**Example 3** **Confidence Interval for Alcohol Use in Video Games**

Twelve different video games showing substance use were observed. The duration times (in seconds) of alcohol use were recorded, with the times listed below (based on data from "Content and Ratings of Teen-Rated Video Games," by Haninger and Thompson, *Journal of the American Medical Association*, Vol. 291, No. 7). The design of the study justifies the assumption that the sample can be treated as a simple random sample. Use the sample data to construct a 95% confidence interval estimate of μ, the mean duration time that the video showed the use of alcohol.

$$84 \quad 14 \quad 583 \quad 50 \quad 0 \quad 57 \quad 207 \quad 43 \quad 178 \quad 0 \quad 2 \quad 57$$

Solution

Requirement check We must first verify that the requirements are satisfied. (1) We can consider the sample to be a simple random sample. (2) When checking the requirement that "the population is normally distributed or $n > 30$," we see that the sample size is $n = 12$, so we must determine whether the data appear to be from a population with a normal distribution. Shown below are a Minitab-generated histogram and a STATDISK-generated normal quantile plot. The histogram does not appear to be bell-shaped, and the points in the normal quantile plot are not reasonably close to a straight-line pattern, so it appears that the times are not from a population having a normal distribution. The requirements are not satisfied. If we were to proceed with the construction of the confidence interval, we would get 1.8 sec $< \mu <$ 210.7 sec, but this result is questionable because it assumes incorrectly that the requirements are satisfied. ✅

STATDISK

MINITAB
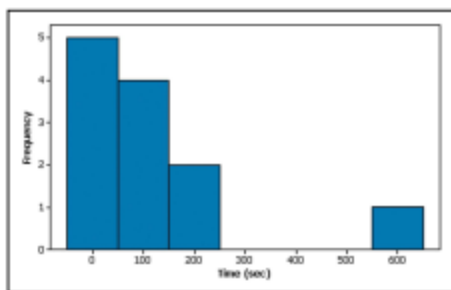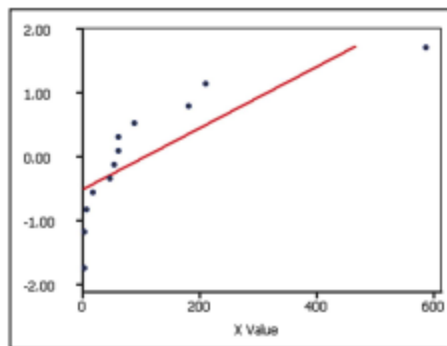
Interpretation

Because the requirement that "the population is normally distributed or $n > 30$" is not satisfied, we do not have 95% confidence that the limits of 1.8 sec and 210.7 sec actually do contain the value of the population mean. We should use some other approach for finding the confidence interval limits. For example, we could use the bootstrap resampling method described in the Technology Project at the end of this chapter.

Captured Tank Serial Numbers Reveal Population Size

During World War II, Allied intelligence specialists wanted to determine the number of tanks Germany was producing. Traditional spy techniques provided unreliable results, but statisticians obtained accurate estimates by analyzing serial numbers on captured tanks. As one example, records show that Germany actually produced 271 tanks in June 1941. The estimate based on serial numbers was 244, but traditional intelligence methods resulted in the extreme estimate of 1550. (See "An Empirical Approach to Economic Intelligence in World War II," by Ruggles and Brodie, *Journal of the American Statistical Association*, Vol. 42.)