

## Section 2.4: Measures of Relative Standing

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measures of relative standing

- give an indication of the position of an individual data point with respect to the rest of the data

example: you ran a race and your time was 1 hour and 56 minutes

but how did everyone else do?

measures: percentiles (we will not cover)

Z-score

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Z-score: number of standard deviations above the mean the data point is

- if  $z$  is negative, then the data point is below the mean

population:

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

↑ sta dev

← mean

sample:

$$z = \frac{x - \bar{x}}{s}$$

example: average diameter for sample of fir trees: 75 cm  
std dev 15 cm

one particular fir tree 58 cm

What is  $\uparrow$  this z-score? round to 2 decimals

answer:

$$\begin{aligned} z &= \frac{x - \bar{x}}{s} \\ &= \frac{58 - 75}{15} \\ &= -1.133333333... \\ &= -1.13 \end{aligned}$$

so, how likely are various z-scores

notation:  $|z|$  is the absolute value of  $z$   
(how far from the origin  $z$  is)

$$\begin{aligned} |-3| &= 3 \\ |3| &= 3 \\ |0| &= 0 \end{aligned}$$

$|z| > 2$  : for any distribution, will happen  $\leq 25\%$  of the time (Tcheby)

for mound-shaped, will happen  
 $\sim 5\%$  of the time (Empirical)

so  $|z| > 2$  is somewhat unlikely

$|z| > 3$  : for any distribution, will happen  
 $\leq 1\%$  of the time (Tcheby)

for mound-shaped, will happen  
 $\sim 0.3\%$  of the time (Empirical)

so  $|z| > 3$  is very unlikely

example: Ten DVDs were picked at random from Pat's DVD collection, and the number of Oscars won by each movie was tabulated.

results: 0, 0, 1, 2, 0, 0, 2, 0, 11, 1  
outlier

The standard deviation for this data set is 3.37. Calculate the z-score for any outliers and state whether those data points are likely or unlikely.

answer:  $\bar{x} = 1.7$   
 $s = 3.37$

$$z = \frac{x - \bar{x}}{s} = \frac{11 - 1.7}{3.37}$$

$$= 2.761158$$

$$= 2.76$$

unlikely

(generally, we round z-scores  
to 2 decimal places)