

## Scotland's Highland Games

*Stone Throws: Mean, Median, Mode, Range, and M.A.D.*

The Highland Games are a centuries-old sporting event and festival that celebrate Scottish heritage. Games are based on unique aspects of life in the Scottish Highlands, such as bagpipe playing, dancing, and drumming. Some of the most popular competitions are the heavy athletics involving kilted contestants contending in demonstrations of athleticism and strength. There are many heavy athletic events like the *caber toss*, the *bar and sheaf toss*, *stone put* and *Scottish hammer throw*.

**Part 1** Fiona and Sophie are practicing in the *stone put* at the Highland Games. This entails hurling an 8- to 18-pound stone as far as possible. During practice, both competitors throws the 10-pound stone in the following distances (in feet):

### Fiona

5	10	10	10	10	12	15	20	20	25	30	30
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### Sophie

8	10.5	10.5	12	12	12	15	18	20	25	28	35
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- a. Find the mean of Fiona's stone throws:

$$\frac{5+10+10+10+10+12+15+20+20+25+30+30}{12} = \frac{197}{12} = 16.42 \text{ ft}$$

- b. Find the median of Fiona's stone throws:

$$\frac{12+15}{2} = \frac{27}{2} = 13.5 \text{ ft}$$

- c. Find the mode and range of Fiona's stone throws:

**Mode 10 ft; Range: 30-5= 25ft**

- d. Find the mean of Sophie's stone throws:

$$\frac{8+10.5+10.5+12+12+12+15+18+20+25+28+35}{12} = \frac{206}{12} = 17.16 \text{ ft}$$

- e. Find the median of Sophie's stone throws:

$$\frac{12+15}{2} = \frac{27}{2} = 13.5 \text{ ft}$$

- f. Find the mode and range of Sophie's stone throws:

**Mode 12 ft; Range: 35-8= 27ft**

**Part 2:** Compare the two competitors.

- a. Compare the two means. Which stone thrower has a longer distance when comparing the means?

*Fiona's average throw is 16.42 ft, whereas Sophie's average throw is 17.16 ft. Sophie's throw is a longer distance on average (and actual data)*

- b. Compare the medians. Which stone thrower has a longer distance when comparing the medians?

*Fiona's and Sophie's median throw is 13.5 ft. Fiona and Sophie had equivalent medians.*

- c. Looking at Fiona's stone throws, which number(s) affect the mean, but not the median?

*Fiona's stone throw of 5 ft affects her mean since it is a very low number compared to the rest of her throws. In calculating the median, the numbers on the left and right of the number in the middle or omitted, making 5 ft irrelevant.*

**Part 3:** Using the Mean Absolute Deviation (MAD), find out the following information:

- a. Find the Mean Absolute Deviation (MAD) of Fiona and Sophie's stone throws.

Fiona: Mean Absolute Deviation (MAD)				Sophie: Mean Absolute Deviation (MAD)			
Data	Mean	Difference	Abs Value	Data	Mean	Difference	Abs Value
5	16.42	-11.42	11.42	8	17.16	-9.16	9.16
10	16.42	-6.42	6.42	10.5	17.16	-6.66	6.66
10	16.42	-6.42	6.42	10.5	17.16	-6.66	6.66
10	16.42	-6.42	6.42	12	17.16	-5.16	5.16
10	16.42	-6.42	6.42	12	17.16	-5.16	5.16
12	16.42	-4.42	4.42	12	17.16	-5.16	5.16
15	16.42	-1.42	1.42	15	17.16	-2.16	2.16
20	16.42	3.58	3.58	18	17.16	0.84	0.84
20	16.42	3.58	3.58	20	17.16	2.84	2.84
25	16.42	8.58	8.58	25	17.16	7.84	7.84
30	16.42	13.58	13.58	28	17.16	10.84	10.84
30	16.42	13.58	13.58	35	17.16	17.84	17.84
		Sum:	85.84			Sum:	80.32
		Count:	12			Count:	12
		M.A.D.=	7.15			M.A.D.=	6.69

- b. What does the MAD tell you about each set of data?

*The mean absolute deviation tells the average of each data from the mean. Fiona's MAD is 7.15ft, whereas Sophie's MAD is 6.69ft. This means that Fiona's average distance from her average is greater than Sophie's by 0.46 (7.15-6.69). This shows that Fiona is a bit more consistent with her throws on average than Sophie.*

- c. Overall, which measure of center best describes travel time to work, the mean or the median?

*Why? The mean is the best measure of center. In this scenario, the mean shows the variation between the distances better than the median. Since the medians are the same, the median can be deceiving in thinking that the travel times are equivalent for each stone thrower.*