SM339 · Applied Statistics   Spring 2024 · Uhan

Quiz 3 – 2/1/2024

Instructions. You have 15 minutes to complete this quiz. You may use your plebe-issue TI-36X Pro calculator. You may <u>not</u> use any other materials.

<u>Show all your work.</u> To receive full credit, your solutions must be completely correct, sufficiently justified, and easy to follow.

Problem	Weight	Score
1a	1	
1b	1	
2a	0.5	
2b	0.5	
2c	0.5	
2d	0.5	
2e	0.5	
Total		/ 45

Problem 1. The registrar at a small liberal arts college computes descriptive summaries for all members of the entering class on a regular basis. For example, the mean and standard deviation of the high school grade point averages for all entering students in a particular year were 3.16 and 0.5247, respectively. The Mathematics Department is interested in helping all students who want to take mathematics to identify the appropriate course, so they offer a placement exam. A randomly selected subset of students taking this exam during the past decade had an average score of 71.05 with a standard deviation of 8.96.

a. What is the population of interest to the registrar at this college?

This is STAT2 Exercise 0.9a, assigned for homework.

b. Are the department's placement exam numerical summaries (71.05 and 8.96) statistics or parameters? Briefly explain.

This is STAT2 Exercise 0.9d, assigned for homework.

Problem 2. A researcher is interested in studying whether the weight of penguins differs by type. She gathers a random sample of the same number of penguins from each of the following five types: King, Emperor, Chinstrap, Royal, and Gentoo. For each penguin, she records its weight and type. The one-way ANOVA table is below.

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Type	4	22.74	5.685	20.159	7.79E-11
Residuals	65	18.31	0.282		

Perform a one-way ANOVA F-test by answering the following prompts. Use a significance level of 0.05.

a. Let μ_{King}, $\mu_{Emperor}$, $\mu_{Chinstrap}$, μ_{Royal}, μ_{Gentoo} be the average weight of King, Emperor, Chinstrap, Royal, and Gentoo penguins, respectively. State the null and alternative hypotheses.

See Example 3 in Lesson 5 Part 1 for a similar example.

b. What is the test statistic? Provide your answer to 3 decimal places.

See Example 3 in Lesson 5 Part 1 for a similar example.

Some of you used the formula $F = \frac{MSGroups}{MSE}$, which is correct. Also note, however, that the test statistic is also directly given in the one-way ANOVA table above!

c. What is the p-value? Do you reject or fail to reject the null hypothesis? Briefly explain.

See Example 3 in Lesson 5 Part 1 for a similar example.

d. Based on your answer to part c, state your conclusion about the average weight of King, Emperor, Chinstrap, Royal, and Gentoo penguins.

See Example 3 in Lesson 5 Part 1 for a similar example.

Be careful with your language here. The conclusion of a hypothesis test like the one-way ANOVA F-test is never certain. See the feedback to Problem 2d in Quiz 2 for some additional guidance.

e. Suppose you rejected the null hypothesis, but in fact, $\mu_{King} = \mu_{Emperor} = \mu_{Chinstrap} = \mu_{Royal} = \mu_{Gentoo}$. What kind of error is this? No explanation necessary.

See page 4 of Lesson 4 Part 1 for details on Type I and Type II errors.