KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
MATHEMATICS DEPARTMENT

STAT 212 BUSINESS STATISTICS II
Semester 233, Second Exam
July 25, 2022

Time allowed 90 minutes

Name: _____ ID #:_____

Important Instructions:

Check that this exam has 15 questions

- All types of mobile phones or smart watches are NOT allowed during the examination.
- Use HB 2.5 pencils only.
- Use a good eraser. DO NOT use the erasers attached to the pencil.
- Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.
- When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.
- The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.
- When bubbling, make sure that the bubbled space is fully covered.
- When erasing a bubble, make sure that you do not leave any trace of penciling
- Formula sheet will be provided to you in exam. You are not allowed to bring, with you, formula sheet or any other printed/written paper.

Q12.8 page 474

Do people of different age groups differ in their response to e-mail messages? A survey by the Center for the Digital Future reported that 65.6% of users over age 70 believe that e-mail messages should be answered quickly, as compared to 58.6% of users 12 to 50 years old. Suppose that the survey was based on 1,000 users over age 70 and 1,000 users 12 to 50 years old. The results of the survey are summarized on the table below

		Age of response		
		12-50 years old	Above age 70	Total
Response to e-mail messages	Yes	586	656	1242
	No	414	344	758
	Total	1000	1000	2000

At the 0.01 level of significance, is there evidence of a significant difference between the two age groups in their belief that e-mail messages should be answered quickly?

Based on this information, answer the next **three** questions

1. What is the alternative hypothesis?

a. $H_1: \pi_1 \neq \pi_2$
b. $H_1: \pi_1 = \pi_2$
c. $H_1: \pi_1 < \pi_2$
d. $H_1: \pi_1 > \pi_2$
e. $H_1: \pi_1 \geq \pi_2$

Expected values

	Age of response		
	12-50 years old	Above age 70	Total
Yes	621	621	1242
No	414	344	758
Total	1000	1000	2000

2. What is the computed value of the test statistic?

a. 10.41
b. 8.05
c. 7.59
d. 4.93
e. 6.46

Test Statistic

12-50 years old	Above age 70	Total
$\frac{1225}{621}$	$\frac{1225}{621}$	$\frac{2450}{621}$
$\frac{1225}{379}$	$\frac{1225}{379}$	$\frac{2450}{379}$
	$\chi_0^2 =$	10.4096

3. Which of the following is correct decision rule?

a. Reject H0 if $\chi_0^2 > 6.635$
b. Reject H0 if $\chi_0^2 > 3.841$
c. Reject H0 if $\chi_0^2 > 2.706$
d. Reject H0 if $|\chi_0^2| > 6.635$
e. Reject H0 if $\chi_0^2 > 5.024$

reject H0 if $\chi_0^2 > \chi_{0.01,1}^2 = 6.635$

Q12.15 Page 480

How do Americans feel about online discounts tailored to their individual interests? A survey of 1,000 adult Internet users. A study showed the results for the different age groups

		Age group			
		Below 25	25 to 55	Above 55	Total
Oppose to discounts on web	Yes	119	58	40	217
	No	221	192	160	573
	Total	340	250	200	790

Groups	Sample proportion	Sample size
1 and 2	0.35	340
1 and 3	0.232	250
2 and 3	0.2	200

Marascuilo's Procedure			
Groups	Absolute difference	Critical Range	
1 and 2	0.118	0.10097	Significant difference
1 and 3	0.15	0.104111	Significant difference
2 and 3	0.032	0.105644	Not significant difference

After calculating the test statistic and compared the value with the critical value at 2.5% level of significance, we found that there a significant difference among the age groups in the opposition to discounts on web pages tailored to their interests. We want to see which groups are different?

Based on this information, answer the next **two** questions

4. What is the critical range for testing the difference between below 25 and between 25 - 55?

   a. 0.100971
   b. 0.037173
   c. 0.079770
   d. 0.090896
   e. 0.112812

$$\chi^2_{0.025,2} = 7.378$$

$$Critical\ range = \sqrt{7.378}\sqrt{\frac{0.35(1-0.35)}{340} + \frac{0.232(1-0.232)}{250}} = 0.100971$$

5. Which of the following conclusions is true?

   a. There is a significant difference between below 25 and 25-55 groups, and between below 25 and above 55 groups.
   b. There is a significant difference between below 25 and 35-54 groups, and between 25-55 and over 55 groups.
   c. There is a significant difference between below 25 and 35-54 groups, only.
   d. There is a significant difference between 25-55 and over 55 groups, only.
   e. There is a significant difference between all three pairs of groups.

Q12.30 page 490

A taste-testing experiment compared two brands of cola. After the initial comparison, 60 preferred Brand A, and 40 preferred Brand B. The 100 respondents were then exposed to a very professional advertisement promoting Brand A. The 100 respondents were then asked to taste the two brands again and declare which brand they preferred. The results are shown in the following table:

		Preference After advertising		
		Brand A	Brand B	Total
Preference prior to advertising	Brand A	55	5	60
	Brand B	15	25	40
	Total	70	30	100

At the 0.05 level of significance, to test that there is an evidence that the proportion who preferred Brand A was lower before the advertising than after the advertising? Answer the next **two** questions

6. What is the computed value of the test statistic?

   a. – 2.24
   b. 33.53
   c. 2.24
   d. – 33.53
   e. 4.47

$$Z_0 = \frac{5 - 15}{\sqrt{5 + 15}} = -2.24$$

7. The p-value of the test is equal to

   a. 0.01255
   b. 0.98745
   c. 0.02510
   d. About 0.0005
   e. 0

Since $H_0: \pi_1 < \pi_2$

$$p - value = P(Z < z_0) = P(Z < -2.24) = 0.01255$$

An agent for a residential real estate company in a large city would like to be able to predict the monthly rental cost for apartments, based on the size of an apartment, as defined by square meter. The agent selects a sample of 25 apartments (with sizes between 200 square meters and 600 square meters) in a particular residential neighborhood and he believes that the appropriate model is

$$\hat{y} = 178.335 + 3.465\ \mathrm{X}$$

Some additional results are given: $s_e(\hat{\beta}_1) = 0.4577,\ SSR = 2240704,\ SSE = 899022$

Based on this information, answer the next **four** questions Q 13.9 & 13.47 page 532

8. the correlation coefficient between the size of the apartment and the monthly rent

   a. 0.844
   b. 0.714
   c. 0.458
   d. – 0.844
   e. – 0.714

$R^2 = \frac{SSR}{SST} = \frac{SST}{SSR+SSE} = \frac{2240704}{2240704+899022} = 0.714 \rightarrow r = +\sqrt{R^2} = +0.844$

9. A good interpretation of \$3.465 is

   a. For each increase of 1 square meter in space, the expected monthly rental is estimated to increase by \$3.465.
   b. For each increase of 1 square meter in space, the expected monthly rental is estimated to decrease by \$3.465.
   c. For each decrease of 1 square meter in space, the expected monthly rental is estimated to increase by \$3.465.
   d. Since the size of apartment cannot be zero square meter, no practical interpretation.
   e. The relationship between the size of apartment and the monthly rent is very week.

10. It is not appropriate to use the model to predict the monthly rent for apartment that have

    a. 150-meter square
    b. 285-meter square
    c. 590-meter square
    d. 210-meter square
    e. 555-meter square

150 out of the range

11. The agent wants to estimate the expected increase in the monthly rental when the size of the apartment increases by one square meter with a 95% confidence interval, the upper limit of the interval is

    a. \$4.41198
    b. \$4.24949
    c. \$4.40969
    d. \$4.28125
    e. \$4.60925

$\hat{\beta}_1 + t_{0.025,23} s_e(\hat{\beta}_1)$
$3.465 + (2.069)(0.4577) = \$4.41198$

The director of graduate studies at a large college of business would like to predict the grade point average (GPA) of students in an MBA program based on Graduate Management Admission Test (GMAT) score. A sample of 20 students who have completed two years in the program is selected. You are given the following information to help you carrying out the analyses:

$$\sum x = 12400, \quad \sum y = 66, \quad Sxx = 75000, \; Syy = 0.6, \; Sxy = 150 \; \& \; SSE = 0.3$$

Based on this information, answer the next **four** questions Q13.78 page 566

12. The predicted GPA for a student with a GMAT score of 620 is

a. 3.3
b. 3.1
c. 3.0
d. 2.9
e. 3.4

$$\hat{\beta}_1 = \frac{Sxy}{Sxx} = 0.002 \;\; \hat{\beta}_0 = \frac{\sum y}{n} - \hat{\beta}_1 \frac{\sum x}{n} = 2.06$$
$$\hat{y}_{x=620} = 2.06 + 0.002(620) = 3.3$$

13. The percentage of the variation that can explained by the model is

a. 50%
b. 55%
c. 60%
d. 70%
e. 75%

$$R^2 = \frac{SSR}{SST} = \frac{SST-SSE}{SSt} = \frac{Syy-SSE}{Syy} = \frac{0.6-0.3}{0.6} = 0.5$$

14. A 99% confidence interval estimates of the mean GPA of students with a GMAT score of 620 is

a. Between 3.2169 and 3.3831
b. Between 3.2393 and 3.3606
c. Between 3.2396 and 3.3604
d. Between 3.2267 and 3.3733
e. Between 3.2174 and 3.3826

$$\hat{y}_{x=620} \pm t_{0.005,18}\sqrt{\hat{\sigma}^2\left(\frac{1}{n} + \frac{(x-\bar{x})^2}{Sxx}\right)} \;\rightarrow\; 3.3 \pm (2.878)\sqrt{\frac{0.3}{18}\left(\frac{1}{20}\right)} \;\rightarrow 3.2169 \; and \; 3.3831$$

15. suppose the director of graduate studies want to obtain a 99% prediction interval of the GPA for a particular student with a GMAT score of 620. The length of the prediction interval is

a. 0.761447
b. 0.380723
c. 0.083081
d. 0.166161
e. 0.002574

$$l = 2\left(t_{0.005,18}\sqrt{\hat{\sigma}^2\left(1 + \frac{1}{n} + \frac{(x-\bar{x})^2}{Sxx}\right)}\right) = 2\left(2.878\sqrt{\frac{0.3}{18}\left(1 + \frac{1}{20}\right)}\right) = 0.781447$$