{2438}{10} - \left(\frac{154}{10}\right)^2 \quad \text{mean} = \frac{154}{10}$$

$$\sigma^2 = 6.64 \quad \text{mean} = 15.4$$

$$\sigma = 2.58 \text{ (3 sf)}$$

$$b) 2sd = 2(2.58)$$

$$2sd = 5.16$$

$$\text{Upper bound: } 15.4 + 5.16 = 20.56$$

$$\text{Lower bound: } 15.4 - 5.16 = 10.24$$

21 is an outlier because it is greater than 20.56

c) 21 is abnormal age for a secondary school student.

d)

$$\text{mean} = \frac{154 - 21}{10 - 1}$$

$$\text{mean} = 14.78$$

$$= 14.8 \text{ (3 sf)}$$

$$\sigma^2 = \frac{2438 - 21^2}{10 - 1} - (14.78)^2$$

$$\sigma^2 = 2.848$$

$$\sigma = 1.69 \text{ (3 sf)}$$

$$6) a) \bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{346.7}{12}$$

$$\bar{x} = 28.89$$

$$= 28.9 \text{ (3 sf)}$$

$$\sigma = \sqrt{\frac{\sum x^2}{n} - (\bar{x})^2}$$

$$\sigma = \sqrt{\frac{10335.41}{12} - (28.89)^2}$$

$$\sigma = 5.15 \text{ (3 sf)}$$

b) upper bound -  $28.9 + 2(5.15) = 39.2^{\circ}\text{C}$

lower bound -  $28.9 - 2(5.15) = 18.6^{\circ}\text{C}$

1)  $18.5^{\circ}\text{C} < 18.6^{\circ}\text{C}$

2)  $42.6^{\circ}\text{C} > 39.2^{\circ}\text{C}$

c)  $18.5$  no, it could just be a very cold day.

$42.6$  yes, it is an extreme value that does not fit the data.

d)  $\bar{x} = \frac{\sum x}{n}$

$$\bar{x} = \frac{346.7 - 42.6}{12 - 1}$$

$$\bar{x} = 27.64$$

$$= 27.6 \text{ (3sf)}$$

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

$$s = \sqrt{\frac{10335.41 - (42.6)^2}{12 - 1} - (27.6)^2}$$

$$s = 3.58 \text{ (3sf)}$$

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