Section 2.5 - Measures of Position

1. Example: Number of touchdown passes thrown by Dan Marino per season (83-99)

20	48	30	44	26	28	24	21	25	24
8	30	24	17	16	23	12			

2. Measuring spread: Determining **Quartiles**
   - Arrange the obervations in increasing order
   - The **Median** (M) is the **Second quartile**. About half of the data falls below/above.
   - **First quartile** Q_1 is the median of the ordered list to the left of the overall median (larger than 25% of the observations)
   - **Third quartile** Q_3 is the median of the ordered list to the right of the overall median (larger than 75% of the observations)
   - The **interquartile range (IQR)** of a data set = $Q_3 - Q_1$.
   - **Five-number summary**: Minimum, Q_1, M, Q_3, Maximum
3. Example: Determine the five-number summary for the Dan Marino data (odd) and w/ last year removed (even).
4. **Boxplot**: Graph of the five-number summary
   (Best used for side-by-side comparison of more than one distribution)
   - A central box spans the quartiles Q_1 and Q_3.
   - A line in the box marks the median M.
   - Lines extend from the box out to the smallest and largest observations.
5. Boxplots and symmetry
   - In a symmetric distribution, Q_1 and Q_3 are equidistant from the median.
   - (Most) skewed to the right $\Rightarrow$ Q_3 is farther above the median than Q_1 is below it.
6. Other fractiles (partition/divide a data set into equal parts):
   - Quartiles: Q_1, Q_2, Q_3
   - Deciles: D_1, D_2, D_3, D_4, D_5, D_6, D_7, D_8, D_9
   - Percentiles: P_1, P_2, P_3, ..., P_{99} (ACT/SAT scores, child growth)
7. The **standard score** or z**-score** tells the number of standard deviations a given x value falls from the mean μ.

$$z = \frac{x - \mu}{\sigma}$$

8. By the 68-95-99.7 Rule, if a distribution is approximately bell shaped,
   - Approximately 68% of z-scores for data lie between 1 and -1.
   - Approximately 95% of z-scores for data lie between 2 and -2.
   - Approximately 99.7% of z-scores for data lie between 3 and -3.

9. Example: (p. 103, pr. 31)
A certain brand of automobile tire has a mean life span of 35,000 miles and a standard deviation of 2250 miles. (Assume the life spans of the tires have a bell-shaped distribution.)

   (a) The life spans of three randomly selected tires are 34,000 miles; 37,000 miles; and 31,000 miles. Find the z-score that corresponds to each life span. According to the z-scores, would the life spans of any of these tires be considered unusual?

   (b) The life spans of three randomly selected tires are 30,500 miles; 37,250 miles; and 35,000 miles. Using the 68-95-99.7 rule, find the percentile that corresponds to each life span.