Warm Up

Construct a dotplot of the data set for class height in inches.

Using a calculator, find the mean and standard deviation for the distribution of the class’ height.

\[ \overline{X} = 60.6 \quad s_x = 4.5 \]

Main Ideas/Questions

Notes

The **percentile** of a data value tells us what percent of the observations fall **less than** or equal to it.

The lowest score is in the **1st** percentile. There is not a **0** percentile.

The highest score is in the **99th** percentile. There is not a **100th** percentile.

Examples

Calculate the percentile for the following heights using the dotplot above.

1) 67 inches
   
   \[ \frac{23}{28} \cdot 100 = 82^{nd} \text{ percentile} \]

2) 62 inches
   
   \[ \frac{5}{28} \cdot 100 = 18^{th} \text{ percentile} \]

3) 82 inches
   
   \[ \frac{28}{28} \cdot 100 = 100^{th} \text{ percentile} \]

4) 60 inches
   
   \[ \frac{1}{28} \cdot 100 = 4^{th} \text{ percentile} \]

**Formula for Qntile**

\[
\text{\# less than or equal to } \frac{1}{\text{total}}
\]

**Percentile**

1) 60\(^{th}\) percentile for a height of 66 inches
   
   60\% of the observations are 66 inches or shorter

2) 25\(^{th}\) percentile for test score of 30%.
   
   25\% of the observations are 30\% or less


**Main Ideas/Questions**

Z-Score

**Notes**

Recall: **Standard deviation** is a measure of spread. It shows on average how far the data is from the mean.

A **z-score** shows how many **standard deviations** a data point is from the mean.

A z-score is sometimes called a **standardized** value.

A positive z-score is **above** the mean, and a negative z-score is **below** the mean.

A z-score is typically between **-3** and **3**.

**Formula**

\[
Z = \frac{x - \bar{x}}{s_x}
\]

- **Z = 0** is the mean
- **X**: data value
- **\(\bar{x}\)**: mean
- **S_x**: standard deviation

**Examples**

Calculate the z-score for the following heights using the mean and standard deviation above.

1) 67 inches

\[
Z = \frac{67-60.0}{4.5} = 0.22
\]

2) 62 inches

\[
Z = \frac{62-60.0}{4.5} = -0.89
\]

3) 82 inches

\[
Z = \frac{82-60.0}{4.5} = 3.56 \text{ * unusual}
\]

**Explain in words what it means to have a z-score of...**

1) **Z=2.5** for a height of 75 inches

75 in is 2.5 standard deviations **above** the mean. (\(+\): above)

**Exploration**

1) Ava scores an 85 on her biology test. The distribution of biology scores have a mean of 82 and a standard deviation of 2. Ava takes a physical science test and scores a 90 with a class mean of 96 and standard deviation of 3. Which test did she perform better in comparison to her classmates? Explain.

**Biology**

\[
Z = \frac{85-82}{2} = -1.5
\]

**Phys. Sci.**

\[
Z = \frac{90-96}{3} = -2
\]

The **z-score is higher** in the physical science test.