

MATH 130.05: Elements of Statistics I

Quiz 4 (15 points)
December 8, 2009

NAME: Key

Answer all questions. Show all your working neatly and indicate your answers clearly.
(Recall: Test statistic for μ with σ known: $z_0 = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$; test statistic for μ with σ unknown:

$$t_0 = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$$

1. (8 points) An energy official claims that the oil output per well in the United States has declined from the 1998 output level of 11.1 barrels per day. He randomly samples 50 wells and determines the mean output to be 10.5 barrels per day. Assume that $\sigma = 1.4$ barrels.

- (a) Identify the null and alternative hypotheses.

$$H_0: \mu = 11.1$$

$$H_1: \mu < 11.1$$

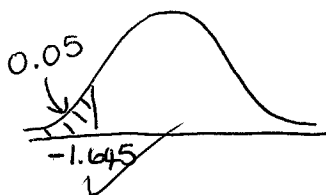
- (b) Is this a left-tailed, right-tailed or two-tailed test?

Left-tailed ✓

- (c) Compute the test statistic.

$$z_0 = \frac{10.5 - 11.1}{1.4/\sqrt{50}} = -3.03$$

- (d) Test the researcher's claim at the $\alpha = 0.05$ level of significance. State your conclusion clearly.



$$z_0 < -1.645$$

Reject H_0 . ✓

There is sufficient evidence to indicate the mean output has decreased from the 1998 level. ✓

- (e) What would it mean to make a Type I error in this situation?

Evidence indicates that the output has decreased, when, in fact, it has not. ✓

THERE IS ANOTHER QUESTION ON THE OTHER SIDE OF THE PAPER!!

2. (7 points) In 2001 the mean household expenditure for energy was \$1493. An economist believes that this amount has changed for 2008. In a random sample of 35 households he found the mean expenditure to be \$1610 with a standard deviation of \$320.

(a) Identify the null and alternative hypotheses.

$$H_0: \mu = 1493 \quad \checkmark$$

$$H_1: \mu \neq 1493 \quad \checkmark$$

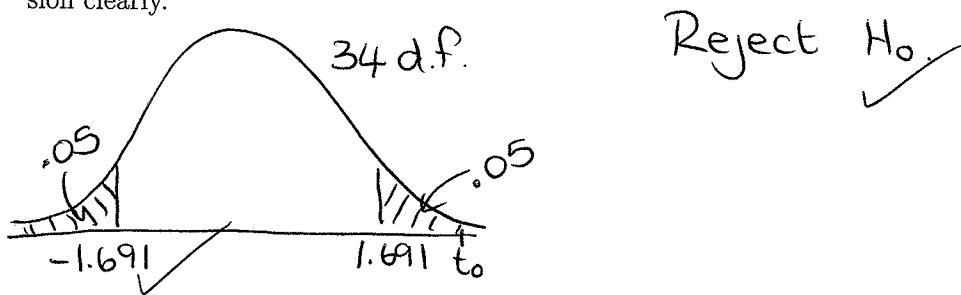
(b) Is this a left-tailed, right-tailed or two-tailed test?

Two-tailed \checkmark

(c) Compute the test statistic.

$$t_0 = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} = \frac{1610 - 1493}{320/\sqrt{35}} = 2.163 \quad \checkmark$$

(d) Test the researcher's claim at the $\alpha = 0.1$ level of significance. State your conclusion clearly.



There is sufficient evidence to indicate that the mean household expenditure for energy has changed. \checkmark

THE END