Lecture 31

Example: Consider $X \sim \mathrm{Bin}(500, p)$ **where we test** $\mathrm{H}_0 : p = 0.7$ **versus** $\mathrm{H}_1 : p \neq 0.7$ **at level** $\alpha = 0.01$**.**

(a) Find the critical region of the test.

(b) Calculate the power at $p = 0.6$**.**

Example: In a two sample test of $\mathrm{H}_0 : \mu_1 - \mu_2 = 3$ **versus** $\mathrm{H}_1 : \mu_1 - \mu_2 > 3$**, suppose that the data are normal,** $m = n$ **and** $\sigma_1^2 = \sigma_2^2 = 84.0$**. Can we choose** m **such that the test has level** $\alpha = 0.01$ **and** $\beta = 0.05$ **at** $\mu_1 - \mu_2 = 5.0$**? This question concerns *experimental design.***

In two sample problems, we can relax the normality assumption in the case of large samples.

Given $X_1, \ldots, X_m$ **iid independent of** $Y_1, \ldots Y_n$ **iid with** m **and** n **large (ie.** $m, n \geq 30$**), then the following statistic can be used for testing and the construction of confidence intervals.**

$$\frac{\bar{X} - \bar{Y} - (\mu_1 - \mu_2)}{\sqrt{s_1^2/m + s_2^2/n}} \sim \text{Normal}(0, 1)$$

where μ_1 **and** μ_2 **are the respective means, and** s_1 **and** s_2 **are the respective sample std devs.**

Example: A college interviewed 1296 students wrt summer incomes. Based on the results in the following table, test whether there is a difference in earnings between male and female students.

Students	n	$\bar{X}$	s
male	675	\$1884.52	\$1368.37
female	621	\$1360.39	\$1037.46

Example: The test scores of first year students admitted to college directly from high school historically exceed the test scores of first year students with working experience by 10%. A recent sample of 50 first year students admitted directly from high school has an average test score of 74.1% with std dev 3.8%. An indpt sample of 50 first year students with working experience yields an average test score of 66.5% with std dev 4.1%. Test whether a change has occurred.