Linear transformation effects

$Var = s^2$

$$x_{new} = a + bx$$

Mean: $a + b\bar{x}$

St. Dev.: bs

Median: $a + bM$

Variance: $(bs)^2 = b^2 s^2 = b^2 Var$

Q1: $a + bQ_1$

Range: b range

Q3: $a + bQ_3$

IQR: b IQR

<u>Example</u>: You add 5 to every observation. How does your mean change? St. deviation? Variance?

$$X_{new} = 5 + X$$

$$\bar{X}_{new} = 5 + \bar{X}$$

$$S_{new} = S$$

$$Var = Var$$

What if you multiply by 3?

$$X_{new} = 3X$$

$$\bar{X}_{new} = 3\bar{X}$$

$$S_{new} = 3S$$

$$Var_{new} = 9\,Var$$

What about the correlation? If you have two variables, *x* and *y*, and you change the units of measurement for them, will the correlation change?

$$r = \frac{1}{n-1}\sum \frac{x_i-\bar{x}}{s_x}\cdot\frac{y_i-\bar{y}}{s_y}$$ does not change

Which measures are more resistant (which would you use if you had outliers in your data)?

Mean: No

St. Dev.: No

Median: ✓

Variance: No

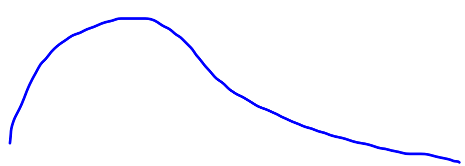
Q1: ✓

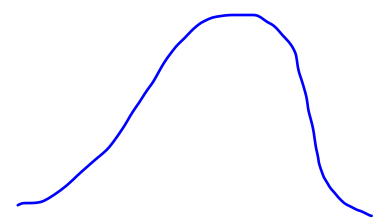
Range: No

Q3: ✓

IQR: ✓

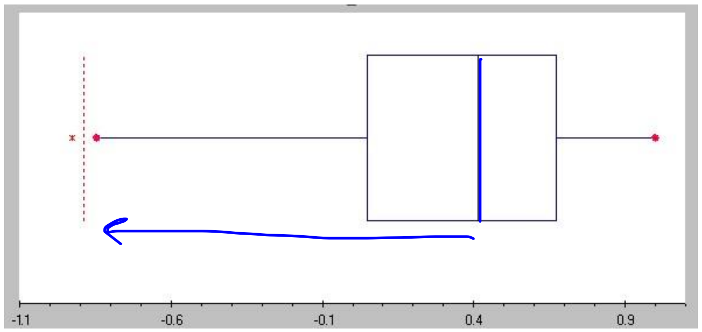
M, IQR





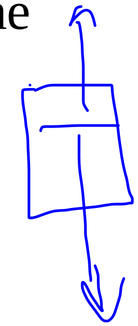
Mean
St. dev

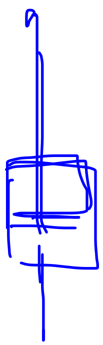
Example: For the given boxplots decide whether the distribution of values is normal, skewed to the left, or skewed to the right, and estimate the value of the mean in relation to the median.



skewed to the left

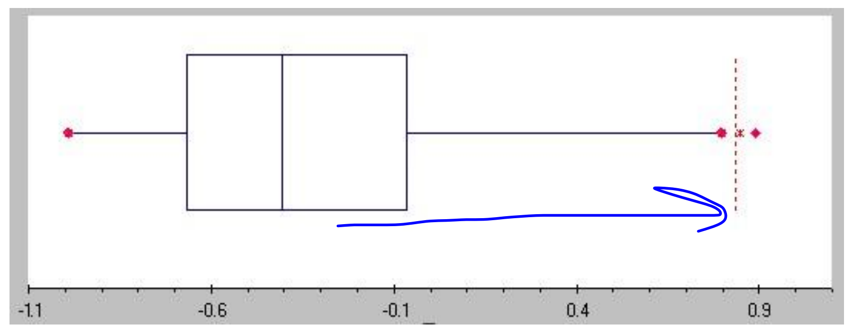
mean < median



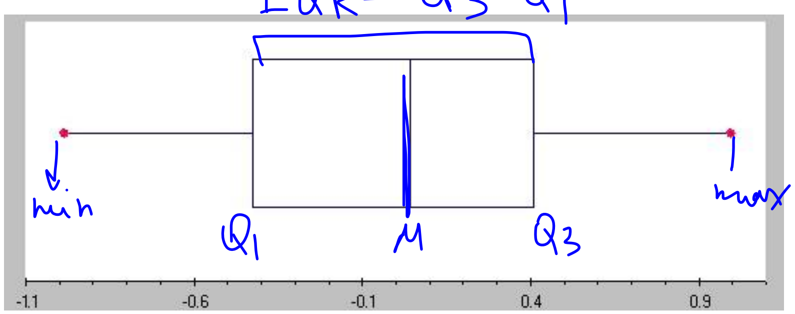


skewed to the right

mean > median



IQR = Q3 − Q1

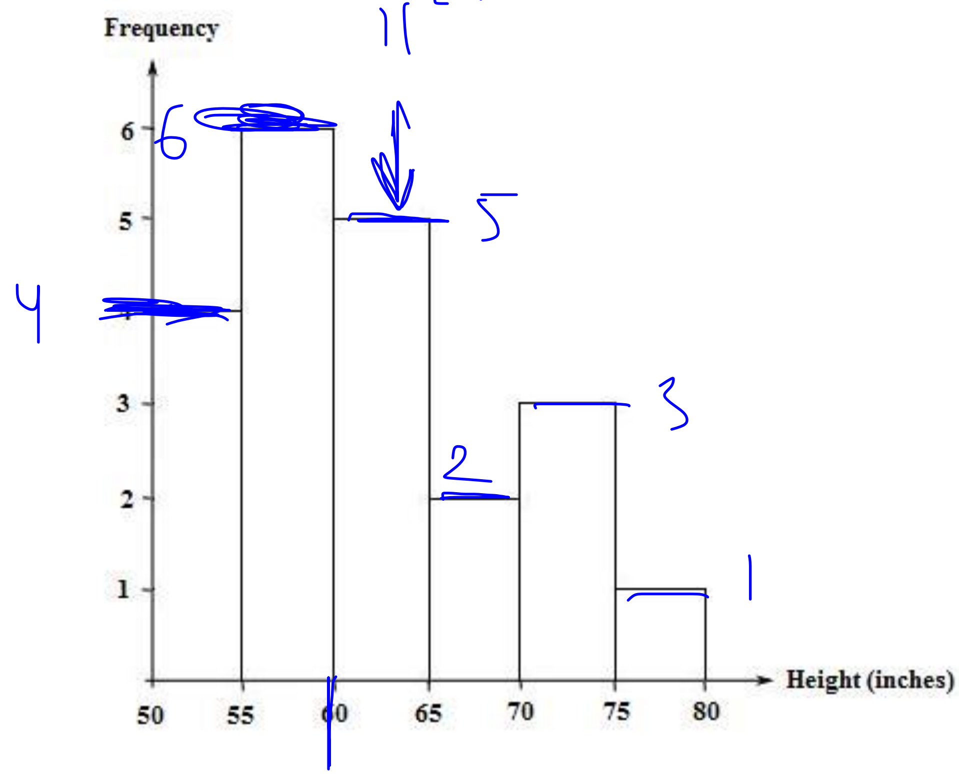


symmetric

mean ≈ median

Example: The histogram shows the heights of 21 students in a class, grouped into 5-inch groups. What percent of students were greater than or equal to 60 inches tall? What can you say about the median for these data?

11th



$5+2+3+1$

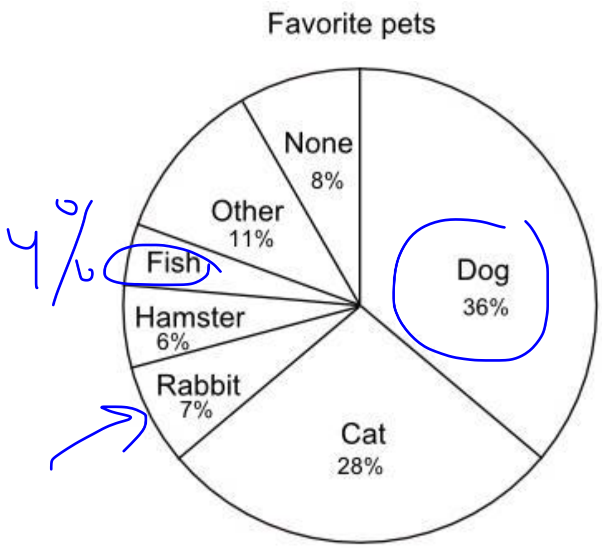
$= 11$

$11/21 \approx 0.52$

52%

$60 \le \text{Median} \le 65$

Example: Anna did a survey where she asked all the children in her school to name their favorite pet. The results are shown in the pie chart:



$$100\% - 11 - 8 - 36 - 28 - 7 - 6$$

$$= 100\% - 96\% = 4\%$$

(a) If there were 800 children in the school, how many said their favorite pet was Fish?

$800 - 100\%$

$x - 4\%$

$$x = \frac{800 \cdot 4}{100} = 32$$

(b) If 720 children said their favorite pet was a Dog, how many children said their favorite pet was a Rabbit?

$720 - 36\%$

$x - 7\%$

$$x = \frac{720 \cdot 7}{36} = 140$$