Homework #8: Due Friday November 6, 2015

1. Do the following problems in Ayyub & McCuen. State any necessary assumptions.
   - # 9-24
   - # 9-26

2. To determine whether the pipe welds in a nuclear power plant meet specifications, a random sample of welds is selected and tests are conducted on each weld in the sample. Weld strength is measured as the force required to break the weld. Suppose the specifications state that mean strength of welds should exceed 100 lb/in$^2$, and the inspection team decides to test $H_0$: $\mu = 100$ vs. $H_a$: $\mu > 100$. Explain why it might be preferable to use $H_a$: $\mu > 100$ rather than $H_a$: $\mu < 100$.

3. A study conducted in 1992 reported the following summary data on daily caffeine consumption for a sample of adult women: $n = 47$, $\bar{x} = 215$ mg, and $s = 235$ mg, with a sample range of 5 mg to 1176 mg.
   (a) Based on the summary data, does it seem plausible that the population distribution of daily caffeine consumption is normal? Is it necessary to assume a normal population distribution to test hypotheses about the value of the population mean consumption? Explain your reasoning.
   (b) Suppose it had previously been believed that the mean consumption was at most 200 mg. Does the given data contradict this prior belief? Test the appropriate hypotheses at significance level 0.10.

4. A sample of 12 radon detectors of a certain type was selected and each was exposed to 100 pCi/L of radon. The resulting readings were as follows:

   105.6  90.9  91.2  96.9  96.5  91.3
   100.1  105.0  99.6  107.7  103.3  92.4

Does this data suggest that the population mean reading differs from 100? State and test the appropriate hypothesis using $\alpha = 0.05$. 
5. A mixture of pulverized fuel ash and Portland cement to be used for grouting should have a compressive strength of more than 1300 kN/m². The mixture will not be used unless experimental evidence indicates conclusively that the strength specification has been met. Suppose compressive strength for specimens of this mixture is normally distributed with \( \sigma = 60 \). Let \( \mu \) denote the true average compressive strength. Answer the following questions for a sample size of \( n = 20 \).

(a) What are the appropriate null and alternative hypotheses to test if the strength specification is met?

(b) Consider a rejection region with \( \bar{x} \geq 1331.26 \). What is the probability that the null hypothesis would be incorrectly rejected (ie. Type I Error)?

(c) For the rejection region specified in part (b) and assuming \( \mu = 1350 \) under the alternative hypothesis, what is the probability that the null hypothesis would be incorrectly accepted (ie. Type II Error)?

(d) Determine the value of \( C \) needed to define the rejection region if \( \alpha = 5\% \).

(e) For the rejection region specified in part (d) and assuming \( \mu = 1350 \) under the alternative hypothesis, what is the probability that the null hypothesis would be incorrectly accepted (ie. Type II Error)?