Discussion 7: Hypothesis Tests, Errors, and Power

1. Specifications for a water pipe call for a mean breaking strength μ of more than 2000 lb per linear foot. Engineers will perform a test to decide whether or not to use a certain kind of pipe. A random sample of 1 ft sections of pipe is selected and their breaking strengths are measured. The pipe will not be used unless the engineers can conclude (statistically, not with certainty) that the mean breaking strength is greater than 2000. Prior literature suggests the breaking strengths of these pipes are roughly symmetric and unimodal and have a population standard deviation of 10.

   (a) Specify appropriate null and alternative hypotheses for this situation.

   (b) What kind of evidence from the sample do you need to reject the null hypothesis?

   (c) Explain in non-statistical language what a Type I Error would be in this context.

   (d) Explain in non-statistical language what a Type II Error would be in this context.

   (e) Which type of Error, Type I or Type II, is worse in this situation? How does this knowledge affect the engineer's process?

   (f) If engineers plan to sample 40 sections of pipe, what power will they have to detect a true mean strength of 2004 lb per linear foot (assuming $\sigma = 10$ and $\alpha = 0.01$)? Draw a picture to help you calculate this. Comment on your findings. You can check your work by looking at: http://digitalfirst.bfwpub.com/stats_applet/stats_applet_9_power.html.

   (g) Suppose engineers are interested in increasing their power to detect a true mean strength of 2004 lb per linear foot (assuming $\sigma = 10$). What minimum sample size should they choose so their estimate of the mean is precise enough to have power of 0.85?