KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS

STAT 212: Business Statistics II
Term 232, Major Exam I
Tuesday February 13, 2024, 06:30 PM

Time allowed **2 hours**

Name: _____ ID #: _____ Sec #: _____

Important instructions:

o   Check that this exam has 20 questions.

o   All types of mobile phones or smart watches are **not** allowed during the examination.

o   Using HB 2.5 pencil is recommended for bubbling your answers.

o   Use a good eraser. It is recommended **not** to use the erasers attached to the pencil.

o   Write your name, ID number and Section number on the examination paper and in the upper left corner of the Test Answer Form (bubbling sheet).

o   When bubbling your ID and Section numbers, be sure that the bubbles match with the numbers that you write.

o   The Test Code Number is already bubbled in your Test Answer Form. Make sure that it is the same as that printed on your question paper.

o   When bubbling, make sure that the bubbled space is fully covered.

o   When erasing a bubble, make sure that you do not leave any trace of penciling.

o   A formula sheet will be supplied during the exam, and you are prohibited from bringing any printed or written materials, including a formula sheet, with you.

o   You are required to bring a standard scientific calculator with basic functions for the exam; however, calculators with more advanced features are **not** permissible.

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Q1: (Q 9.10, Page 337) In a country's judicial system, a defendant is presumed guilty until proven innocent. Consider a null hypothesis, H_0, that the defendant is guilty, and an alternative hypothesis, H_1, that the defendant is innocent. A jury has two possible decisions: Convict the defendant (i.e., do not reject the null hypothesis) or do not convict the defendant (i.e., reject the null hypothesis). What is the meaning of the risks of committing a Type I error here?

    (A)   A Type I error would be not convicting a guilty person.
    (B)   A Type I error would be convicting a guilty person.
    (C)   A Type I error would be convicting an innocent person.
    (D)   A Type I error would be not convicting an innocent person.
    (E)   There is no risk of committing a Type I error here.

(Q 9.14, Page 337) The quality-control manager at a light bulb factory needs to determine whether the mean life of a large shipment of light bulbs is equal to 560 hours. The population standard deviation is 60 hours. A random sample of 24 light bulbs indicates a sample mean life of 547 hours. Based on this information, **answer the next __two__ questions**:

Q2: Rounded to two decimal points, the value of test statistic is

    (A)   -1.06
    (B)   1.06
    (C)   -5.2
    (D)   -0.09
    (E)   5.2

Q3: What is *p-value* of the test?

    (A)   0.28914
    (B)   0.14457
    (C)   0.05480
    (D)   0.10960
    (E)   0.85543

Q4: (Q 9.35, Page 344) Although many people think they can put a meal on the table in a short period of time, an article reported that they end up spending about 40 minutes doing so. Suppose another study is conducted to test the validity of this statement. A sample of 13 people is selected, and the length of time to prepare and cook dinner (in minutes) is recorded, with the following results.

44.0	51.9	49.7	40.0	55.5	33.0	43.4	41.3	45.2	40.7	41.1	49.1	30.9

For testing if there is evidence that the population mean time to prepare and cook dinner is different from 40 minutes, what assumption is needed in order to conduct the t test?

(A)   The population distribution needs to be normal.
(B)   The sample size needs to be more than 15.
(C)   The population standard deviation should be known.
(D)   The population mean should not be equal to sample mean.
(E)   The population distribution should not be symmetric.

(Q 9.49, Page 348) You are the manager of a restaurant that delivers pizza to college dormitory rooms. You have just changed your delivery process in an effort to reduce the mean time between the order and completion of delivery from the current 30 minutes. A sample of 19 orders using the new delivery process yields a sample mean of 26.72 minutes and a sample standard deviation of 5.91 minutes. At the 0.005 level of significance, we want to test if there is evidence that the population mean delivery time has been reduced below the previous population mean value of 30 minutes. Based on this information, **answer the next <u>three</u> questions**:

Q5: What is the alternative hypothesis, H_1?

(A) $\mu < 30$
(B) $\mu > 30$
(C) $\mu \leq 30$
(D) $\mu \geq 30$
(E) $\mu \neq 30$

where μ denotes the mean time between the order and completion of delivery.

Q6: Rounded to three decimal points, what is the computed value of test statistic?

(A)   -2.419
(B)   2.419
(C)   1.269
(D)   -0.409
(E)   -10.545

Q7: Based on critical value approach, the decision rule is:

(A)   We reject the null hypothesis if test statistic is less than -2.878.
(B)   We reject the null hypothesis if test statistic is more than -2.878.
(C)   We reject the null hypothesis if test statistic is less than 3.197.
(D)   We reject the null hypothesis if test statistic is less than -3.197 or more than 3.197.
(E)   We reject the null hypothesis if test statistic is less than -2.861 or more than 2.861.

(Q 9.58, Page 352) Of 100 respondents aged 24 to 35, 37% reported that they preferred to "look for a job in a place where I would like to live" rather than "look for the best job I can find, the place where I live is secondary." At the 0.001 level of significance, we want to test if there is evidence that the proportion of all young jobseekers aged 24 to 35 who preferred to "look for a job in a place where I would like to live" rather than "look for the best job I can find, the place where I live is secondary" is different from 55%. Based on this information, **answer the next <u>three</u> questions**:

Q8: What is the alternative hypothesis, H_1?

    (A) $\boldsymbol{\pi \neq 0.55}$
    (B) $\pi < 0.55$
    (C) $\pi > 0.55$
    (D) $\pi \leq 0.55$
    (E) $\pi \geq 0.55$

    where π denotes the proportion of all young jobseekers aged 24 to 35 who preferred to "look for a job in a place where I would like to live" rather than "look for the best job I can find, the place where I live is secondary."

Q9: Rounded to two decimal points, what is the computed value of test statistic?

    (A)   **-3.62**
    (B)   -3.73
    (C)   3.73
    (D)   -72.73
    (E)   3.27

Q10: Compute the *p-value*.

    (A)   **0.00030**
    (B)   0.00015
    (C)   0.00010
    (D)   0.00020
    (E)   0.00054

(Q 10.68, Page 403) According to Census estimates, there are about 20 million children between 8 and 12 years old (referred to as tweens) in a country. A recent survey of 987 eight to twelve years old children reported the following results. Suppose the survey was based on 519 boys and 468 girls.

What Tweens Did in the Past Week	Boys	Girls
Played a game on a video game system	403	213
Read a book for fun	238	301
Gave product advice to parents	107	120
Shopped at a mall	122	229

For activity "Read a book for fun", we want to determine whether there is a difference between boys and girls at the 0.002 level of significance. We define the following notation: $\pi_1 \rightarrow$ proportion of tween boys who read a book for fun in the past week, $\pi_2 \rightarrow$ proportion of tween girls who read a book for fun in the past week. Based on this information, **answer the next <u>three</u> questions**:

Q11: Which one of the following is the correct alternative hypotheses?

(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) $H_1: \pi_1 \leq \pi_2$

where Population 1 = Boys and Population 2 = Girls

Q12: What is the computed value of test statistic?

(A)   -5.816
(B)   -183.272
(C)   -4.095
(D)   -6.045
(E)   -6.812

Q13: Which one of the following is correct decision rule?

(A)   Reject the null hypothesis if $|Z_{STAT}| > 3.09$
(B)   Reject the null hypothesis if $|Z_{STAT}| < 3.09$
(C)   Reject the null hypothesis if $Z_{STAT} > 3.09$
(D)   Reject the null hypothesis if $|Z_{STAT}| > 2.88$
(E)   Reject the null hypothesis if $Z_{STAT} < -2.88$

Q14: (Q 10.20, Page 384) Nine experts rated two brands of Colombian coffee in a taste-testing experiment. A rating on a 7-point scale (1 = extremely unpleasing, 7 = extremely pleasing) is given for each of four characteristics: taste, aroma, richness, and acidity. The following data display the ratings accumulated over all four characteristics.

Expert		C.C.	S.E.	E.G.	B.L.	C.M.	C.N.	G.N.	R.M.	P.V.
Brand	A	24	27	19	24	22	26	27	25	22
	B	26	27	22	27	25	27	26	27	23

At the 0.05 level of significance, it is to be tested if there is evidence of a difference in the mean ratings between the two brands. The sampled information gave a p-value of 0.0112. Which one of the following statements give correct decision and conclusion?

(A)   **We reject H_0 and conclude that there is evidence of a difference in the mean ratings between the two brands.**

(B)   We fail to reject H_0 and conclude that there is evidence of a difference in the mean ratings between the two brands.

(C)   We reject H_0 and conclude that there is no significant difference in the mean ratings between the two brands.

(D)   We fail to reject H_0 and conclude that there is no significant difference in the mean ratings between the two brands.

(E)   We fail to reject H_0 and conclude that the mean ratings of brand A is higher.

Q15: (Q 10.67, Page 402) A hotel manager looks to enhance the initial impressions that hotel guests have when they check in. Contributing to initial impressions is the time (in minutes) it takes to deliver a guest's luggage to the room after check-in. A random sample of 16 deliveries on a particular day selected in Wing A of the hotel produced a mean 11.39 with a standard deviation 1.62, and a random sample of 25 deliveries selected in Wing B produced a mean 9.02 with a standard deviation 1.02. The objective is to analyze the data and determine whether there is a difference in the mean delivery time in the two wings of the hotel at the 0.05 level of significance. Which one of the following tests will be used in this situation?

(A)   **A two-sample separate-variance T test**
(B)   A two-sample pooled-variance T test
(C)   A two-sample Z test for Means
(D)   A two-sample Z test for Proportions
(E)   Paired T test

(Q 10.60, Page 401) The American Society for Quality (ASQ) conducted a salary survey of all its members. ASQ members work in all areas of manufacturing and service-related institutions, with a common theme of an interest in quality. Two job titles are black belt and green belt. Descriptive statistics concerning salaries for these two job titles are given in the following table:

Job Title	Sample Size	Mean	Standard Deviation
Black Belt	21	81,094	25,852
Green belt	32	68,284	17,271

Assuming unequal variances and degree of freedom = 31, we need to test if there is a difference between the mean salary of black belts and green belts. Based on this information, **answer the next three questions**:

Q16: What is the value of test statistic?

   (A) **1.997**
   (B)   304.417
   (C)   0.0003
   (D)   2.166
   (E)   1.049

Q17: What is the critical value for this test at 0.1 level of significance?

   (A) **1.696**
   (B)   1.309
   (C)   2.040
   (D)   1.645
   (E)   2.453

Q18: Which one of the following is the correct conclusion of this test?

   (A) **At 0.1 level of significance, there is enough evidence of a difference between the mean salary of green belt and the mean salary of black belts.**
   (B)   At 0.05 level of significance, there is enough evidence of a difference between the mean salary of green belt and the mean salary of black belts.
   (C)   At any level of significance, there is enough evidence of a difference between the mean salary of green belt and the mean salary of black belts.
   (D)   At any level of significance, there is not enough evidence of a significant difference between the mean salary of green belt and the mean salary of black belts.
   (E)   At 0.1 level of significance, there is not enough evidence of a significant difference between the mean salary of green belt and the mean salary of black belts.

(Q 12.44(c), Page 493) A manufacturer of doorknobs has a production process that is designed to provide a doorknob with a target diameter of 2.5 inches. In the past, the standard deviation of the diameter has been 0.035 inch. In an effort to reduce the variation in the process, various studies have resulted in a redesigned process. A sample of 25 doorknobs produced under the new process indicates a sample standard deviation of 0.025 inch. At the 0.05 level of significance, it is to be tested if there is evidence that the population standard deviation is less than 0.035 inch in the new process. Based on this information, **answer the next <u>two</u> questions**:

Q19: What is the computed value of test statistic?

    (A)   **12.245**
    (B)   12.755
    (C)   47.04
    (D)   0.51
    (E)   1.96

Q20: If the *p-value* of test came out to be 0.023, which one of the following is the correct decision?

    (A)   **We reject the null hypothesis.**
    (B)   We fail to reject the null hypothesis.
    (C)   We accept the null hypothesis.
    (D)   We reject the alternative hypothesis.
    (E)   We do not have enough evidence to accept the alternative hypothesis.