

Homework 5, due in Lecture Tuesday, Oct 11th ---- **Solutions**

(assignment for these solutions can be found on the last page)

1. AIDS research

- a. Confidence Interval: At 95% confidence interval for p , the population proportion of adults willing to support tax hikes to fund AIDS research is:

| Sample | X | N | Sample p | 95% CI | Exact P-Value |
|--------|-----|------|----------|----------------------|---------------|
| 1 | 254 | 1016 | 0.250000 | (0.223638, 0.277819) | 0.000 |

- b. Hypothesis Test:

- i. $H_0: p=0.20$, $H_A: p \neq 0.20$. Has the proportion changed (is it different) from 1990 of $p=0.20$ to 1997?
- ii. Calculate the test statistic and p -value in Minitab. Below the p -value for the test is very small (close to 0):

Test and CI for One Proportion

Test of $p = 0.2$ vs p not = 0.2

| Sample | X | N | Sample p | 95% CI | Exact P-Value |
|--------|-----|------|----------|----------------------|---------------|
| 1 | 254 | 1016 | 0.250000 | (0.223638, 0.277819) | 0.000 |

- iii. Because the p -value=0 < $\alpha=0.05$, we **Reject H_0 in favor of H_A** concluding that the population proportion has changed from 1990 to 1997.
- c. 0.20 is outside of the 95% confidence interval, and we Reject the hypothesis that the population proportion is 0.20 at the $\alpha=0.05$ level. These results are equivalent. An value outside the 95% confidence interval will be rejected at the 0.05 level.

2. Asthma.

- a. $H_0: p=0.014$, $H_A: p \neq 0.014$. Is the population proportion of asthmatic male children aged 0-4 years old in households with smoking mothers different from the overall U.S. proportion of .014?
- b. Calculate the test statistic and p -value in Minitab. Below the p -value for the test is rather large (0.339):

Test and CI for One Proportion

Test of $p = 0.014$ vs p not = 0.014

| Sample | X | N | Sample p | 95% CI | Exact P-Value |
|--------|----|-----|----------|----------------------|---------------|
| 1 | 10 | 500 | 0.020000 | (0.009631, 0.036472) | 0.339 |

- c. Because the p -value=0.339 > $\alpha=0.05$, we **Fail to Reject H_0** concluding there is insufficient evidence to conclude that the population proportion of asthmatic male children aged 0-4 years old in households with smoking mothers is different from the overall U.S. proportion of .014.

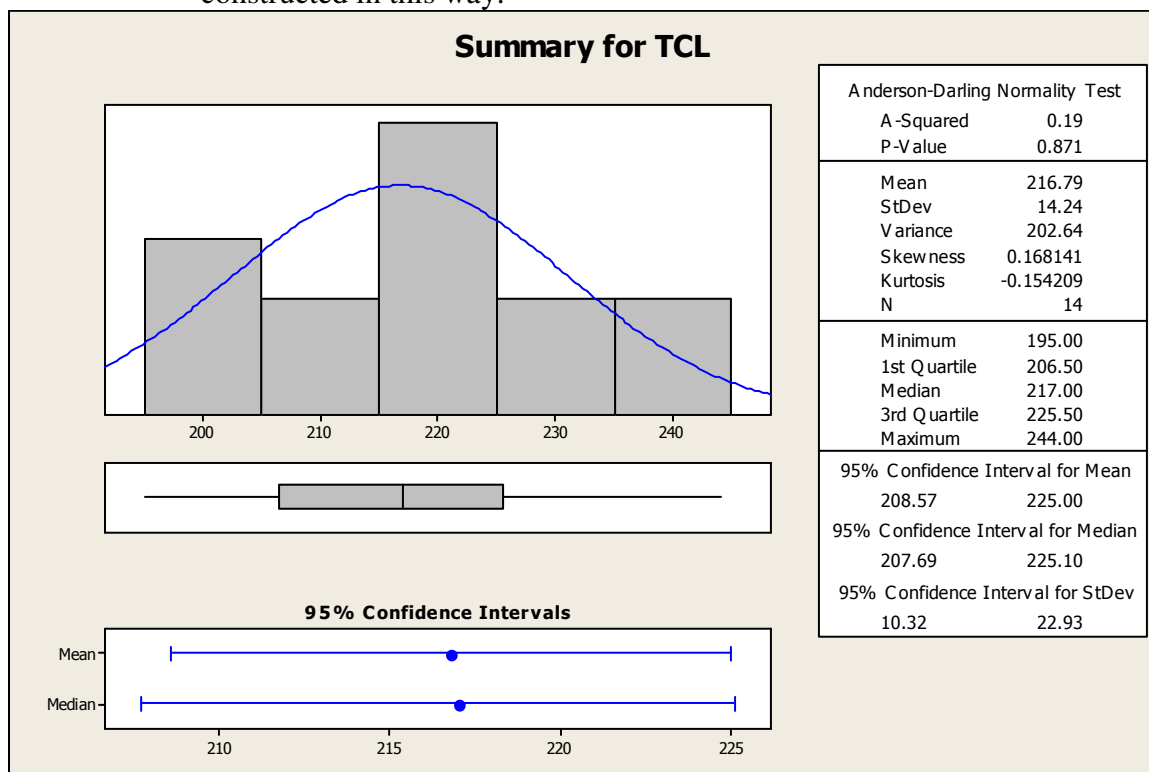
3. Kaiser Total cholesterol levels (TCL).

- $H_0: \mu=210$, $H_A: \mu \neq 210$.** Is the mean TCL of all young adult males on the Kaiser plan different from the U.S. male mean TCL?
- Calculate the test statistic and p -value in Minitab. Below the p -value for the test is large (0.098):

One-Sample T: TCL

Test of $\mu = 210$ vs not = 210
 Variable N Mean StDev SE Mean 95% CI T P
 TCL 14 216.786 14.235 3.805 (208.567, 225.005) 1.78 0.098

- Because the p -value=0.098 $>$ $\alpha=.05$, we **Fail to Reject H_0** concluding there is insufficient evidence to conclude that the mean TCL of all young adult males on the Kaiser plan different from the U.S. male mean TCL.
- Because the sample size is small, we need to check the assumption that the population is normal. In the plot below, the data looks very close to normal. The p -value for the Anderson-Darling Normality Test is 0.871, which causes us to Fail to Reject the normality assumption.
- We are 95% confident the population mean TCL of all young adult males on the Kaiser plan is in the interval (208.567, 225.005). Another way of saying that is, the true population mean will be in 95% of intervals constructed in this way.



4. Nitrates.

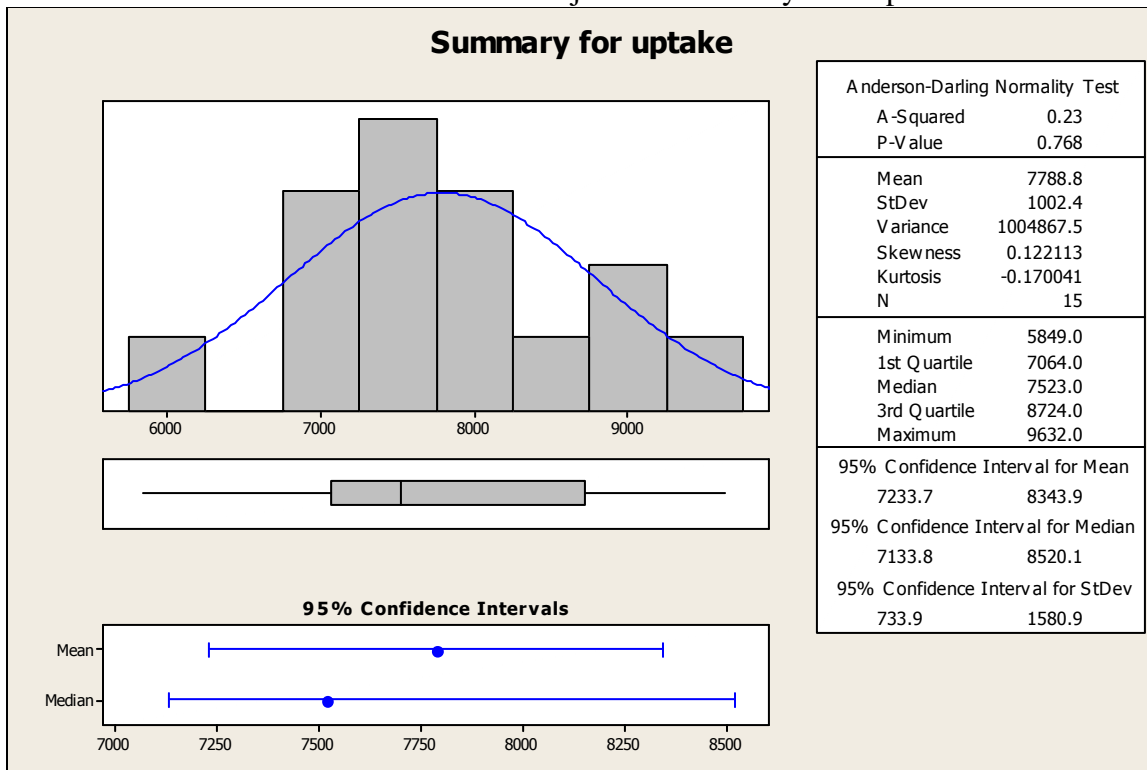
- a. $H_0: \mu=8000$, $H_A: \mu<8000$. Is the mean uptake of cultures with nitrates lower than the mean uptake of cultures with nitrates?
- b. Calculate the test statistic and p -value in Minitab. Below the p -value for the test is large (0.214):

One-Sample T: uptake

Test of $\mu = 8000$ vs < 8000

| Variable | N | Mean | StDev | SE Mean | 90% Upper Bound | T | P |
|----------|----|---------|---------|---------|-----------------------|-------|--------------|
| uptake | 15 | 7788.80 | 1002.43 | 258.83 | 8136.93 | -0.82 | 0.214 |

- c. Because the p -value=0.214 $>$ $\alpha=0.05$, we **Fail to Reject H_0** concluding there is insufficient evidence to conclude that the mean uptake of cultures with nitrates is lower than the mean uptake of cultures with nitrates.
- d. Because the sample size is small, we need to check the assumption that the population is normal. In the plot below, the data looks very close to normal. The p -value for the Anderson-Darling Normality Test is 0.768, which causes us to Fail to Reject the normality assumption.



In each problem make sure you clearly define the population proportion or mean (which ever is relevant) in the context of the problem.

Also, make sure to write a brief, coherent summary for each problem.

1. Do this problem in Minitab

A 1997 survey conducted by M.I.T. reported that 25% of the 1,016 adults surveyed would be willing to support tax hikes to fund AIDS research. Find a 95% CI for the proportion p of all adults that favor such a tax hike.

Suppose it was known that in 1990 that the proportion of all adults willing to support tax hikes to fund AIDS research was .20. Is there evidence that the proportion of adults in 1997 willing to spring for tax hikes for this purpose has changed since 1990? Carry out a test to answer this question. Use $\alpha = .05$.

Is the result of the CI consistent with the test? Explain.

2. Do this problem in Minitab

The annual incidence of asthma in the general U.S. population among male children 0-4 years old is known to be 1.4%. Suppose that we wish to assess whether the population proportion of asthmatic male children aged 0-4 years old in households with smoking mothers differs from the overall U.S. proportion of .014. A sample of 500 boys from the population is selected, and 10 are found to be asthmatic. Carry out the appropriate test of interest at the .05 level, and write a conclusion

3. Do this problem in Minitab.

The following data are the total cholesterol levels (TCL) for a sample of 14 young adult males (aged 25 years or less) on the Kaiser Health plan in California:

225 237 219 211 216 244 216 222 208 202 195 227 218 195

Suppose it is believed that the mean TCL of all adult males in the United States is 210. Is it plausible the mean TCL of all young adult males on the Kaiser plan is the same as the U.S. male mean TCL? Test at the 5% level. Be sure to state any assumptions needed to carry out the test and check whether these assumptions are reasonable. Also, construct and interpret a 95% CI for the Kaiser population mean.

4. Do this problem in Minitab.

Many scientists have expressed concern about the use of nitrates as meat preservatives. In one study, bacteria cultures were grown in a medium containing nitrates. The rate of uptake of radio-labeled amino acid was then determined for each one, yielding the following observations:

7251 6871 9632 6866 9094 5849 8957 7978 7468
7064 7494 7883 8178 7523 8724

Suppose it is known that the true mean uptake for cultures without nitrates is 8000. Does the data suggest that the addition of nitrates results in a decrease in true mean uptake? Test the appropriate hypotheses at the 10% level. Be sure to state any assumptions needed to carry out the test and check whether these assumptions are reasonable.