ANSWERS CHAPTER 13

THINK IT OVER

think it over

TIO 13.1: $\frac{(n-1)s^2}{\sigma^2}$ in the expression, $n-1$ can never be negative since you cannot have a less than zero population or sample size. Both s^2 and σ^2 can never have a negative value since any negative value squared will always be a positive.

TIO 13.2: The z- and t-distributions are symmetrical about the mean. Also, referring to TIO 13.1, this distribution will always be positive for the reasons given.

TIO 13.3: The relationship $0.25 \leq \sigma^2 \leq 0.72$ says the expected value of the variance, using this distribution, will be between 0.25 and 0.72.

TIO 13.4: The population variance and the sample variance should be normally distributed. Although related, they are different distributions.

TIO 13.5: You would get a value of 1, meaning both distributions have identical values for the variance. It is extremely unlikely that this would arise from different sets of data, so you need to check the means and make sure you haven't used the same data twice. If you look at a table for the F distribution, you will see that all values tend to 1. In other words, like other distributions, the curve touches the horizontal axis at infinity! (Wherever that is.)

EXERCISES

1. (a) Length, diameter, tensile strength.
   (b) Passengers in terms of safety. The company in terms of manufacturing costs and litigation!
2. The null hypothesis would be the production run was within tolerance.
3. Yes it would since it is just inside the upper limit for the tolerance.
4. (a) The F-test since it compares variances.

   (b) $F = \frac{S_A^2}{S_B^2}$ The variances from each factory are used to calculate the F statistic.

   (c) Because the components are safety critical, a p-value of 0.01 would be chosen. The F statistic would then be calculated and depending on whether the calculated value was greater or less than the one expected from the table, the null hypothesis would either be accepted or rejected. If the calculated value was less than the expected one, the null hypothesis would be rejected.

5. (a) A Type I error is where the null hypothesis is rejected when in fact it is true. For example, if a test is done to compare the tensile strengths of two different materials for the bolts and the null hypothesis is there is no difference in their strengths. If a Type I error is committed and there is a difference in their strengths, the results could be devastating. By selecting an appropriate level of significance, Type I errors can be controlled.

   (b) A Type II error is when the null hypothesis is accepted when in fact it is false. As in part (a) the implications of making this error depend on what the null hypothesis states.

   (c) This depends on the null hypothesis and what you are trying to determine.