

STA2023 TEST 4 REVIEW (15 POINTS) Name:

- 1) The GPAs of seven randomly selected seniors at Big-Wig University are: 2.70, 3.55, 2.42, 3.23, 2.89, 3.06, 2.54 .
 - a) To construct a confidence interval for the mean, what assumption is needed regarding the population of GPAs?
 - b) With the assumption above, construct a 95% confidence interval for the mean GPA of Big-Wig University seniors.
- 2) Seventeen randomly selected bottles of Berry-Buddy fruit juice have a mean juice volume of 47.8 ounces and a standard deviation of .19 ounces. Construct a 90% confidence interval for the mean juice volume of bottles of Berry-Buddy fruit juice. (assume that the volumes are normally distributed).

For questions 3) and 4), conduct the hypothesis test using the rejection region approach.

Also, IF an error was made, state which type it would have been and express it in the context of the problem.

- 3) A random sample of 15 bags of Fido-feast dog food contains a mean weight of 10.03 pounds and a standard deviation of .17 pounds (assume the weights are normally distributed). Does the sample provide sufficient evidence to conclude that the mean weight of bags of Fido-Feast dog food is different than 10 pounds? (test using $\alpha = .10$)
- 4) Using a regular feed mixture, a poultry farmer's newborn chickens have had normally distributed weights with a mean of 62.2 ounces. In an experiment with an enriched feed mixture, 9 chickens (treat them as a random sample) are born with the weights (in ounces) shown below. Does the sample provide sufficient evidence to conclude that the enriched feed mixture increases the mean weight of newborn chickens? (test using $\alpha = .025$)
61.4, 62.2, 66.9, 63.3, 66.2, 66.0, 63.1, 63.7, 66.6

For problems 5) through 8), conduct each hypothesis test by both approaches (rejection region and p-value).

- 5) The makers of Friendly-Fridge frozen dinners want both their dinner flavors (Chicken Surprise and Mystery Meat) to have the same mean protein content. To test if they are meeting their goal, they obtain random samples of both flavors and test for protein content (data, in grams, shown below). Do the samples provide sufficient evidence to conclude that the two dinner flavors have different mean protein contents? (test using $\alpha = .05$)
Chicken Surprise: sample size: 40 mean: 21.2 standard deviation: 1.03
Mystery Meat: sample size: 50 mean: 20.6 standard deviation: .87

- 6) Random samples of bottles of honey from two different brands are obtained and analyzed (data, in ounces, at the right) Do the samples provide sufficient evidence to conclude that the mean amount of honey in bottles of Tubby-Cubby is greater than that of Grumpy-Grizzly? (test using $\alpha = .05$)

	Brand: Tubby-Cubby	Grumpy-Grizzly
n	60	60
\bar{x}	12.02	11.99
s	.13	.11

- 7) The makers of Mucho-Munch corn chips wonder if the proportions of men and women who are familiar with their brand are the same. In a random sample of 80 men, 49 are familiar with Mucho-Munch. In a random sample of 100 women, 41 are familiar with Mucho-Munch. Do the samples provide sufficient evidence to conclude that the proportions of men and women who are familiar with the Mucho-Munch brand differ? (test using $\alpha = .025$)
- 8) A company will choose the production process (A or B) that is less likely to produce defective parts. They obtain random samples of parts produced by both processes (results below). Do the samples provide sufficient evidence to conclude that the proportion of defective parts produced by process A is less than by process B? (test using $\alpha = .01$)
A: sample size: 200 proportion defective: 6.5% B: sample size: 200 proportion defective: 8.5%

For problems 9) and 10), conduct the hypothesis test using the rejection region approach.

- 9) A snack food maker wants to determine if a consumer preference exists among its three brands of potato chips. A random sample of 150 people is obtained and each person participates in a blind taste test of the three brands (results below). Does the sample provide sufficient evidence to conclude that a consumer preference exists among the three brands of potato chips? (test using $\alpha = .05$)

	Brand: Sergeant-Sodium	Captain-Salty	Major-Tater
Votes:	44	55	51

- 10) Nationwide, a sandwich shop's distribution of consumer preference for its meats is shown at the right. The shop wants to open in a new city so it tests consumer preference in the city. In a random sample of 200 of the city's consumers, preferences are: beef: 77, chicken: 63, turkey: 40, tuna: 20. Does the sample provide sufficient evidence to conclude that the distribution of consumer preference for meat in this city differs from the nationwide distribution? (test using $\alpha = .10$)

beef:	46%
chicken:	32%
turkey:	14%
tuna:	8%
- 11) To test the fairness of a die by rolling it only 18 times, why would a chi-square goodness-of-fit test be inappropriate?

- 12) Weight (in pounds) and gas mileage (in miles per gallon) for 7 randomly selected cars is given below;

Weight:	3175	3450	3225	3985	2440	2500	2290
MPG:	27	29	27	24	37	34	37

(before answering the questions below, graph the data to verify a linear relationship)

 - a) Find the equation of the regression line (line of best fit).
 - b) Use your calculator to predict the mileage (in MPG) for a car weighing 3000 pounds.
 - c) Calculate and interpret r (coefficient of correlation)
 - d) Calculate and interpret r^2 (coefficient of determination)

13) Answer true or false to each of the following questions:

- a) If $r=0$, then there is no linear relationship between the two variables, but there may be a relationship that is other than linear.
- b) A strong correlation between two variables does not mean that there must be a cause-and-effect relationship between the two variables.

Answers: 1) a) We must assume that the population of GPAs is normally distributed b) (2.544, 3.282) 2) (47.72, 47.88)

3) $H_0: \mu = 10$ $H_a: \mu \neq 10$

T.S.: $t = .683$

R.R.: $t < -1.761$ or $t > 1.761$

Decision: Do not reject H_0

Conclusion: There is not sufficient evidence to conclude that the mean weight of bags of Fido-feast dog food differs from 10 pounds.

IF an error, Type II error:

Not concluding that the mean weight of bags of Fido-Feast dog food differs from 10 pounds when in fact it does differ.

4) $H_0: \mu = 62.2$ $H_a: \mu > 62.2$

T.S.: $t = 3.164$

R.R.: $t > 2.306$

Decision: Reject H_0

Conclusion: There is sufficient evidence to conclude that the enriched feed mixture increases the mean weight of newborn chickens.

IF an error, Type I error:

Concluding that the enriched feed mixture increases the mean weight of newborn chickens when in fact it does not.

5) $H_0: \mu_1 = \mu_2$ $H_a: \mu_1 \neq \mu_2$

T.S.: $z = 2.94$

R.R.: $z < -1.96$ or $z > 1.96$

Decision: Reject H_0

Conclusion: There is sufficient evidence to conclude that the two dinner flavors have different mean protein contents.

P-Value: .0032 (.0032 is less than .05, so reject H_0)
.0033 (calculator)

6) $H_0: \mu_1 = \mu_2$ $H_a: \mu_1 > \mu_2$

T.S.: $z = 1.36$

R.R.: $z > 1.645$

Decision: Do not reject H_0

Conclusion: There is not sufficient evidence to conclude that the mean amount of honey in bottles of Tubby-Cubby is greater than that of Grumpy-Grizzly.

P-value: .0869 (.0869 is not less than .05, so don't reject H_0)
.0862(calculator)

7) $H_0: p_1 = p_2$ $H_a: p_1 \neq p_2$

T.S.: $z = 2.70$

R.R.: $z < -2.24$ or $z > 2.24$

Decision: Reject H_0

Conclusion: There is sufficient evidence to conclude that the proportions of men and women who are familiar with the Mucho-Munch brand differ.

P-Value: .0070 (.0070 is less than .025, so reject H_0)
.0069 (calculator)

8) $H_0: p_1 = p_2$ $H_a: p_1 < p_2$

T.S.: $z = -.76$

R.R.: $z < -2.33$

Decision: Do not reject H_0

Conclusion: There is not sufficient evidence to conclude that the proportion of defective parts produced by process A is less than that produced by process B.

P-Value: .2236 (.2236 is not less than .01, so don't reject H_0)
.2238 (calculator)

9) $H_0: p_1 = p_2 = p_3 = 1/3$ $H_a: \text{not all } p_i = 1/3$
(no preference exists) (a preference exists)

T.S.: $\chi^2 = 1.24$

R.R.: $\chi^2 > 5.991$

Decision: Do not reject H_0

Conclusion: There is not sufficient evidence to conclude that a consumer preference exists among the three brands of potato chips.

10) $H_0: p_1=.46, p_2=.32, p_3=.14, p_4=.08$ $H_a: \text{not all } p_i \text{ equal their hypothesized values}$
(distribution is the same) (distribution differs)

T.S.: $\chi^2 = 8.604$

R.R.: $\chi^2 > 6.251$

Decision: Reject H_0

Conclusion: There is sufficient evidence to conclude that the distribution of consumer preference for meat in this city differs from the nationwide distribution.

11) Because each expected category (cell) frequency must be 5 or higher, but here each is only $18(1/6) = 3$.

12) a) $\hat{y} = -.00797X + 54.695$

b) 30.785

c) $r = -.944$, strong negative correlation between weight and MPG

d) $r^2 = .891$, 89.1% of variability in MPG is explained by weight

13) a) true

b) true