5.8
A.) $Z_{250} = -1.22$; Area beyond = .1112
B.) $Z_{300} = -0.22$; Area beyond = .4129
C.) $Z_{350} = 0.78$; Area beyond = .2177
D.) $Z_{400} = 1.78$; Area beyond = .0375
E.) $Z_{250} = -1.22$; $Z_{350} = 0.78$; Area between = .3888 + .2823 = .6711
F.) $Z_{300} = -0.22$; $Z_{350} = 0.78$; Area between = .0871 + .2823 = .3694
G.) $Z_{350} = 0.78$; $Z_{375} = 1.28$; Area between = .3997 - .2823 = .1174

5.14. The cut-off for acceptance is the top 10% of the distribution. On the Z - distribution, this would be the score that separates the top 10% from the bottom 90%, or the Z-score that has 10% of the area beyond it. Looking in the “area beyond Z” column, we find that an area of .10 corresponds to a Z score of 1.28. Converting this Z to a raw score, we get:

$$X = 1.28(.33) + 2.78 = 3.202.$$ Since GPA’s are reported to the nearest one hundredth of a point, this would round to a GPA of 3.20. Therefore, all of the GPA’s would qualify.

(Note: You may have decided not to round; then 3.20 would not qualify).

7.6 Population $\sigma$ is unknown and $N < 120$, so use the t distribution. At the 99% confidence level, with 99 degrees of freedom, the t-value is 2.63. The estimated standard error of the mean is

$$s/\sqrt{(N-1)} = 0.3/\sqrt{99} = .03$$

99% C.I. = $2.37 \pm (2.63)(.03) = 2.29$ to 2.45

We are 99% confident that the mean number of violent acts per TV program lies between these two values.

7.10 The sample $p = .30$ (30%)

99% C.I. = $p \pm 2.58 \sqrt{(p(1-p)/N)} = .30 \pm 2.58 \sqrt{(.3)(.7)/324} = .236$ to .364

We are 99% confident that the proportion who are very satisfied with their trash collection is between 23.6% and 36.4%.

7.18 Population $\sigma$ is unknown, but since $N = 120$, we can use the Z distribution and $s/\sqrt{N}$.

99% C.I. = $75.5 \pm 2.58 (3.7/\sqrt{120}) = 74.6$ to 76.4 mpg

Since we are 99% confident that the true mean gas mileage lies between 74.6 and 76.4 mpg, it would be very surprising if it were actually 78! As this is highly unlikely, I'd say the manufacturer's claim is NOT supported.
8.2 a) This is a problem involving the mean.

\[ H_0: \mu = 3.3; \quad Ha: \mu \neq 3.3 \] (Two-tailed, since the problem says, “different”)

Test statistic = \( \frac{3.8 - 3.3}{0.53/\sqrt{116}} = 0.5/0.049 = 10.16 \)

C.V. = \( t(116) = \text{about 2.62} \) (.01 level, two-tailed)

Reject \( H_0 \). Sociology majors attend more parties than the average student at St. Algebra.

b) Under a one-tailed test, the alternative hypothesis would become: \( H: \mu > 3.3 \); the critical value would become 2.37 (at .01), and the conclusion would be that Soc. majors attend MORE parties. (However, we cannot determine from this information whether they actually have more fun. Perhaps we should extend our research by attending some of the parties.)

8.6 a ) This is a problem involving the mean.

\[ H_0: \mu = 24,230; \quad Ha: \mu \neq 24,230 \] (two-tailed test is asked for)

The population standard deviation is given, so a Z test can be used.

Test statistic = \( \frac{24,375 - 24,230}{523/\sqrt{105}} = 255/51.04 = 2.84 \)

C.V. = Z = 1.96 or 2.58 (.05 and .01 level, respectively two-tailed)

Reject \( H_0 \). The workers in the overkill division have different salaries from the others in the company.

b) Using a one-tailed test, the critical values are 1.65 and 2.33, respectively, the alternative hypothesis would become \( H: \mu > 24,230 \), and conclusion is that the O.K. workers are paid significantly higher salaries. As to whether they are “overpaid,” we really can’t say, since we are not given a definition of “overpaid,” nor are factors such as working conditions taken into account.

8.16 This is a proportion problem.

\[ H_0: P = 0.18 \quad H_a: P > 0.18 \]

(one-tailed because only a positive difference is relevant to the decision)

\[ s_p = \sqrt{(0.217)(1-0.217)/323} = 0.023 \]

\[ Z = (0.217 - 0.18)/0.023 = 1.61 \]

1-tailed critical value = 1.65. **Retain** \( H_0 \). Unemployment rate is not significantly higher among teenage males. There is not a convincing need for the program.

8.19 a.) Only probability samples allow us to use sampling distributions such as (Z or t) to select and control our probability of error and confidence level.

b.) The sampling distribution is assumed to be normal if N is large and/or if the population standard deviation is known.

c.) The sampling distribution provides us with a basis for comparison. It tells us what we would expect to find under the null hypothesis. This baseline can then be compared with our actual observations to determine whether the observations are consistent with the hypothesis.
d.) It is possible to test the null because we know what we would expect to find if the null is true. By starting with the assumption that the null is true, we have a distribution of expected results against which we can compare our actual observations (i.e., we know what “reality” would look like if the null were true). The alternative hypothesis does not provide us with such a picture of “reality”). Since we don’t know what to expect under the alternative, it is impossible to test it.

e.) The critical region is the area on the tail(s) of the distribution beyond the critical value. It might be considered the “region of rejection:” if the test statistic falls into this area, we will reject the null. The size of the critical region is determined by the researcher: it represents what s/he considers a reasonable probability of Type I error.

f.) A one-tailed test may be used anytime the researcher expects that a change or difference can only occur in one direction, or if the researcher is only interested in change or difference in one direction. For example a program to prevent truancy from school will be funded only if truancy rates decline as a result of the program. An increase in truancy would make no difference in the sense that it would have the same result as no change at all: either way, the program would not get funded.

g.) The t distribution is wider and more spread out; the critical values corresponding to any given significance level will be higher than the value of Z for the same significance level. Therefore, a bigger difference between observed and hypothesized results is required in order to reject using t.

h.) We can conclude that the difference between observed and hypothesized results probably did not occur by chance; the null is probably not true.