Equitable Equations: *Sampling distributions*

Problem 1

The heights of four friends, in centimeters, are 160, 165, 170, and 185. $\text{heights} \leftarrow c(160, 165, 170, 185)$

(a) Compute the mean μ and standard deviation σ of their heights.

(b) List all possible random samples of size 2 (with replacement). Compute the sample mean $\bar{x}$ of each. *Hint:* order doesn't matter, so there are 10 possibilities.

(c) Compute the mean $\mu_{\bar{x}}$ and standard deviation $\sigma_{\bar{x}}$ of these 10 values of $\bar{x}$. This is the mean and standard deviation of the sampling distribution of the sample mean.

(d) Verify that $\mu_{\bar{x}} = \mu$ and $\sigma_{\bar{x}} = \sigma/\sqrt{n}$ in this case.

a) $\mu = \text{mean}(\text{heights}) = 170$

$\sigma = \text{sd}(\text{heights}) = 10.8$

b) $H_2 = 160, 160 \qquad \bar{x} = 160$

$160, 165 \qquad \bar{x} = 162.5$

$160, 170 \qquad \bar{x} = 165$

$160, 185 \qquad \bar{x} = 172.5$

$165, 165 \qquad \bar{x} = 165$

$165, 170 \qquad \bar{x} = 167.5$

$165, 185 \qquad \bar{x} = 175$

$170, 170 \qquad \bar{x} = 170$

$170, 185 \qquad \bar{x} = 177.5$

$185, 185 \qquad \bar{x} = 185$

c) $\mu_{\bar{x}} = 170$

$\sigma_{\bar{x}} = 7.6$

d) $\mu_{\bar{x}} = 170 = \mu$

$$\sigma_{\bar{x}} = \frac{10.8}{\sqrt{2}} = 7.6$$