Homework 15: ECO220Y

Exercises: Chapter 12: 39, 41, 44, 46

Problems:

(1) True or False? Explain: In hypothesis testing a smaller p-value means a larger Type II error.

(2) This question expands on exercises 44 ("Radio ads") and 46 ("Radio ads, part 2") in Chapter 12. [Note: You should complete those exercises in their entirety before attempting these follow-on questions.] The opening states "A company is willing to renew its advertising contract with a local radio station only if the station can prove that more than 20% of the residents of the city have heard the ad and recognize the company's product. The radio station conducts a random phone survey of 400 people."

(a) If the significance level is 0.05, what is the power of the hypothesis test if in truth 24% of residents have heard the ad? Find the answer numerically *and* illustrate it graphically. *Interpret the numerical value for the power of the test that you find.*

(b) If the significance level is 0.05, what is the power of the hypothesis test if in truth 26% of residents have heard the ad? Find the answer numerically *and* illustrate it graphically.

(c) If the significance level is 0.05, what is the power of the hypothesis test if in truth 28% of residents have heard the ad? Find the answer numerically *and* illustrate it graphically.

(d) Explain *in words* why power changes in the way that it does from (a) to (c).

(e) Without doing further calculations (but reviewing your work thus far), explain what the power would be if in truth 50% of residents have heard the ad? Verify your thinking by doing the actual calculation.

(f) Without doing calculations further calculations (but reviewing your work thus far), explain what the power would be if in truth 20.5% of residents have heard the ad? Verify your thinking by doing the actual calculation.

(g) If the significance level is 0.10, what is the power of the hypothesis test if in truth 26% of residents have heard the ad? Find the answer numerically *and* illustrate it graphically.

(h) Explain *in words* why power changes in the way that it does comparing (b) with (g).

(i) If the significance level is 0.05, what is the power of the hypothesis test if in truth 26% of residents have heard the ad and the random sample size is 600? Find the answer numerically *and* illustrate it graphically.

(j) Explain *in words* why power changes in the way that it does comparing (b) with (i).

(k) In "Radio ads, part 2" (exercise 46) it says that the radio station "contacts 600 people selected at random, and 133 can remember the ad." At a conventional significance level of 5% you cannot reject the null hypothesis and hence the radio station would lose this client. Explain whether there is evidence to suggest that radio station has actually exceeded the expectations of the client. Further, comment on the power of the statistical test performed in light of the evidence gathered.

(3) You wish to test the following hypotheses about the population proportion. H_0: $p = 0.60$; H_1: $p > 0.60$. You collect a random sample of 100 individuals and obtain a sample proportion of 0.63.

(a) Compute the Type II error if the true population proportion is 0.58, 0.59, 0.60, 0.61, 0.62, 0.64, 0.66, 0.68, 0.70, 0.72, 0.74, 0.76. Draw a line graph with the values you have computed where the horizontal axis is the population proportion and the vertical axis is the probability of making a Type II error.

(b) Sketch in how this curve would look for $p < 0.58$ and $p > 0.76$?

(c) Without recalculating everything, describe how the graph you constructed in part **(a)** would change if the sample size were 400 instead of 100?