Prince Sultan University

Deanship of Educational Services
Department of Mathematics
and General Sciences

COURSE DETAILS:

Statistical Analysis STAT 271 Final Exam	
Semester:	Spring Semester --Term 172
Date:	May 10, 2018
Time Allowed:	**180 minutes**

STUDENT DETAILS:

Student Name:	
Student ID Number:	
Section/Time	
Instructor's Name:	Dr. Eric Benson

INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.

GRADING:

	Page 2	Page 3	Page 4	Page 5	Page 6	Page 7	Page 8	Page 9	Total
Questions	**10**	**9**	**6**	**6**	**8**	**25**	**8**	**8**	**80**
Marks									

10 points

1. Ice Cream Sales data (Temp in degrees Fahrenheit and Sales in 100s of dollars)

Temp	Sales
65	20
68	22
66	21
75	23
81	25
76	26
78	28
85	30
88	30
95	35
90	29
82	28
80	26
76	26

a. Find the sample correlation between Sales and Temperature. **(2 points)**

b. Using $\alpha = 0.05$, test the claim that there is a relationship (correlation) between Sales and Temperature. **Give a conclusion (5 points)**

c. Find the coefficient of determination. **Interpret this value**. **(3 points)**

9 points

2. Shorney Construction Company bids on projects assuming that the mean idle time per worker is 72 or fewer minutes per day. A sample of 30 construction workers will be used to test this assumption. Assume that the population standard deviation is 20 minutes. Take $\alpha = 0.10$
   a. State the hypotheses to be tested. **(2 points)**

   b. What is the probability of making a Type II error when the population mean idle time is 80 minutes? **(4 points)**

   c. What is power of the test when the population mean idle time is 75 minutes? **Interpret this value (3 points)**

6 points

3. Joan's Nursery specializes in custom-designed landscaping for residential areas. The estimated labor cost associated with a particular landscaping proposal is based on the number of plantings of trees, shrubs, and so on to be used for the project. For cost estimating purposes, managers use two hours of labor time for the planting of a medium-sized tree. Actual times from a sample of 10 plantings during the past month follow (times in hours).

1.7	1.5	2.6	2.2	2.4	2.3	2.6	3.0	1.4	2.3

With a .05 level of significance, test to see whether the mean tree-planting time differs from two hours.

a. State the null and alternative hypotheses. **(2 points)**

b. Do a test and state you conclusion? **(3 points)**

d. Estimate the p-value for this test? **(1 points)**

6 points

4. The following sample data have been collected for the purpose of testing whether a population standard deviation is equal to 40.

318	255	323	325	334
354	266	308	321	297
316	272	346	266	309

a. Conduct the appropriate hypothesis test using $\alpha = 0.10$. **(4 points)**

b. Find the 95% confidence interval for the population standard deviation. **(2 points)**

8 points

5. The authors of the paper "Racial Stereotypes in Children's Television Commercials" (Journal of Advertising Research [2008]: 80–93) counted the number of times that characters of different ethnicities appeared in commercials aired on Philadelphia television stations, resulting in the data in the accompanying table.

Ethnicity	African-American	Asian	Caucasian	Hispanic
Observed Frequency	57	11	330	6

Based on the 2000 Census, the proportion of the U.S. population falling into each of these four ethnic groups are .177 for African-American, .032 for Asian, .734 for Caucasian, and .057 for Hispanic. Do the data provide sufficient evidence to conclude that the proportions appearing in commercials are not the same as the census proportions? Test the relevant hypotheses using a significance level of .10.

25 points

6. A simple linear regression model was used to describe the relationship between sales revenue (in thousands of dollars) and advertising expenditure (also in thousands of dollars) for fast-food outlets during a 3-month period. A sample of 15 outlets yielded the accompanying summary quantities.

$$\sum x = 14.10 \quad \sum y = 1438.50 \quad \sum x^2 = 13.92$$
$$\sum y^2 = 140{,}354 \quad \sum xy = 1387.20$$
$$\sum (y - \bar{y})^2 = 2401.85 \quad \sum (y - \hat{y})^2 = 561.46$$

a. Estimate the fitted regression line. **(3 points)**

b. What proportion of observed variation in sales revenue can be attributed to the linear relationship between revenue and advertising expenditure? **(5 points)**

c. Calculate s_ε and s_{b_1}. **(6 points)**

d. Obtain a 90% confidence interval for β_1, the average change in revenue associated with a \$1000 (that is, 1-unit) increase in advertising expenditure. **Give a precise interpretation. (5 points)**

e. Test $H_0 : \beta_1 = 0$ vs $H_A : \beta_1 \neq 0$, for $\alpha = 0.10$. **Give a precise conclusion. (6 points)**

8 points

7. Credit scorecards are used by financial institutions to help decide to whom loans should be granted (see the Applications in Banking: Credit Scorecards summary on page 63). An analysis of the records of a random sample of loans at one bank produced the following results:

	Score Below 600	Score 600 or More
Sample size	562	804
Number defaulted	11	7

a. Do these results allow us to conclude that those who score below 600 are more likely to default than those who score 600 or more? Use a 10% significance level. **(4 points)**

b. Find the p-value for this test. **(2 points)**

c. What is the 95% confidence interval for the difference in the population proportions? **(2 points)**

8 points

8. No Left Turn An experiment was conducted to compare the mean reaction times to two types of traffic signs: prohibitive (No Left Turn) and permissive (Left Turn Only). Ten drivers were included in the experiment. Each driver was presented with 40 traffic signs, 20 prohibitive and 20 permissive, in random order. The mean time to reaction (in milliseconds) was recorded for each driver and is shown here.

Driver	Prohibitive	Permissive
1	824	702
2	866	725
3	841	744
4	770	663
5	829	792
6	764	708
7	857	747
8	831	685
9	846	742
10	759	610

a. Determine whether there is a significant difference in mean reaction times to prohibitive and permissive traffic signs. Use $\alpha = 0.10$.**(5 points)**

b. Find a 90% confidence interval for this difference. **(3 points)**