Homework 5

QSCI 482: Hypothesis Testing & Estimation for Ecologists & Resource Managers

1. The following data (cm) representing tree trunk diameter at breast height (DBH, i.e., diameter at 4.5 ft above general ground level) were collected from a randomly sampled group of 19 trees in a forest.

   3.2, 8.3, 5.6, 12.4, 3.8, 14.9, 2.5, 2.8, 5.6, 5.3, 6.5, 7.5, 7.8, 3.6, 4.6, 3.2, 3.0, 5.0, 4.7

   Make a Q-Q plot to assess if these data conform to a normal distribution (note that the Z-scores for a sample of size 19 have already been calculated and are given in the course reader when we looked at the octopod mantle data!). Let's also try a transformation of the data to see if a re-expressed random variable follows a normal distribution. To do this, compute a new variable Y = log(DBH +1) for each data point. (See p. 275 in Zar for a brief explanation of this transformation.) Logs to any base may be used, but for consistency, let's follow Zar's example and use logarithms to the base 10. Now, redo the normal probability plot for the log-transformed data (you can either use a computer stats package or just compute the normal scores and either use a spreadsheet program to graph it on ordinary axes or use graph paper to graph it by hand). Compare the results to the original plot for the untransformed data. What do you see happened? Data transformations like this are sometimes used to help conformance with normal-distribution theory test assumptions.

2. A wildlife scientist was studying a particular small mammal. The scientist would like to know in a very specific sense if the adult size of females is different from males. The following femur length data (mm) were collected randomly and independently from individuals of this species.

   Females: 23.0, 25.5, 26.0, 26.5, 23.5, 22.5, 25.0, 24.0

   Males: 26.5, 27.5, 27.0, 26.0, 28.5, 26.5, 28.0, 29.5

   [a] Previous evidence has shown that data of this type do not follow a normal distribution. Test whether there is a significant difference between femur length between males and females of this species using 0.10 as the significance level. Describe the assumptions/requirements for the test you use and state conclusions in terms of the original problem.

   [b] Since the above test assumes equal shapes for the two distributions, let's try a test for equal variability. Use a *nonparametric* test to test the null hypothesis (use 0.10 level of significance) that the two samples display equal variability.

3. A study was conducted to determine if it takes the same amount of time for garment workers to runstitch a collar in an egonomically designed workplace as it does in the standard workplace. A random sample of 12 workers were chosen and each was asked to spend a day runstitching collars in each workplace, randomizing the workplace in which they started. The following data on average “auxiliary manual times” were collected for each worker working in each workplace, standard and ergonomic:

Worker:	1	2	3	4	5	6	7	8	9	10	12
Standard:	4.9	4.9	4.6	4.6	4.4	4.7	4.8	5.1	4.7	4.8	5.1
Ergonomic:	3.9	4.6	5.6	5.2	4.4	4.2	4.4	4.9	4.8	4.3	5.5

   Previous pilot studies have shown non-normal distributions for data of this type, so normality-based tests should not be used here. Use the appropriate *nonparametric* test to see if there is a general difference in the in runstitch times between to two workplaces. Include also the p-value associated with the test statistic (bracketing OK).