Practice questions

1. EPA technicians measured emissions from industrial plants in North Carolina to determine if they emitted more CO2 than the federal standard or not. According to a national survey, 23% of industrial plants are not in compliance. Assume the proportion of North Carolina plants in "non-compliance" is the same as the rest of the country.

   - What is the probability that in a random sample of 12 plants, 4 plants will not meet standards?
   - What is the probability of finding 5 or more plants in "non-compliance"?

2. What are three ways to test whether your data are normally distributed? Write one pro and one con for each of the methods.

3. Researchers measured levels of dissolved oxygen (DO) at two different depths in a freshwater lake. They took 20 observations at 3 meter depth, and 20 observations at 12 m depth. Based on past research, researchers expect that the DO should decrease with depth (the deep water sample should have less DO than water near the surface). Exhaustive previous research has calculated the average DO for the entire lake to be 8.4 mg/L (population mean).

   a. If the researchers articulate an alternative hypothesis, H_a: "Mean DO of the 12 m sample will be lower than the 3 m sample", what type of test would they need to conduct? (one-sample, two-sample, one-sided, two-sided).
   b. If the researchers articulate an alternative hypothesis, H_a: "Mean DO of the 3 m sample will be different than the average DO for the lake", what type of test would they need to conduct? (one-sample, two-sample, one-sided, two-sided).
   c. If the average DO for the sample at 12 m is 5 mg/L and the standard deviation is 4.90, calculate the t-statistic to test the hypothesis that: $H_a : \mathrm{DO}_{12\mathrm{m}} < \mathrm{DO}_{\mathrm{lake}}$.
   d. What is the probability of getting this t statistic?
   e. The mean dissolved oxygen of the 20 readings taken in the deep water was 5 mg/L, with a sample standard deviation of 4.9. What is the 88% confidence interval of deep water DO?

4. If the data resulting from the sampling of DO are:

   DO3 = 4.7, 8.1, 3.8, 14.0, 8.7, 3.9, 9.3, 10.4, 9.7, 6.0, 13.6, 8.9, 4.7, -2.0, 12.0, 7.1, 7.2, 11.3, 10.7, 9.8
   DO12 = 8.9, 7.6, 13.6, -1.2, 15.8, 7.1, -2.7, 0.4, 5.3, 5.0, -6.2, 8.7, 2.3, 5.8, 7.8, 12.4, 8.2, 10.5, 1.2, 2.9

   a. Is there a significant difference between the mean DO of the two samples?
   b. Is mean DO at the surface, 3 m, significantly greater than at 12 m depth?

5. Solar can help balance the power grid by keeping some generating capacity in reserve. Electricity use in a particular area surpasses capacity 4 times a month on average, so the electric company uses solar reserves to fulfill the need. The company is trying to decide whether it should increase its use of solar. It is willing to invest the resources if the probability of exceeding capacity 5 or more 5 times a month is greater than 40%. Will the company invest in additional solar at this time?