

MAS 250 Homework Assignment 6

Due: November 21 (Monday) 1 pm

Instruction: Turn in homework as **a single pdf file**.

1. Salmon grown at a commercial hatchery have weights that are normally distributed. When the “Norwegian method” is used, the adult salmon have mean weight 7.6 pounds. A hatchery claims that a modification to the method that they are using increases the average weight. Suppose a random sample of 40 fish grown using the new method yielded an average weight of 8.1 pounds with a sample standard deviation of 1.5 pounds.
 - (a) Define the parameter involved and state the null and alternative hypotheses using the parameter.
 - (b) Perform the hypothesis test at the 5% level of significance. What is the p -value?
 - (c) Calculate the type II error with the alternative hypothesis $\mu = 8.2$.
 - (d) To achieve at least 90% of power at $\mu = 8.2$, how large does a random sample need to be? Use $\sigma = 1.5$ and $\alpha = .05$.
2. The braking ability of two types of automobiles was compared. Random samples of 26 automobiles were tested for each type. The recorded measurement was the distance required to stop when the brakes were applied at 40 miles per hour. The computed sample means and variances were as follows.

$$\begin{array}{l|l} n_1 = 14 & n_2 = 12 \\ \bar{x} = 118 & \bar{y} = 109 \\ s_1^2 = 102 & s_2^2 = 87 \end{array}$$

Use $t_{0.025,24} = 2.064$.

- (a) Calculate a 95% confidence interval for the difference of population means.
 - (b) Carry out a t-test of $H_0 : \mu_1 = \mu_2$ versus $H_1 : \mu_1 \neq \mu_2$ at $\alpha = .05$. Interpret the result in the context.
 - (c) State the relationship between (a) and (b).
 - (d) What assumptions do you need make to calculate (a)-(c)?
3. In an experiment to compare two diets for fattening beef steers, nine pairs of animals were chosen from the herd; members of each pair were matched as closely as possible with respect to hereditary factors. The members of each pair were randomly allocated, one to each diet. The following table shows the weight gains (lb) of the animals over a 140-day test period on diet 1 and on diet 2.

Pair	1	2	3	4	5	6	7	8	9
Diet 1	596	422	524	454	538	552	478	564	556
Diet 2	498	460	468	458	530	482	528	598	456

- (a) Construct a 90% confidence interval for the mean difference. Interpret the obtained interval.
 - (b) Do the data support the difference of the means between the diets? Define the parameters involved and state the appropriate hypotheses.
 - (c) Perform and interpret the testing result in the context using $\alpha = 0.1$.
4. A physical model suggests that the mean temperature increase in the water used as coolant in a compressor chamber should not be more than 5°C . Temperature increases in the coolant measured on 8 independent runs of the compressing unit revealed the following data: 6.4, 4.3, 5.7, 4.9, 6.5, 5.9, 6.4, 5.1.
- (a) Do the data contradict the assertion of the physical model? (Test at $\alpha = 0.05$.) State the assumption you make about the population.
 - (b) Determine a 95% confidence interval for the mean increase of the temperature in the coolant.
5. A genetic model suggests that 80% of the plants grown from a cross between two given strains of seeds will be of the dwarf variety. After breeding 200 of these plants, 64 were not of the dwarf variety.
- (a) Does this observation strongly contradict the genetic model? ($\alpha = 0.05$)
 - (b) Construct a 95% confidence interval for the true proportion of dwarf plants obtained from the given cross.
6. Researchers at the National Cancer Institute released the results of a study that investigated the effect of weed-killing herbicides on house pets. They examined 827 dogs from homes where an herbicide was used on a regular basis, diagnosing malignant lymphoma in 473 of them. Of the 130 dogs from homes where no herbicides were used, only 19 were found to have lymphoma.
- (a) Define the parameters of interest, p_1 and p_2 , in the context of the problem. What is an estimate of $p_1 - p_2$?
 - (b) Determine the null and alternative hypothesis to test if pets are more likely to be diagnosed with lymphoma as a result of regular use of herbicides.
 - (c) Check the conditions for carrying out the test in (d).
 - (d) Determine the test statistic and p -value.
 - (e) Draw the conclusion in the context of the problem. Use a significance level of 0.01.
 - (f) Obtain a 99% confidence interval. Interpret the confidence interval in the context of the problem.

7. **R assignment.** Use the **gallup** data for Homework 1.

- (a) Construct a 95% confidence interval for **lsalary** and test the hypothesis H_0 : mean **lsalary** ≥ 9.85 vs. H_1 : mean **lsalary** < 9.85 . What is the p -value and your conclusion of the test at $\alpha = 0.05$? (Note that the confidence interval is two-sided while the test is one-sided.)
- (b) Obtain a 95% confidence interval for the ratio of $\text{var}(\text{male lsalary})$ and $\text{var}(\text{female lsalary})$, and test whether these two variances are equal or not.
- (c) Construct a 95% confidence interval for the mean difference of **lsalary** by **gend**. Is there a difference in mean of **lsalary** between male and female? Use $\alpha = 0.01$.
- (d) Let $p = \text{proportion of } \mathbf{train} = 1$. Test $H_0 : p = 0.5$ vs. $H_1 : p \neq 0.5$ using both exact and approximated results.

8. From the exercise problems in Chapter 8:

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9. (Suggested: no submission)

2, 5, 7, 12, 15, 23, 26, 27, 32, 38, 42, 47, 48, 51, 58, 59, 60, 63, 66