Homework Set 6 Solution

MAT 203, Elementary Statistics, Term IV — Dowman P. Varn, Instructor
Coker College — Due: 14 April 2009

Homework Policy: The point of homework is to learn by doing. I have no problem if you work in groups, use the internet or use human resources to help you complete the assignment. I do ask that you not copy someone else's homework. Please do all the mathematics yourself. By submitting your homework, you implicitly signify that it is your own. This assignment is due at the beginning of class on 14 April 2009.

1. Larson & Farber, problem 19, p. 375. Use the given statement to represent a claim. Write its complement and state which is H_0 and H_a.

$$\begin{aligned} H_0 &: \mu \leq 645 \text{ (claim)} \\ H_a &: \mu > 645 \end{aligned}$$

2. Larson & Farber, problem 19, p. 375. Determine whether the hypothesis test with the given null and alternative hypotheses is left-tailed, right-tailed or two-tailed.

$$\begin{aligned} H_0 &: \mu \leq 8.0 \\ H_a &: \mu > 8.0 \end{aligned}$$

The inequality sign in the alternative hypothesis points to the right, so this is a right-tailed test.

3. Larson & Farber, problem 25, p. 376. State the claim mathematically. Write the null and alternative hypotheses and identify which is the claim. The standard deviation of the base price of a certain type of all-terrain vehicle is no more than \$320.

$$\begin{aligned} H_0 &: \sigma \leq \$320 \text{ (claim)} \\ H_a &: \sigma > \$320 \end{aligned}$$

4. Larson & Farber, problem 33, p. 376. Write a statement describing Type I and Type II errors for a hypothesis test of the indicated claim. According to a recent survey, 88% of college students own a computer.

Type I Error: Even though it is true that 88% of college students own a computer, this hypothesis is rejected.

Type II Error: Although it is not true that 88% of college students own a computer, this hypothesis is not rejected.

5. Larson & Farber, problem 42, p. 393. In your work for a national health organization, you are asked to monitor the amount of sodium in a certain brand of cereal. You find that a random sampling of 52 servings has a mean sodium content of 232 milligrams with a standard deviation of 10 milligrams. At $\alpha = 0.04$, can you conclude that the mean sodium content per serving is greater 230 milligrams?

(a)

$$\begin{aligned} H_0 &: \mu \leq 230 \text{ (claim)} \\ H_a &: \mu > 230 \end{aligned}$$

(b) We need to use a right-tailed test. We can find the critical value as $z_0 =$ `invNorm(0.96,0,1)` $= 1.75$. The rejection region is anything to the right of $z_0 = 1.75$.

(c) The test statistic is given by:

$$\begin{aligned} z &= \frac{x-\mu}{\sigma/\sqrt{n}} \\ &= \frac{232-230}{10/\sqrt{52}} \\ &= \frac{2}{1.39} \\ &= 1.44 \end{aligned}$$

(d) Since $z < z_0$, the test statistic is not in the rejection region, thus we fail to reject the null hypothesis.

(e) We can not conclude that the mean sodium content is greater than 230 milligrams per serving.

6. Larson & Farber, problem 28, p. 405. An employment information service claims that the mean annual pay for full-time female workers over age 25 and without a high school diploma is \$19,100. The annual pay for a random sample of 12 full-time female workers over age 25 without a high school diploma is given in the table below. At $\alpha = 0.05$, test the claim that the mean salary is \$19,100.

18,165	16,112	18,794	18,803	19,864	19,177
17,328	21,445	20,354	19,143	18,316	19,237

Since $n = 12$ which is less than 25, we need to use the t-distribution.

(a)

$$\begin{aligned} H_0 &: \mu = 19,100 \text{ (claim)} \\ H_a &: \mu \neq 19,100 \end{aligned}$$

(b) This is a two-tailed test. We can find the critical values from Table 5 on page A18 of Larson & Farber. Since $n = 12$, we have $df = n - 1 = 12 - 1 = 11$. We find the critical values to be $t_0 = 2.201$. So, the rejection regions are $t < -2.201$ and $t > 2.201$.

(c) From the TI-83, we find the average of the data to be \$18,886.5 and the standard deviation to be \$1397.

The test statistic is given by:

$$\begin{aligned} t &= \frac{x-\mu}{\sigma/\sqrt{n}} \\ &= \frac{18886.5-19100}{1397/\sqrt{12}} \\ &= \frac{-213.5}{403.3} \\ &= -0.529 \end{aligned}$$

(d) Since t is not in the rejection zone, we fail to reject the null hypothesis.

(e) The data is consistent with the average salary being \$19,100 (at the $\alpha = 0.05$ level), but we can draw no conclusions.