STAT 8010 Exam II

June 12, 2023

Name:_____

Directions

1. Show your work on ALL questions (except those multiple choice questions). Unsupported work will NOT receive full credit.
2. Decimal answers should be exact, or to exactly 4 significant digits.
3. Please write legibly. If I cannot read your writing, NO credit will be given.
4. Put your work into a **single file** and upload it to Canvas before 9:30pm.
5. **Please work on these questions independently. Collaborating with another student will be considered a violation of academic integrity.**

Good Luck!!!

Problem	Points Possible	Points Earned
1	20	
2	25	
3	15	
4	20	
5	20	
Total	100	

Problem 1

(4 points for each answer.)

(a) Which of the following statements is false?

A : If we make a Type II error, we have missed detecting an event or effect when there actually was one.

B : If we increase the probability of making a Type II error, we decrease the probability of making a Type I error.

C : The 90% confidence interval around a given sample mean is wider than the 95% confidence interval around that mean.

D : If we reject the null hypothesis at the $\alpha = 0.05$ level, then we should also reject it at the $\alpha = 0.1$ level.

(b) Which of the following corresponds to a Type I error in hypothesis testing?

A : Rejecting H_0 when H_a is true

B : Failing to reject H_0 when H_0 is true

C : Failing to reject H_0 when H_a is true

D : Rejecting H_0 when H_0 is true

(c) Which of the following is NOT a linear contrast of population means?

$A : \mu_1 - \mu_2$

$B : \mu_2 - \frac{1}{2}\mu_3 - \frac{1}{2}\mu_5$

$C : \mu_1 - \mu_2 + \frac{1}{3}\mu_3 - \frac{1}{4}\mu_4$

$D : \mu_1 + \mu_2 - \mu_3 - \mu_4$

(d) The standard deviation of GRE Quantitative scores is 10 points. What is the standard deviation of the sampling distribution of the sample mean with sample size $n = 100$?

A : 2

B : 1

C : 10

D : Can't be determined without sample mean

(e) If the true means of the J populations are equal, then MSTr/MSE should be:

A : more than 10.00

B : equal to 0.00

C : close to -1.00

D : close to 1.00

Problem 2

(5 points for each answer.)

An advertising manager wants to investigate post–advertisement attitude towards a brand expressed by four different groups - each group saw the same advertisement except that the eye-color ("Blue" = blue eyes, "Brown" = brown eyes, "Green"= green eyes, "Down" = eye color cannot be seen) of the model was manipulated. The advertising manager would like to know if model's eye color affects the attitude towards the brand. Use the data set, `Response2EyeColor.csv`, to answer the following questions:

(a) State the null and alternative hypotheses.

(b) Fill in the missing elements in the ANOVA table below:

Source	df	SS	MS	F statistic
Group		SSTr =	MSTr =	
Error		SSE = 613.1387	MSE =	
Total		SSTo = 637.5584		

(c) Perform an overall F-test for part (a) at 0.05 level.

(d) Use the R output of Tukey Honest Significant Differences (HSD) test to identify the color pairs that are significantly different from each other at FWER $\bar{\alpha} = 0.1$

	diff	lwr	upr	p adj
Brown-Blue	0.53029447	-0.261510938	1.3220999	0.41321572
Down-Blue	-0.08671278	-0.853231218	0.6798057	0.99377199
Green-Blue	0.66571041	0.019850181	1.3115706	0.08478926
Down-Brown	-0.61700725	-1.493593332	0.2595788	0.36810918
Green-Brown	0.13541594	-0.637880949	0.9087128	0.97770956
Green-Down	0.75242319	0.005039228	1.4998071	0.09648953

(e) Construct a 99% confidence interval for $L = \frac{1}{2}\mu_{\text{Green}} + \frac{1}{2}\mu_{\text{Brown}} - \frac{1}{2}\mu_{\text{Blue}} - \frac{1}{2}\mu_{\text{Down}}$

Problem 3

(5 points for each answer.)

Suppose concrete cylinders for bridge supports. There are three ways of drying green concrete (A, B, and C), and you want to find the one that gives you the best compressive strength. The concrete is mixed in batches that are large enough to produce exactly three cylinders, and your production engineer believes that there is substantial variation in the quality of the concrete from batch to batch. You have data from 4 batches on each of the 3 drying processes. Use the data set, `rcbd.txt`, to answer the following questions:

(a) Test, at the 5% level of significance, whether these data provide sufficient evidence that at least one of the three treatments (A, B, and C) affects the average compressive strength.

(b) Create a interaction plot to assess the appropriateness of the assumption that treatments have the same effect across blocks.

(c) Perform a Fisher's LSD with Bonferroni correction to determine which pairs are significantly different than each other at 0.05 level after accounting for multiple comparisons.

Problem 4

A graduate school administrator would like to know the average TOEFL (Test of English as a Foreign Language) score for international applicants. She take a random sample of 100 international applicants. Use $\bar{x} = 80$, $s = 21$ to answer the following questions:

(a) Construct a 95% confidence interval for the average TOEFL score for all international applicants. **(7 points)**

(b) One of the graduate school administrators would like to know if the average TOEFL score is greater than 79, the university minimum requirement. Conduct a hypothesis test for this assessment (using $\alpha = 0.05$ for this test). **(7 points)**

(c) Compute the minimum sample size needed such that the 95% CI for average TOEFL score to be 5 in width if $\sigma = 20$ **(6 points)**

Problem 5

An educational researcher wants to evaluate the effectiveness of directed reading activities in terms of the performance of pupils on Degree of Reading Power test (DRP). She conducts an experiment with two groups of pupils, one control group and one group that was given Directed Reading Activities, and she records their reading performance in the data set `DirectedReadingActivities.csv`. She wants to know if having directed reading activities will improve the average DRP score.

(a) What is the point estimate of the average difference (Control - Treatment)?

(b) Create QQ-plot for each group to assess the normality assumption.

(c) State the null and alternative hypotheses.

(d) Perform the test in (c). State the assumptions being made for performing the test and draw the conclusion in this context at 0.05 level.