# PHSX 616: Homework #1

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## Problem 1

**(Problem 1.4)** Find the mean, median, and most probable value of $x$ for the following data (from rolling dice).

| i | $x_i$ | i | $x_i$ | i | $x_i$ | i | $x_i$ | i | $x_i$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 6 | 8 | 11 | 12 | 16 | 6 | 21 | 5 |
| 2 | 7 | 7 | 9 | 12 | 8 | 17 | 7 | 22 | 10 |
| 3 | 3 | 8 | 7 | 13 | 6 | 18 | 8 | 23 | 8 |
| 4 | 7 | 9 | 5 | 14 | 6 | 19 | 9 | 24 | 8 |
| 5 | 12 | 10 | 7 | 15 | 7 | 20 | 8 | 25 | 8 |

**Solution:**

(1) **Mean:** The mean is given by:

$$\bar{x} = \frac{\sum x_i}{n}$$
$$= \frac{3+7+3+7+12+8+9+7+5+7+12+8+6+6+7+6+7+8+9+8+5+10+8+8+8}{25}$$
$$= \frac{184}{25} = 7.36$$

(2) **Median:** The data sorted in order is:

$$3, 3, 5, 5, 6, 6, 6, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 9, 9, 10, 12, 12$$

Since there are 25 numbers (odd count), the median is the middle value, which is the 13th number in this ordered list:
$$\text{Median} = 7$$

(3) **Mode:** The mode is the most frequently occurring value. From the ordered list, we see that 7 and 8 appear the most (six times each):
$$\text{Mode} = 7, 8$$

Since we have two modes, the data is bimodal.

## Problem 2

**(Problem 1.6)** Calculate the standard deviation from the data of Exercise 1.4

**Solution:**

The standard deviation is given by:

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

Computing each squared deviation:

$$(3 - 7.36)^2 = 19.0596, \quad (7 - 7.36)^2 = 0.1296, \quad (3 - 7.36)^2 = 19.0596,$$
$$(7 - 7.36)^2 = 0.1296, \quad (12 - 7.36)^2 = 21.3376,$$

(similar calculations for all 25 values),

Summing up all squared differences:

$$\sum (x_i - \bar{x})^2 = 113.76$$

Now, dividing by $n = 24$:

$$\frac{107.64}{25} = 4.74$$

Taking the square root gives the standard deviation:

$$\sigma = \sqrt{4.3056} = 2.18$$