Prince Sultan University
Mathematics Department

STAT 271

Final Exam

Spring, Term 162

May 23, 2017

Time Allowed: **180** minutes

Student Name: _____

Student ID #: _____

Time:

Teacher 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.

Problems	Max points	Student's Points
1 , 2	5, 10	
3 , 4	10 , 20	
5	5	
6	5	
7	15	
8	10	
Total	**80**	**/80 = %**

1. A random sample of 64 bicycle-riding adults in Portland indicated that 24 always wore a helmet while riding. A random sample of 80 bicycle-riding adults in Amsterdam indicated that 18 always rode a helmet while riding.
   a. Use the sample information to develop a 95% confidence interval estimate for the difference between the proportions of bicycle-riding adults that wear a helmet in the two cities.

   b. Based on the sample results, can you conclude that the population proportion of bicycle-riding adults in Portland who always wear a helmet is greater that the population proportion of bicycle-riding adults in Amsterdam who always wear a helmet? Use a 0.025 level of significance to conduct the test.

   c. Calculate the p-value for this test.

2. Gym Outfitters sells and services exercise equipment such as treadmills, ellipticals, and stair climbers to gymnasiums and recreational centers. The company's management would like to determine if there is a relationship between the number of minutes required to complete a routine service call and the number of machines serviced. A random sample of 12 records revealed the following information concerning the number of machines serviced and the time (in minutes) to complete the routine service call:

Number of Machines	Service Time (minutes)
11	115
8	60
9	80
10	90
7	55
6	65
8	70
4	33
10	95
5	50
5	40
12	110

a. Estimate the least squares regression equation.

b. If a gymnasium had six machines, how many minutes should Gym Outfitters expect a routine service call to require?

c. Provide a 90% confidence interval for the average amount of time required to complete a routine service call when the number of machines being serviced is nine.

d. Provide a 90% prediction interval for the time required to complete a particular routine service call for a gymnasium that has seven machines.

e. Find and interpret the coefficient of variation.

15 points

3. A study was conducted to investigate the effectiveness of hypnotism in reducing pain. Results for randomly selected subjects are given in the accompanying table. The values are before and after hypnosis; the measurements are in centimeters on a pain scale. **Use traditional Method**

Subjects	A	B	C	D	E	F	G	H
Before	6.6	6.5	9.0	10.3	11.3	8.1	6.3	11.6
After	6.8	2.4	7.4	8.5	8.1	6.1	3.4	2.0

a. Use a 0.05 significance level to test the claim that the sensory measurements are lower after hypnotism.

b. Find the 95% confidence interval for the mean difference. **Give an Interpretation**

c. Estimate the *p* –value of this test.

4. The following are the numbers of mistakes made in 5 successive days for 4 technicians working for a photographic laboratory:

Technician I	Technician II	Technician III	Technician IV
5	17	9	9
12	12	11	13
9	15	6	7
8	14	14	10
11	17	10	11

a. Test at the level of significance $\alpha = 0.05$ whether the differences among the 4 sample means can be attributed to chance.

b. If the null hypothesis in part (a) is rejected, which set of means differs?

5. To determine whether there really is a relationship between an employee's performance in the company's training program and his or her ultimate success in the job, the company takes a sample of 400 cases from its very extensive files and obtains the results shown in the following table:

		Performance in training program			
		Below average	*Average*	*Above average*	*Total*
Success in job (employer's rating)	*Poor*	23	60	29	112
	Average	28	79	60	167
	Very good	9	49	63	121
	Total	60	188	152	400

Use the 0.01 level of significance to test the null hypothesis that performance in the training program and success in the job are independent.

6. The College Board provided comparisons of Scholastic Aptitude Test (SAT) scores based on the highest level of education attained by the test taker's parents. A research hypothesis was that students whose parents had attained a higher level of education would on average score higher on the SAT. The overall mean SAT math score was 514 (College Board website, January 8, 2012). SAT math scores for independent samples of students follow. The first sample shows the SAT math test scores for students whose parents are college graduates with a bachelor's degree. The second sample shows the SAT math test scores for students whose parents are high school graduates but do not have a college degree.

Student's Parents	
College Grads	**High School Grads**
485	442
534	580
650	479
554	486
550	528
572	524
497	
592	
487	492
533	478
526	425
410	485
515	390
578	535
448	
469	

a. Formulate the hypotheses that can be used to determine whether the sample data support the hypothesis that students show a higher population mean math score on the SAT if their parents attained a higher level of education. **Assume equal population variances**

b. What is the point estimate of the difference between the means for the two populations?

7. 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.

   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**

   c. Find the power of this test? **Interpret**

8. A study was made by a retail merchant to determine the relation between weekly advertising expenditures and sales

Adv. Cost	40	20	25	20	30	50	40	20	50	40	25	50
Sales	385	400	395	365	475	440	490	420	560	525	480	510

a. Using a model, $y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$, what are the least squares estimates of β_0 and β_1 ? What is the fitted equation?

b. What is the interpretation of the slope of the fitted equation?

c. Construct the ANOVA table and test the hypothesis $H_0 : \beta_1 = 0$ with $\alpha = 0.05$

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

e. What are the confidence limits ($a = 0.05$) for the true mean value of Sales when Adv. Cost is 40? **Interpret**

f. What are the confidence limits ($a = 0.05$) for the particular value of Sales when Adv. Cost is 40? **Interpret**