Empirical Rule

- Applies to normal distributions
- Almost all data will fall within three standard deviations of the mean

Empirical Rule Example

Data from a sample of a larger population

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Mean = \( \bar{x} = 0.08 \)

Standard Deviation = \( s = 1.77 \) (sample)
Your Turn

Revisit the data you collected during the Fling Machine Instant Challenge.

- Assume that you repeated launch cotton balls with your device. Using the mean and sample standard deviation of your data:
  - Predict the range of travel distances within which 68% of cotton balls would fall
  - Predict the range of travel distances within which 95% of cotton balls would fall

Example

Assume that a statistical analysis resulted in the following:

- Mean = \( \bar{x} = 2.35 \text{ ft} \)
- Sample standard deviation = \( s = 0.76 \text{ ft} \)

- Predict the range of travel distances within which 68% of cotton balls would fall
  \[ \bar{x} \pm s = 2.35 - 0.76 = 1.59 \text{ ft} \]
  \[ 2.35 + 0.76 = 3.26 \text{ ft} \]

Prediction: Approximately 68% of the launches will result in a travel distance between 1.59 ft and 3.26 ft.
Example

Assume that a statistical analysis resulted in the following:

- Mean = \( \bar{x} = 2.35 \text{ ft} \)
- Sample standard deviation = \( s = 0.76 \) ft

Predict the range of travel distances within which 95% of cotton balls would fall:

\[ \bar{x} \pm 2s : \ 2.35 - 2(0.76) = 0.83 \text{ ft} \]
\[ 2.35 + 2(0.76) = 3.87 \text{ ft} \]

Prediction: Approximately 95% of the launches will result in a travel distance between 0.83 ft and 3.86 ft.