STATISTICS 211
Assignment #5

Review assignment 4 on confidence intervals, normal approximation to Binomial and the t-distribution.

1. (a) **5.622** $\pm 2.35\frac{.068}{\sqrt{41}}$ **5.622** $\pm$ **.025 [5.597g, 5.647g]**

   (b)**Yes because it falls in the 98.12% CI**

2. **124** $\pm 2.26\frac{18}{\sqrt{10}}$ **124** $\pm$ **12.8641** [111.1359, 136.8641]

3. Sample%=80% SE% = $\frac{\sqrt{(.8)(.2)}}{\sqrt{2250}}\times 100\%$ =.8433%

   80% $\pm$ **1.95 (.8433%) 80%** $\pm$ **1.6444%** [78.36%, 81.64%]
   Results are not valid because the sample is self-selected (not a random sample)

4. Sample%=$\frac{150}{850}\times 100\%$ =17.65% SE% ~ $\frac{\sqrt{(.1765)(.8235)}}{\sqrt{850}}\times 100\%$ =1.3077%

   17.65% $\pm$ **2.35 (1.3077%) 17.65%** $\pm$ **3.0731%** [14.5769%, 20.7231%]

5. Sample%=$\frac{90}{400}\times 100\%$ =22.5% SE% ~ $\frac{\sqrt{(.225)(.775)}}{\sqrt{400}}\times 100\%$ =2.0879%

   22.5% $\pm$ **1.95 (2.0879%) 22.5%** $\pm$ **4.0714%** [18.4286%, 26.5714%]

6.

   Ho: avg job length is 27 days
   Ha: avg job length is less than 27 days

   Expected avg = 27 SEavg = $\frac{SD}{\sqrt{\#\ of\ \ draws}} = \frac{2.1}{\sqrt{50}}$ **=.297**

   $z = \frac{25.3-27}{.297}$ **= -5.724 P(Z<-5.724) ~ 0 ~ 0%chance**

   There is ~0% chance that the sample average for time spent on a job would take less than 25.3 days on avg if the true avg is 27 days. Most likely it takes less than 27 days on avg to complete the job since the observed sample avg was 25.3 days

7.

   Ho:corporate extortion costs companies $3.35 million on avg
   Ha: corporate extortion costs companies more than $3.35 million on avg

   Expected avg = 3.35 million SEavg = $\frac{SD}{\sqrt{\#\ of\ \ draws}} = \frac{1.21}{\sqrt{65}}$ **=.15**

   $z = \frac{3.71-3.35}{.15}$ **= 2.4 P(Z>-2.4) =.0082 ~ 0.82%chance**

   There is ~0.82% chance that the sample avg cost of extortion is 3.71 million or higher if the true avg is 3.35 million. Since we observed a sample average of 3.71 million, most likely the average extortion costs more than 3.35 milliion since the observed avg was 3.71 million.

8.

Ho: daily average is $5000
Ha: daily average is greater than $5000

Expected avg = 5000 SEavg = $\frac{SD+}{\sqrt{\# \ of \ \ draws}} = \frac{507}{\sqrt{20}}$ **=113.3686**

$t = \frac{5200-500}{113.3686}$ **= 1.764 df = 20-1 = 19 P(t>1.764) ~P(t>1.72) = .05 less than a 5% chance**

There is less than a 5% chance that the sample avg of daily revenue is $5200 or more if the true avg is $5000. Since we observed a sample avg of $5200, most likely the average daily revenue is more than $5000.

9. **Ho: average fill =19.2 oz**
Ha: average fill is not equal to 19.2 oz.

Expected avg = 19.2 SEavg = $\frac{SD+}{\sqrt{\# \ of \ \ draws}} = \frac{.67}{\sqrt{60}}$ **=.0865**

$z = \frac{19.2-19.0}{.0865}$ **= 2.31 P(z>2.31) ~.0107 1.07% chance.**

There is approximately a 1.07% chance that the sample avg fill for 60 boxes is 19.2 oz or more if the true avg is 19 oz. The difference between 19.2 and 19 oz is considered to be significant. Since we observed a sample avg of 19.2oz, most likely the true average fill is more than 19.0 oz.

(b) **Since this is a non directional test, the p-value = 2 (1.07%) = 2.14%**

10. Ho: at least .25 pounds of beef on average
Ha: less than .25 pounds of beef on average

Expected avg = .25 SEavg = $\frac{SD+}{\sqrt{\# \ of \ \ draws}} = \frac{.06}{\sqrt{100}}$ **=..006**

$z = \frac{.237-.25}{.006}$ **= -2.17 P(z< -2.17) ~.015 1.5% chance.**

There is approximately a 1.5% chance that the sample avg fill for 100 burgers is .237 pounds or less if the true avg is .25 pounds or more. Since we observed a sample avg of .237, most likely the true average pounds of beef on average is less than 0.25. The difference between .237 and .25 pounds is considered to be significant. Based on the sample data, Big Burger is guilty of false advertising.

11.

Ho: the machine is operating properly (% is at most 5% for bottles that are not full)
Ha: the machine is not operation properly (% is more than 5% for bottles that are not full)

Sample % = $\frac{7}{100} \times 100\%$ **=7% Assuming that the machine is operating properly, than the**

SE%= $\frac{\sqrt{(.05)(.95)}}{\sqrt{100}} \times 100\%$ **=2.1794%**

$z = \frac{7-5}{2.1794}$ **= .9177 P(z> .9177) ~.17.88 17.88% chance.**

There is approximately a 17.88% chance of observing a sample % of 7% or higher (for a sample of 100 bottles) of bottles that are not full when the true % is at most 5%. This observed difference between 7% and the expected 5% is most likely due to random sampling or chance error.

12. **Ho: the % of people against the war in Iraq is the same as last year (65%)**
Ha: the % of people against the war in Iraq is higher than last year (greater than 65%)

Sample % = $\frac{701}{1002} \times 100\%$ **=69.96%   Assuming that the % is the same than the**

SE%= $\frac{\sqrt{(.65)(.35)}}{\sqrt{1002}} \times 100\%$ **=1.5068%**

$z = \frac{69.96\% - 65\%}{1.5068}$ **= 3.29   P(z> 3.29) ~.0   ~0% chance.**

There is approximately a 0% chance of observing a sample % of 69.96% or higher (for a sample of 1002 people) of people who are against the war when the true % is 65%. This observed difference between 69.96% and the expected 65% is considered to be a significant difference.

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13.

Ho: on average school A and B are the same
Ha: on average school A does better than school B.
Observed difference = 37.75-33.74=4.01 expected difference = 0

SE difference = $\sqrt{SE_A^2 + SE_B^2}$ = $\sqrt{\left(\frac{6.67}{\sqrt{110}}\right)^2 + \left(\frac{6.68}{\sqrt{130}}\right)^2}$ = $\sqrt{(.6357)^2 + (.5859)^2}$ **=.8645**

$z = \frac{4.01 - 0}{.8645} = 4.6483$ **`~0% chance**

There is approximately a 0% chance of observing a difference of 4.01 when the true difference is 0. Since we observed a difference of 4.01, we can conclude that on average School A does better than school B based on the sample data.

14.

Ho: on average procedure 1 and 2 are the same
Ha: on average procedure 1 is better than procedure 2.
Observed difference = 154-150=4 expected difference = 0

SE difference = $\sqrt{SE_1^2 + SE_2^2}$ = $\sqrt{\left(\frac{12}{\sqrt{150}}\right)^2 + \left(\frac{15}{\sqrt{260}}\right)^2}$ = $\sqrt{(.9798)^2 + (.9303)^2}$ **=1.3511**

$z = \frac{4 - 0}{1.3511} = 2.9606$ **`~.16% chance**

There is approximately a .16% chance of observing a difference of 4 when the true difference is 0. Since we observed a difference of 4, we can conclude that on average procedure 1 is better (faster time) than procedure 2

15.

Ho:the percentage of adults is the same for Quebec and Ontario
Ha: the percentage of adults is not the same for Quebec and Ontario

Quebec sample % = $\frac{80}{200} \times 100\%$ **=40% Ontario sample % =** $\frac{150}{300} \times 100\%$ **=50%**

Observed difference 50%-40% = 10%
SE difference

= $\sqrt{SE_1^2 + SE_2^2}$ = $\sqrt{\left(\frac{\sqrt{(.4)(.6)}}{\sqrt{200}} \times 100\%\right)^2 + \left(\frac{\sqrt{(.5)(.5)}}{\sqrt{300}} \times 100\%\right)^2}$ =

$\sqrt{(3.4641\%)^2 + (2.8868)^2}$ **=4.5093**

$z = \frac{10 - 0}{4.5093} = 2.2176$ **~1.32% chance**

There is approximately a 1.32% chance of observing a difference of 10% or more when the true difference is 0%. Since we observed a difference of 10% we can conclude that the % of people who own their business in Ontario is significantly higher than people in Quebec.

16.

Ho:the percentage unemployed in August is the same as March
Ha: the percentage unemployed in August is less than that in March

March sample % = $\frac{75}{1000}\times 100\%$ **=7.5% Ontario sample % =** $\frac{65}{1000}\times 100\%$ **=6.5%**

Observed difference 7.5%-6.5% = 1.0%

SE difference

$$= \sqrt{SE_1^{\,2} + SE_2^{\,2}} = \sqrt{\left(\frac{\sqrt{(.075)(.925)}}{\sqrt{1000}}\times 100\%\right)^2 + \left(\frac{\sqrt{(.065)(.935)}}{\sqrt{1000}}\times 100\%\right)^2} =$$

$\sqrt{(.8329\%)^2 + (0.7796)^2}$ **=1.1408%**

$z = \frac{1.0\% - 0}{1.1408\%} = .9766$ **~18.99% chance**

There is approximately a 9.68% chance of observing a difference of 1.5% or more when the true difference is 0%. We can conclude that the program has not been effective (% in March that are unemployed is the same as the % in August) because the difference is not considered significant.

24. Review chapters from previous tutorial and chapters 26, and 27 for quiz 4.