QUANTITATIVE METHODS
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Winter 2005

Assignment 21
SOLUTIONS

This assignment is due **Wednesday April 20, 2005**.

Question 1 (6 points)

A machine in the college dispenses coffee. The average cup of coffee is supposed to contain 350 ml. Forty cups of coffee from this machine show the average content to be 325 ml with standard deviation 50 ml. Do you think the machine has slipped out of adjustment and the average coffee per cup is less than 325 ml? Use the classical approach with a 2% level of significance.

Step 1 Assumptions: $n = 40 \geq 30$

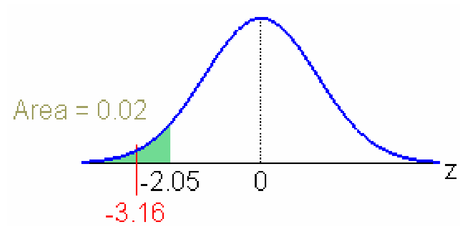
Step 2 $H_o: \mu = 350$ ml

$H_a: \mu < 350$ ml

Step 3 Left-tailed test with $\alpha = 0.02$

Area to the left = 0.02

$z_o = -2.05$



Step 4 $z = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{325 - 350}{\frac{50}{\sqrt{40}}} = -3.16$

Step 5 z is in the critical region

Reject H_o.

∴ There is sufficient evidence at the 5% level of significance to conclude that the machine has slipped out of adjustment.

Question 2 (6 points)

A clinic claims that patients wait, on average, for no more than 20 minutes if they have appointment. To test this claim, a sample of 35 patients was taken, and it was found that the average waiting time was 22 minutes with a standard deviation of 6 minutes. Is this sufficient evidence, at the 5% level of significance, to conclude that the clinics claim is wrong and that patients wait, on average, for more than 20 minutes? Use the classical approach.

Step 1 Assumptions: $n = 35 \geq 30$

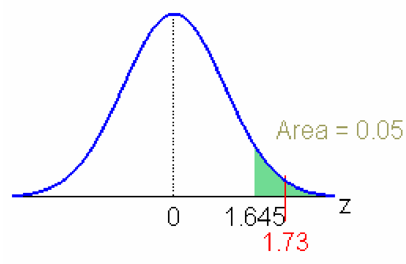
Step 2 $H_o: \ \mu = 20$ min

$H_a: \ \mu > 20$ min

Step 3 Right-tailed test with $\alpha = 0.05$

Area to the left = 0.95

$z_o = 1.645$



Step 4 $z = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{21.7 - 20}{\frac{5.8}{\sqrt{35}}} = 1.73$

Step 5 z is in the critical region

Reject H_o.

∴ There is not sufficient evidence at the 5% level of significance to conclude that patients wait, on average, for more than 20 minutes.

Question 3 (6 points)

The dean at a college claims that students study an average of 12 hours per week. To test this claim, a random sample of 72 students was taken, and it was found that they studied an average of 12.9 hours per week with a standard deviation of 3.2 hours. Is this sufficient evidence to conclude, at the 1% level of significance, that the dean's claim is false? Use the classical approach.

Step 1 Assumptions: $n = 72 \geq 30$

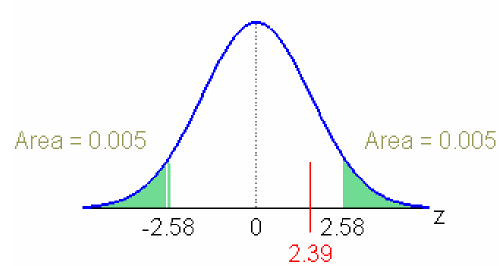
Step 2 $H_o: \ \mu = 12$ hours

$H_a: \ \mu \neq 12$ hours

Step 3 Two-tailed test with $\alpha = 0.01$

Area to the left = 0.995

$z_o = \pm 2.58$



Step 4 $z = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{12.9 - 12}{\frac{3.2}{\sqrt{72}}} = 2.39$

Step 5 z is not in the critical region

Fail to reject H_o.

∴ There is not sufficient evidence at the 1% level of significance to conclude that students do not study an average of 12 hours per week.

Question 4 (6 points)

A random sample of 64 Canadians showed that they watched an average of 14.8 hours of television a week, with a standard deviation of 3.1 hours. Can you conclude, at the 1% level of significance, that Canadians watch more than 14 hours (2 hours per day) of television per week?

Step 1 Assumptions: $n = 64 \geq 30$

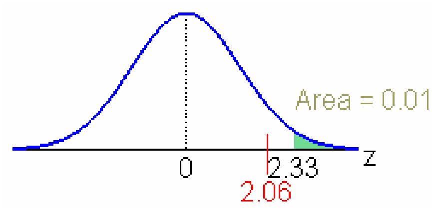
Step 2 $H_o: \ \mu = 14$

$H_a: \ \mu > 14$

Step 3 Right-tailed test with $\alpha = 0.01$

Area to the left = 0.99

$z_o = 2.33$



Step 4 $z = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{14.8 - 14}{\frac{3.1}{\sqrt{64}}} = 2.06$

Step 5 z is not in the critical region

Fail to reject H_o.

∴ There is not sufficient evidence at the 5% level of significance to conclude that Canadians watch more than 14 hours of television each week.

Question 5 (6 points)

Three years ago, the average number of *e*-mails a student at SLC received was 3.6 per day. A random sample of 45 students was recently taken and showed that the average number of *e*-mails they received was 5.1 *e*-mails with a standard deviation of 2.9 *e*-mails. Can you conclude, at the 5% level of significance, that the number of *e*-mails received by students at SLC is different now then it was three years ago?

Step 1 Assumptions: $n = 45 \geq 30$

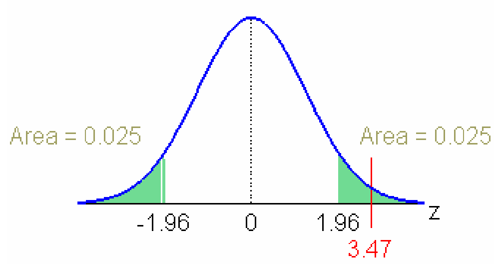
Step 2 $H_o: \ \mu = 3.6$ emails

$H_a: \ \mu \neq 3.6$ emails

Step 3 Two-tailed test with $\alpha = 0.05$

Area to the left = 0.975

$z_c = 1.96$



Step 4 $z = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \dfrac{5.1 - 3.6}{\frac{2.9}{\sqrt{45}}} = 3.47$

Step 5 z is in the critical region

Reject H_o.

∴ There is sufficient evidence at the 5% level of significance to conclude that the number of *e*-mails received by students at SLC is different now then it was three years ago.