**Chapter 5 The Standard Deviation as a Ruler and the Normal Model**

Where are we going?

How do we measure things when they are on different scales?

We need to standardize results

Base value for comparison (usually the mean)

How far away from mean -> standard deviation

Example: 2008 Olympics – heptathlon (7 track & field events)

Combined into one score

1st player – long jump 6.63m

2nd player – 200m 23.21sec which performance deserves more points?

Another example: A college applicant scores 1500 on her SAT. Another applicant presents her ACT score of 21. Which candidate scored better?

Expressing the distances or scores as values measuring how far they are away from their respective means **standardizes** the values

**z-score =  or**

When we standardize data to get z-scores

1. We shift the data (by subtracting the mean)
2. We rescale the data (by dividing by the std. dev.)

Shifting the data by adding (or subtracting) a constant value will increase (or decrease) all measure of position (center, percentiles, min, max) by the same constant but the shape of the distribution and measures of spread do not change.

Rescaling the data by multiplying (or dividing) all the data values by any constant -> all measures of position and measures of spread are multiplied (divided) by that constant.

A z-score gives an indication of how “unusual” a data value is by indicating how far away the value is from the mean. The farther away, the more “unusual” it is.

Standardizing into z-scores

* Does not change the shape of the distribution
* Changes the center by making it 0
* Changes the spread by making the standard deviation 1

Normal model 🡪 bell-shaped distribution, parameters are µ and .

Standard Normal model 🡪 bell-shaped distribution, parameters are 0 and 1.



“Approximation Method”: 68 – 95 – 99.7 Rule used to get approximate percentages

“Exact Method”: Using the Normal table (or calculator) for exact percentages

Reading the table “forward” -> know data value, need to find area/proportion;

Reading the table “backward” -> know the area/proportion, need to find the data value

Normal Probability Plots

If the distribution of the data is roughly normal (make a histogram to see), then the Normal probability plot will roughly be a straight line (computers are usually used to do this).