6.3.

a. $\mu = \dfrac{\sum x}{N} = \dfrac{1{,}954}{11} = 177.64$

$\bar{x} = \dfrac{\sum x}{n} = \dfrac{650}{3} = 216.67$

Sampling error = 216.67 - 177.64 = 39.03

b. The smallest 3 values that could be in a sample from the population are:

100 100 105 $\qquad\qquad \bar{x} = \dfrac{\sum x}{n} = \dfrac{305}{3} = 101.67$

Sampling error = 101.67 - 177.64 = -75.97

The largest 3 values that could be in a sample from the population are:

400 330 200 $\qquad \bar{x} = \dfrac{\sum x}{n} = \dfrac{930}{3} = 310.0$

Sampling error = 310.0 – 177.64 = 132.36

The range in potential sampling error is -75.97 to 132.36

c. The smallest 5 values are:

100 100 105 120 129 $\qquad \bar{x} = \dfrac{\sum x}{n} = \dfrac{554}{5} = 110.8$

Sampling error = 110.8 – 177.64 = -66.84

The largest 5 values are:

400 330 200 190 150 $\qquad \bar{x} = \dfrac{\sum x}{n} = \dfrac{1.270}{5} = 254.0$

Sampling error = 254.0 – 177.64 = 76.36

It is seen that the range of potential sampling error is greater when the sample is size five compared with a sample of size 3. In general, increasing the sample size will reduce the range for potential sampling error.

6.6.

$$\mu = \frac{\sum x}{N} = \frac{18{,}430}{30} = 614.33$$

a. The smallest 6 values are:

395 400 405 415 450 455

$$\bar{x} = \frac{\sum x}{n} = \frac{2{,}520}{6} = 420.0$$

The sampling error = 420.0 - 614.33 = -194.33

The largest 6 values are:

995 905 800 780 780 780 $\bar{x} = \frac{\sum x}{n} = \frac{5{,}040}{6} = 840.0$

The sampling error = 840.0 – 614.33 = 225.67

The range in sampling error for a sample of size 6 is –194.33 to 225.67.

b. The smallest 10 values are:

395 400 405 415 450 455 490 495 495 500

$$\bar{x} = \frac{\sum x}{n} = \frac{4{,}500}{10} = 450$$

The sampling error = 450 – 614.33 = -164.33

The largest 10 values are:

995 905 800 780 780 780 750 750 700 690

$$\bar{x} = \frac{\sum x}{n} = \frac{7{,}930}{10} = 793$$

The sampling error = 793 – 614.33 = 178.67

The range in sampling error for a sample of size 10 is – 164.33 to 178.67

Larger sample sizes will yield a lower range in the potential sampling error.

6.10.

a. Students can use Excel functions to calculate the mean and standard deviation. Remember to use the STDDEVP function for the population

standard deviation. The mean = 42,287.4375 and the standard deviation = 12,743.1481.

b. The sample mean for the sample is 44,126.5; the sampling error is 44,126.5 – 42,287.4375 = 1,839.0625

c. The sampling error for this data is 38,014.5 – 42,287.4375 = -4,272.9375; Each time you take a sample out of a population you will obtain a mean of the sample that is normally different from the mean of the population. Most samples taken will have a different mean from the other samples as well as the population. This is why you have sampling error and why the sampling errors are different for different samples. The ramifications of sampling error are that you do not know how close your sample mean is to the true population mean and you do not know whether it is actually lower or higher. This could lead to incorrect decisions.

d. Student samples will vary depending upon the sample selected. A smaller sample could in fact have a smaller sampling error than a larger sample simply because of the items in the sample. Generally a larger sample will have a smaller sampling error just because the larger proportion you select from the population the closer you will come to getting a representative sample of the population. This will not occur all of the time, however.

6.13.

$P(x>450) = P(z > (450 – 400)/50) = P(z > 1) = 0.5 – 0.3413 = 0.1587$

$P(\bar{x} > 450) = P(z > (450 – 400)/(50/\sqrt{3})) = P(z > 1.73) = 0.5 – 0.4582 = 0.0418$

c. As the sample size increases the standard deviation of the sampling distribution is reduced. This means the spread of the sampling distribution is reduced.

6.20.

a. $P(\bar{x} < 400{,}000) = P(z < (400{,}000 – 417{,}330)/[(45{,}285/\sqrt{40}]\sqrt{\frac{220-40}{219}} =$
$P(z < \text{-}2.67) = 0.5 – 0.4962 = 0.0038$

The shape of the sampling distribution of the sample means will be approximately normally distributed for samples of size 40 regardless of the shape of the population from which the samples are taken. This characteristic of the distribution of the sample means is known as the Central Limit Theorem.

The standard deviation of the distribution of the sample mean =
$45{,}285/\sqrt{40}\sqrt{\dfrac{220-40}{219}} = 6{,}491.40$ Note, the standard deviation is modified
using the finite correction factor since the sample size is more than 5% of
the size of the population.

$P(\bar{x} < 400{,}000) = P(z < (400{,}000 - 417{,}330)/(45285/\sqrt{60}\sqrt{\dfrac{220-60}{219}}) = P(z$
$< -3.49) = 0.5 - 0.5 =$ approximately 0.00. The standard deviation of the
distribution of the sample mean $= 45{,}285/\sqrt{60}\sqrt{\dfrac{220-60}{219}} = 4{,}997.08$.
The distribution does not change shape. It will still be approximately
normal.

Having a probability of 0.15 in the upper tail results in a z of 1.04

     $1.04 = (x - 417{,}330)/45285;\; x = \$464{,}426.40$ is the smallest sales
level for the sales personnel to enjoy a complimentary trip to Hawaii
6.26.
    a.
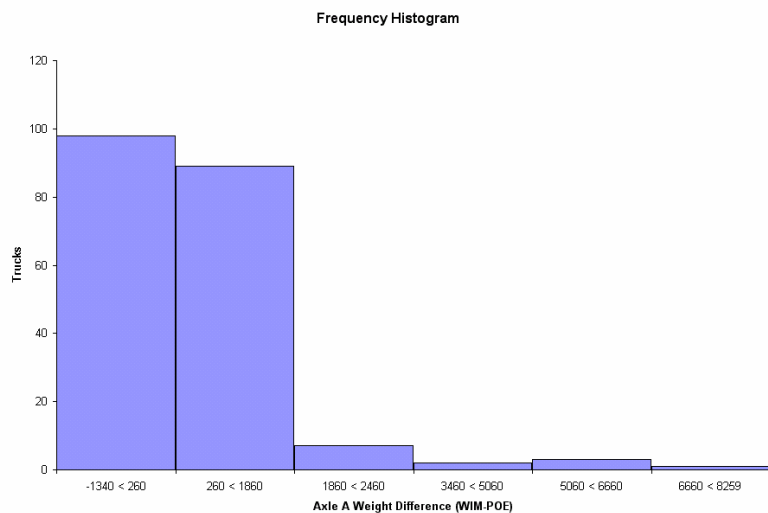
    The distribution does not look like a normal distribution. It
appears to be right skewed.

b. Student can use Excel to calculate the mean and standard deviation.
Remember to use the STDEVP function to calculate the standard
deviation of the population.

Mean = 450; standard deviation = 1148.43

c. Student responses will vary depending on the sample selected.
6.29.
Number of items in the population with the attribute = 40. Population size = 50. Population proportion = 40/50 = 0.8000.

Number of items in the sample with the attribute = 7. Sample size = 15. Sample proportion = 7/15 = 0.4667. Sampling error = sample proportion – population proportion = 0.4667 – 0.8000 = -0.3333.

Highest possible sample proportion = 1.0000 when the sample selects 15 items all having the attribute of interest. Lowest possible sample proportion = 0.3333 when the sample selects all 10 of the items without the attribute of interest and 5 with the attribute of interest. Range of sampling error = (0.3333 – 0.8000) ----- (1.0000 – 0.8000) = -0.4667 to 0.2000.

For a sample size of 30 the highest possible sample proportion remains 1.0000 when 30 items having the attribute of interest are selected. The lowest possible sample proportion becomes 0.6667 when the 10 items without the attribute of interest are all selected and the remaining 20 items in the sample have the attribute of interest. The range of extreme sampling error becomes (0.6667 – 0.8000) ----- (1.000 – 0.8000) = -0.1333 to 0.2000.

Note that the range of extreme sampling error has narrowed from the case where the sample size was 15. When everything else is held constant, increasing the sample size will reduce the potential for extreme sampling error.
6.37.
$$\bar{p} = 35/300 = 0.1167$$

$P(\bar{p} \geq 0.1167) = P(z \geq (0.1167 - .08)/ \sqrt{[0.08(1-0.08)]/300}) = P(z \geq 2.34)$
$= 0.5 – 0.4904 = 0.0096$

The probability of getting a sample proportion as high as the new style coupon if the redemption rate is actually 0.08 is less than 1%. Therefore, the redemption rate is probably not the same.

Yes because it seems like this coupon is more effective than some of the other coupons.

6.41.

Students can use Excel's pivot table feature to group by Medicare.

P(Medicare) = 116/138 = 0.8406

BC	5
CAID	7
CARE	116
HMO	1
INS	3
OGVT	1
OTHR	4
SELF	1
Grand Total	138

$P(\bar{p} > 0.8406) = P(z > (0.8406 - 0.80)/ \sqrt{[0.80(1-0.80)]/138}) = P(z > 1.19)$
$= 0.5 - 0.383 = 0.117$

Since the probability of finding a sample with a proportion of .8406 or greater if the true proportion is .80 is only 11.7% then you may reasonably assume that the proportion of people
6.51.
The true population mean is 405.55. The mean of the sample means should be the same as the population mean.

    b. $12.25 = [(\text{sigma}/ \sqrt{150}) \sqrt{(1250-150)/(1250-1)}] =$

    sigma = 159.83
6.56.
The probability that the sample mean would be exactly $3.45 is essentially 0. Again, the sample is a subset of the population so the probability of getting exactly a specific value is essentially 0. Of course, when the sample is selected and the mean computed it has to be some value. In reality, the probability of any specific value is extremely small so as to approach zero.

Again the probability would essentially be 0 since again you cannot calculate the probability of one sample being exactly $3.45 therefore you do not expect two samples to be exactly $3.45.

No, just as you do not expect a 2nd sample to be the same as the first sample, you would not expect the 3rd sample to be the same mean.

6.68.

$P(\bar{x} > 16.00) = P(z > (16.00 - 15.30)/ (7/\sqrt{40}) = P(z > 0.63) = 0.5 - 0.2357 = 0.2643$

$P(15.10 < \bar{x} < 15.80) = P[(15.10\text{-}15.30)/(7/\sqrt{100}) < z < (15.80\text{-}15.30)/(7/\sqrt{100})] = P(\text{-}0.29 < z < 0.71) = 0.2611 + 0.1141 = 0.3752$

c. $P(\bar{x} \leq 14.00) = P(z \leq (14.00 - 15.30)/ (7/\sqrt{50}) = P(z \leq \text{-}1.31) = 0.5 - 0.4049 = 0.0951$

The probability of getting an average of $14 or less for a sample of 50 is only 9.5%. Thus, there is a fairly low chance that this sample of fifty bikes would have an average repair cost of $14 or less. Thus, he would probably have been better off to charge a higher price per bike.