

Exercises

 derekogle.com/NCMTH107/modules/CE/HypTesting_CE1

Identifying Hypotheses

For each research hypothesis or statement below, construct the null and alternative hypotheses (use their respective symbols) and explicitly define the parameter in the hypotheses.

1. The mean number of murders per burrough in New York City in 2010 was less than 90.
 2. The Toyota dealership has advertised that oil changes will be completed in 15 minutes or less. Test whether their advertisement is incorrect, on average.
 3. The National Institute of Diabetes and Digestive and Kidney Diseases reports that the average cost of bariatric (weight loss) surgery is \$22,500. You think that this information is incorrect.
 4. Washburn High School publicizes that 61% of its students are involved in at least one extracurricular activity. A parent organization believes that the percentage is higher.
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I urge you to follow these steps when answering all p-value-related questions:

- a. Identify H_0 and H_A . If the question has a context then the parameter should be stated within that context.
- b. Define the p-value specific to the situation.
- c. Draw the null distribution.
- d. Compute the p-value.
- e. Make a decision about H_0 . If the question has a context then the conclusion should be stated within that context.

A reminder to use these steps will **NOT** be provided on future quizzes, but you should get in the habit of following them. See [here](#) for a demonstration of the steps.

P-Value Calculations and Decisions I

Compute the p-value (see the steps suggested above) For each situation below.

1. $H_A: \mu \neq 14$, $\sigma = 6$, $n = 25$, $\bar{x} = 11.2$, $\alpha = 0.05$.
2. $H_A: \mu > 75$, $\sigma = 12$, $n = 50$, $\bar{x} = 79.5$, $\alpha = 0.10$.

3. $H_A: \mu < 15000, \sigma = 8000, n = 50, \bar{x} = 13700, \alpha = 0.10$.

Body Temperature

Machowiak et al. (1992)¹ provided a critical examination of whether normal body temperature was 37°C. They recorded the orally-determined body temperatures of 65 male and 65 female subjects. Use their results in Table 1 to answer the questions further below.

Table 1: Summary statistics for the body temperature of a sample of men and women.

	n	mean	sd	min	Q1	median	Q3	max
	130.00	36.81	0.41	35.70	36.60	36.80	37.10	38.20

1. construct statistical hypotheses,
2. compute the sample mean (use `Summarize()`),
3. compute the p-value assuming that $\sigma = 0.41$ (use `distrib()`),
4. make a decision about the hypotheses using $\alpha = 0.05$, and
5. summarize your findings in terms of body temperatures.

Beetle Size

Researchers examined the size of two different species of beetles. They hypothesized that the thorax length of the *Halticus oleracea* species would be greater than 190 μm . Use their results for the *Halticus oleracea* species in Table 2 to answer the questions further below.

Table 2: Summary statistics for the thorax length for two species of beetles.

	species	n	mean	sd	min	Q1	median	Q3	max
1	Halticus.carduorum	20	179.55	10.09	158	175.75	180.5	181.75	198
2	Halticus.oleracea	18	194.17	14.03	170	189.75	192.0	200.75	221

1. construct statistical hypotheses,
2. compute the p-value assuming that $\sigma = 14$,
3. make a decision about the hypotheses using $\alpha = 0.05$, and
4. summarize your findings in terms of the beetle's thorax size.

Identifying Type I and II Errors

In each situation below, describe what a Type I and a Type II error is and make an argument for which error is more egregious. [*Hint: begin by identifying H_0 and H_A and then writing what these hypotheses mean in words.*]

1. The United States Department of Agriculture's (USDA) limit for salmonella contamination for chicken parts is 15.4% ([source](#)). Suppose that a meat inspector reports that the chicken produced by a particular company exceeds the USDA limit. A hypothesis test will be performed to determine whether the meat inspector's claim appears to be true or not.
2. The process of manufacturing a certain drug is quite complex. Small departures from the standard procedure can result in a drug that does not meet specifications and is dangerous to the user. Before being released for use, a sample of a batch of the drug is tested to determine if the mean amount of a particular chemical in the drug exceeds specifications. A hypothesis test will be performed to determine if the safe level was exceeded.