Prince Sultan University
Department of General Seciences
STAT271

Final Exam

Semester I, Term 171

Tuesday, January 9th, 2018

Time Allowed: **3 hours**

Student Name: _____

Student ID #: _____   **Class Time**: _____

Teacher's Name: Dr. Benson

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard
6. Looking around or making an attempt to cheat will result in your exam being cancelled
7. This examination has 8 problems, some with several parts.

Problems	Max points	Student's Points
1	8	
2	8	
3	8	
4	10	
5	12	
6	12	
7	10	
8	12	
Total	**80**	_____/80

1. A random sample of 500 adult residents of Maricopa County indicated that 385 were in favor of increasing the highway speed limit to 75 mph, and another sample of 400 adult residents of Pima County indicated that 267 were in favor of the increased speed limit.

   a. Do these data indicate that there is a difference in the support for increasing the speed limit for the residents of the two counties? Use $\alpha = 0.05$. What is the P-value for this test?

   b. Construct a 85% confidence interval on the difference in the two proportions. Provide a practical interpretation of this interval.

2. Consider the following computer output for an experiment. There are four populations.

Source of Variation	df	SS	MS	F_0	F_{Crt}
Between samples	?	?	330.4716	4.42	?
Within samples	?	?	?		
Total	31	?			

    a.   What are the appropriate null and alternative hypotheses?
    b.   Fill in the missing information in the ANOVA table.
    c.   Test the given hypotheses at $\alpha = 0.05$.
    d.   State the necessary conclusion.

3. Smoking and College Education A survey showed that among 785 randomly selected subjects who completed four years of college, 18.3% smoke and 81.7% do not smoke (based on data from the American Medical Association).
   a. Use a 0.05 significance level to test the claim that the rate of smoking among those with four years of college is less than the 27% rate for the general population.
   b. Calculate the p-value of this test.
   c. Find the 95% confidence interval for the population proportion

4.   According to data from the Environmental Protection Agency, the average daily water consumption for a household of four people in the United States is approximately at least 243 gallons. Suppose a state agency plans to test this claim using an alpha level equal to 0.05 and a random sample of 100 households with four people.

   a. State the appropriate null and alternative hypotheses. **2 points**

   b.   Calculate the probability of committing a Type II error if the true population mean is 230 gallons. Assume that the population standard deviation is known to be 40 gallons. **Interpret 4 points**

   c. Calculate the probability of committing a Type II error if the true population mean is 240 gallons. Assume that the population standard deviation is known to be 44 gallons. **Interpret 4 points**

5.　　Test percentage of titanium in an alloy used in aerospace castings is measured in 51 randomly selected parts. The sample standard deviation is $s = 0.37$.

　　　a.　Test the hypothesis $H_0 : \sigma = 0.35$ versus $H_A : \sigma \neq 0.35$ using $\alpha = 0.05$.

　　　b.　Estimate the p-value for this test.

　　　c.　Construct a 95% confidence interval for σ.

6.   The following data give the annual incomes (in thousands of dollars) and amounts (in thousands of dollars) of life insurance policies for eight persons.

Annual income	42	58	27	36	70	24	53	37
Life insurance	150	175	25	75	250	50	250	100

a. $H_0 : \rho = 0$ versus $H_A : \rho \neq 0$ using $\alpha = 0.05$. Give a detailed conclusion

b.   Setup an **ANOVA** table to test $H_0 : \beta_1 = 0$ versus $H_A : \beta_1 \neq 0$

c.   Find the coefficient of determination. Interpret this value using $\alpha = 0.05$.

7. The following data give the annual incomes (in thousands of dollars) and amounts (in thousands of dollars) of life insurance policies for eight persons.

Annual income	42	58	27	36	70	24	53	37
Life insurance	150	175	25	75	250	50	250	100

a. Using a model, $y_i = b_0 + b_1 x_i + e_i$, what are the least squares estimates of b_0 and b_1? What is the fitted equation? **3 points**

b. What is the interpretation of the slope of the fitted equation? **3 points**

c. What are the confidence limits ($a = 0.05$) for b_1? **Interpret 2 points**

d. What are the confidence limits ($a = 0.05$) for the true mean value of Life insurance when annual income is 70? **Interpret 2 points**

e. What are the confidence limits ($a = 0.05$) for the particular value of Life insurance when annual income is 70? **Interpret 2 points**

8. The MBA program was experiencing problems scheduling its courses. The demand for the program's optional courses and majors was quite variable from one year to the next. In one year, students seem to want marketing courses; in other years, accounting or finance are the rage. In desperation, the dean of the business school turned to a statistics professor for assistance. The statistics professor believed that the problem may be the variability in the academic background of the students and that the undergraduate degree affects the choice of major. As a start, he took a random sample of last year's MBA students and recorded the undergraduate degree and the major selected in the graduate program. The undergraduate degrees were BA, BEng, BBA, and several others. There are three possible majors for the MBA students: accounting, finance, and marketing. The results were summarized in a cross-classification table, which is shown here. Can the statistician conclude that the undergraduate degree affects the choice of major?

Undergraduate Degree	MBA Major			Total
	Accounting	Finance	Marketing	
B.A.	31	13	16	60
B.Eng.	8	16	7	31
B.B.A.	12	10	17	39
Other	10	5	7	22
Total	61	44	47	152

9. A course can be taken for credit either by attending lecture sessions at fixed times and days, or by doing online sessions that can be done at the student's own pace and at those times the student chooses. The course coordinator wants to determine if these two ways of taking the course resulted in a significant difference in achievement as measured by the final exam for the course. The following data gives the scores on an examination with 45 possible points for one group of $n_1 = 9$ students who took the course online, and a second group of $n_2 = 9$ students who took the course with conventional lectures. **Assume equal population variances**

Online	Classroom
32	35
37	31
35	29
28	25
41	34
44	40
35	27
31	32
34	31

    a.   Do these data present sufficient evidence to indicate that the grades for students who took the course online are significantly higher than those who attended a conventional class?

    b.   Find a 95% confidence interval for the difference in the population means.

10. **Heart Attacks on Mondays** Do you hate Mondays? Researchers from Germany have provided another reason for you: They concluded that the risk of a heart attack for a working person may be as much as 50% greater on Monday than on any other day. The researchers kept track of heart attacks and coronary arrests over a period of 5 years among 330,000 people who lived near Augsburg, Germany. In an attempt to verify their claim, you survey 200 working people who had recently had heart attacks and recorded the day on which their heart attacks occurred:

Day	Observed Count
Sunday	24
Monday	36
Tuesday	27
Wednesday	26
Thursday	32
Friday	26
Saturday	29

Do the data present sufficient evidence to indicate that there is a difference in the incidence of heart attacks depending on the day of the week? Test using $\alpha = 0.05$.