812 Section # 12

TA: Sarah Bouchat

21 November 2014

---

1 Definitions

Exercise 1 What are the following and why are they important?

a. Simple hypothesis
b. Complex hypothesis
c. Type-I errors
d. Type-II errors
e. Statistical power
f. Level of significance
g. Null hypothesis
h. Test statistic
i. Critical value/region

2 Neyman-Pearson Lemma and Hypothesis Testing

Exercise 2 You are trying to figure out whether a specific machine at the widget factory is defective. There is some probability of error even if the machine is fully functional. Here is the probability distribution of the number of errors in a batch of five widgets for non-defective and defective machines respectively:

x	0	1	2	3	4	5
$P(X = x)$ if functional	0.40	0.30	0.20	0.07	0.02	0.01
$P(X = x)$ if defective	0.20	0.35	0.25	0.15	0.03	0.02

a. Assume that the factory owner does not want to throw out possibly good machines more than 10% of the time (i.e. α=0.1). According to the Neyman-Pearson Lemma, for which values of x should the owner replace the machine (i.e. reject H_0)?
b. Let's say that the owner becomes more conservative about throwing away possibly good machinery and he sets the probability that a good machine will be discarded as 5%. For which values of x should the owner discard the machine as defective?

Exercise 3 (Walpole et al. Example 10.3) A random sample of 100 recorded deaths in the United States during the past year showed an average sample life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does this seem to suggest that the mean life span today is over 70 years old? Use a 0.05 level of significance.

a. What is H_0? What is H_A?
b. What is the critical region?
c. Should we reject H_0?

Exercise 4 (Modified Walpole et al. Example10.4) A manufacturer of rope asserts that the rope has a mean breaking strength of 80 kg with a standard deviation of 5 kg. In 50 samples of rope, the sample average breaking strength was found to be 78 kg. Test the hypothesis that $\mu = 80$ against the alternative that $\mu \neq 80$. Use a 0.01 level of significance.

Many thanks to Emily Sellars for past years' section materials!