Assignment 8:

Chapter 1: 20, 36, 38, 42, 50

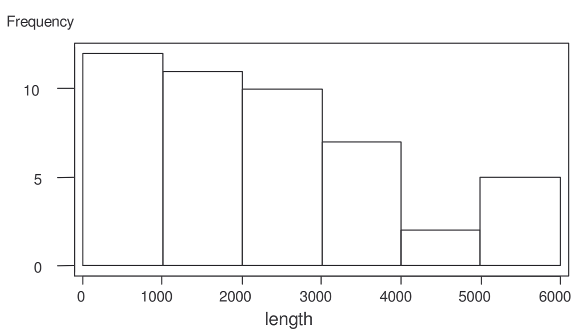
20.

a. The following stem-and-leaf display was constructed:

0	123334555599	
1	00122234688	stem: thousands
2	1112344477	leaf: hundreds
3	0113338	
4	37	
5	23778	

A typical data value is somewhere in the low 2000's. The display is almost unimodal (the stem at 5 would be considered a mode, the stem at 0 another) and has a positive skew.

b. A histogram of this data, using classes of width 1000 centered at 0, 1000, 2000, 6000 is shown below. The proportion of subdivisions with total length less than 2000 is (12+11)/47 = .489, or 48.9%. Between 2000 and 4000, the proportion is 17/47 = .362, or 36.2%. The histogram shows the same general shape as depicted by the stem-and-leaf in part (a).



36.

a. A stem-and leaf display of this data appears below:

32	55	stem: ones
33	49	leaf: tenths
34		
35	6699	
36	34469	
37	03345	

38	9
39	2347
40	23
41	
42	4

The display is reasonably symmetric, so the mean and median will be close.

b. The sample mean is $\bar{x}$ = 9638/26 = 370.7. The sample median is $\tilde{x}$ = (369+370)/2 = 369.50.

c. The largest value (currently 424) could be increased by any amount. Doing so will not change the fact that the middle two observations are 369 and 170, and hence, the median will not change. However, the value x = 424 can not be changed to a number less than 370 (a change of 424-370 = 54) since that *will* lower the values(s) of the two middle observations.

d. Expressed in minutes, the mean is (370.7 sec)/(60 sec) = 6.18 min; the median is 6.16 min.

38.

a. The reported values are (in increasing order) 110, 115, 120, 120, 125, 130, 130, 135, and 140. Thus the median of the reported values is 125.

b. 127.6 is reported as 130, so the median is now 130, a very substantial change. When there is rounding or grouping, the median can be highly sensitive to small change.

39.

a. $\Sigma x_l = 16.475$ so $\bar{x} = \dfrac{16.475}{16} = 1.0297$

$$\tilde{x} = \frac{(1.007 + 1.011)}{2} = 1.009$$

b. 1.394 can be decreased until it reaches 1.011(the largest of the 2 middle values) – i.e. by 1.394 – 1.011 = .383, If it is decreased by more than .383, the median will change.

42.

a.

$$\bar{y} = \frac{\Sigma y_i}{n} = \frac{\Sigma(x_i + c)}{n} = \frac{\Sigma x_i}{n} + \frac{nc}{n} = \bar{x} + c$$

$\tilde{y} =$ the median of $(x_1 + c, x_2 + c, ..., x_n + c) =$ median of $(x_1, x_2, ..., x_n) + c = \tilde{x} + c$

b.

$$\bar{y} = \frac{\Sigma y_i}{n} = \frac{\Sigma(x_i \cdot c)}{n} = \frac{c\Sigma x_i}{n} = c\bar{x}$$

$$\tilde{y} = (cx_1, cx_2, ..., cx_n) = c \cdot median(x_1, x_2, ..., x_n) = c\tilde{x}$$

50. First, we need $\bar{x} = \dfrac{1}{n}\sum x_i = \dfrac{1}{27}(20{,}179) = 747.37$.

Then we need the sample standard deviation $s = \sqrt{\dfrac{24{,}657{,}511 - \dfrac{(20{,}179)^2}{27}}{26}} = 606.89$.

The maximum award should be $\bar{x} + 2s = 747.37 + 2(606.89) = 1961.16$, or in dollar units, \$1,961,160.

This is quite a bit less than the \$3.5 million that was awarded originally.

Chapter 5: 46, 48, 50

46. $\mu = 12$ cm $\sigma = .04$ cm

a. n = 16 $E(\bar{X}) = \mu = 12cm$ $\sigma_{\bar{x}} = \dfrac{\sigma_x}{\sqrt{n}} = \dfrac{.04}{4} = .01cm$

b. n = 64 $E(\bar{X}) = \mu = 12cm$ $\sigma_{\bar{x}} = \dfrac{\sigma_x}{\sqrt{n}} = \dfrac{.04}{8} = .005cm$

c. $\bar{X}$ is more likely to be within .01 cm of the mean (12 cm) with the second, larger, sample. This is due to the decreased variability of $\bar{X}$ with a larger sample size.

48.

a. $\mu_{\bar{X}} = \mu = 50$, $\sigma_{\bar{x}} = \dfrac{\sigma_x}{\sqrt{n}} = \dfrac{1}{\sqrt{100}} = .10$

P(49.75 ≤ $\bar{X}$ ≤ 50.25) = $P\left(\dfrac{49.75-50}{.10} \le Z \le \dfrac{50.25-50}{.10}\right)$

= P(-2.5 ≤ Z ≤ 2.5) = .9876

b. P(49.75 ≤ $\bar{X}$ ≤ 50.25) ≈ $P\left(\dfrac{49.75-49.8}{.10} \le Z \le \dfrac{50.25-49.8}{.10}\right)$

= P(-.5 ≤ Z ≤ 4.5) = .6915

50. μ = 10,000 psi σ = 500 psi

a. n = 40

P(9,900 ≤ $\bar{X}$ ≤ 10,200) ≈ $P\left(\dfrac{9{,}900-10{,}000}{500/\sqrt{40}} \le Z \le \dfrac{10{,}200-10{,}000}{500/\sqrt{40}}\right)$

= P(-1.26 ≤ Z ≤ 2.53)
= Φ(2.53) - Φ(-1.26)
= .9943 - .1038
= .8905

b. According to the Rule of Thumb given in Section 5.4, n should be greater than 30 in order to apply the C.L.T., thus using the same procedure for n = 15 as was used for n = 40 would not be appropriate.