## MATH111-01: REVIEW PROBLEMS I

Summer Session II, 2017. Raritan Valley Community College

## **Open-Ended Questions**

- 1. Describe the difference between the null hypothesis and the alternative hypothesis in the context of hypothesis testing.
- 2. Define what a confidence interval is and what it is used for. Mention how confidence levels relate to confidence levels, significance levels, and margins of error. Describe how confidence intervals can be used to evaluate hypothesis tests.
- 3. Define what a p-value is the context of a hypothesis test. How does one calculate p-values? How does the p-value effect the evaluation of a hypothesis test?
- 4. Describe what statistical power is in the context of a hypothesis test? What factors effect a test's power?
- 5. List some assumptions made in creating hypothesis tests that have been discussed. List the assumptions for specific types of hypothesis tests: z-tests, paired difference t-tests, pooled and nonpooled t-tests, and ANOVA.

## Calculating p – values

For the following tests, calculate the p-value from the corresponding test statistic. Use Tables II, IV and VIII. For t-tests and F-tests, give an interval of possible p-values.

- 1. Left-tailed z-test. z = -1.22.
- 2. Right-tailed z-test. z = 1.56.
- 3. Two-tailed z-test. z = 1.09.
- 4. Left-tailed z-test. z = 2.08.
- 5. Left-tailed *t*-test. t = -1.85. df = 20.

- 6. Left-tailed *t*-test. t = 1.55. df = 35.
- 7. Two-sided t-test. t = 1.9. df = 5.
- 8. Right t-test. t = 2.9. df = 25.
- 9. F-test. F = 5.00. df = (7, 5).
- 10. F-test. F = 2.20. df = (6, 11).

2 Section

## Word Problems

1. The batting averages for a random sample of athletes of a tri-state highschool softball conference is as follows:

A good batting average is 300. We wish to test the alternative hypothesis  $\mu \neq 300$  against the null hypothesis  $\mu = 300$ . Here,  $\mu$  is the population mean.

- a) Calculate the sample mean  $\bar{x}$  and sample standard deviation  $s_d$ .
- b) Assuming that the sampled population is normal, calculate the standard error  $\bar{x}$ , the 90% margin of error, and the 90% confidence interval.
- c) Given the above confidence interval, would you reject the null hypothesis with a 10% significance?
- 2. An experiment was conducted to determine if eating vegetables had any positive short-term impact on intelligence. Twenty subjects were asked to take a test (scored from 0 to 100) consisting of logical puzzles. Then they were asked to eat a green leaf salad. They then took another puzzle test and the difference between their first test test and second test (diff = test 1 score test 2 score) was recorded. The following are the sample statistics:

	test 1 score	test 2 score	diff
mean	70.31	71.85	-1.54
stdev	14.46	17.34	11.53
size	20	20	20

Let  $\mu_1$  and  $\mu_2$  be the population means corresponding to the test 1 scores and test 2 scores, respectively. The null and alternative hypothesis for this experiment takes the following form:

$$H_0$$
:  $\mu_1 = \mu_2$   
 $H_A$ :  $\mu_1 < \mu_2$ 

Assume that the assumptions for performing a paired difference test is satisfied.

- a) Calculate the t-statistic and its degrees of freedom associated with the null hypothesis.
- b) Calculate a range for the p-value for this test. Would you reject the null hypothesis at 5% significance?
- c) What are some possible errors made in this experiment?
- 3. An experiment was conducting to compare the charitable givings of NJ and PA residents. A survey asked participants how much of their income they donated to charity in the last year. The results of the survey are as follows:

	NJ	PA
mean	1256	1195
stdev	356	342
sample size	24	32

Suppose the conditions for performing a nonpooled mean comparison test was satisfied. Consider the following null and alternative hypotheses:

$$H_0$$
:  $\mu_{NJ} = \mu_{PA}$   
 $H_A$ :  $\mu_{NJ} \neq \mu_{PA}$ 

- a) Calculate the nonpooled t-statistic and degrees of freedom. Then calculate the p-value corresponding to this test statistic.
- b) Assume that the population variances are equal (homoscedasticity). Calculate the pooled tstatistic and degrees of freedom. Then calculate the p-value corresponding to this test statistic.

4. An experiment was performed to determine if one's state of residence had any bearing on their love for pineapple pizza. Residents of New York, Texas, and Hawaii were asked to rate the deliciousness of pineapple pizza on scale of 1 through 10. The results of this were as follows:

	NY	TX	HI
	5	5	10
	8	7	9
	5	9	10
		4	7
		5	
mean	6.000	6.000	9.000
stdev	1.732	2.000	1.414

Suppose that the assumptions for performing a one-way ANOVA test are satisfied. And consider a hypothesis test with the following null and alternative hypotheses:

$$H_0$$
:  $\mu_{\text{NY}} = \mu_{\text{TX}} = \mu_{\text{HI}}$   
 $H_A$ : not  $H_0$ 

- a) Calculate the treatment mean square and its degrees of freedom.
- b) Calculate the mean square error and its degrees of freedom.
- c) Calculate the F-statistic and its corresponding p-value. Would you reject the null hypothesis at 5%? At 10%?
- d) Which pizza topping pairs best with pineapple?