PRINCE SULTAN UNIVERSITY
Department of Mathematical Sciences
Final Examination (082)
Spring Semester 2009
STAT 271

Student name			
Student ID		Section No.	
Name of Teacher	Dr. Quazi Abdus Samad		

Time allowed: **120 Minutes**
Write down your answer in the space provided underneath the question.
Numbers are given in the brackets.
You may use a programmable calculator and/or the formula sheet.

Question(s)	**Maximum Points**	**Points obtained**
1	**16**	
2	**20**	
3	**18**	
4	**14**	
5	**12**	
Total	**80**	

Question 1 [16 points] The average low temperature for Marquette, MI in December is 12'F. The average low temperature for each of 8 randomly selected years is listed as:

11.0, 12.4, 11.8, 10.9, 11.4, 12.2, 10.8, and 12.2.

Assume the December low temperature distribution is normal. It is of interest to know if the sample data suggest the average low temperature is lower than 12'F.

a. State the null and alternative hypotheses [3 points].

b. Compute the appropriate test statistic for the hypotheses in **a** above [7 points].

c. Find the *p*-value or the appropriate critical value associated with the test statistic in **b** above at $\alpha = 0.05$ level [3 points].

d. Does the sample data support the null hypothesis at the $\alpha = 0.05$ level? **Justify and interpret your answer** [3 points].

Question 2 [20 points] Physicians depend on laboratory test results when managing medical problems such as diabetes or epilepsy. In a uniformity test for glucose tolerance, three different laboratories each sent $n_t = 5$ identical blood samples from a person who had drunk 50 milligrams (mg) of glucose dissolved in water. Do the data indicate a difference in the average readings for the three laboratories? The laboratory results (in mg/dl) are listed below:

Lab 1	Lab 2	Lab 3
121.3	99.5	104.2
111.9	113.2	109.7
110.1	108.9	102.3
105.4	109.1	111.2
101.6	100.4	106.6

a. State the null and alternative hypotheses in this context [2 points].

b. Show all steps of computations (**CM, SST, SSE, Total SS, DF, F** etc.) [8 points].

c. Show the complete ANOVA table [2 points].

d. Interpret the result at the 5% level of significance [3 points].

e. Show with the t-test whether there exists any difference between the means of Lab 1 and Lab 3. Use $\alpha = 0.05$ [5 points].

Question 3 (18 points) A professor of economics wants to study the relationship between income (*y* in $1000s) and education (*x* in years). A random sample of eight individuals is taken and the results are shown below.

Education	16	11	15	8	12	10	13	14
Income	58	40	55	35	43	41	52	49

a. Calculate the Pearson correlation coefficient. What sign does it have? **Why**? [3 points]

b. Determine the coefficient of determination and discuss what its value tells you about the two variables [2 points].

c. Conduct a test of the population slope to determine at the 5% significance level whether a linear relationship exists between years of education and income. State the null and alternative hypotheses. **Show all steps of computations** [10 points].

d. Interpret the result [3 points].

Question 4 (14 points) A pollster was interested in determining whether three television dramas are equally preferable among men and women. The following data was recorded:

	Preference		
Gender	NYPD Blue	Law & Order	The Practice
Male	40	35	13
Female	30	45	10

a. State the null and alternative hypotheses [2 points].

b. Compute the value of the test statistic. **Show all steps** [7 points].

c. Set up the appropriate rejection region for $\alpha = 0.05$ [3 points].

d. What is the appropriate conclusion? [2 points]

Question 5 (12 points) A car dealer was interested in comparing two brands of tires to see if they yielded different wear length (in thousands of miles). The dealer selected eight cars at random and used each of the brands of tires on each car. The wear length was recorded as follows:

Car	*Brand A*	*Brand B*
1	45	47
2	43	40
3	54	57
4	63	61
5	39	43
6	47	45
7	56	58
8	50	55

Use the sign test to see if the distribution of wear length is the same for both brands of tires. Use $\alpha = 0.05$.

a. State the null and alternative hypotheses. [2 points]

b. Find the value of the test statistic. [2 points]

c. Find the corresponding p-value from the Cumulative binomial probability table 1 in Appendix I. [2 points]

d. Interpret the result. [2 points]

e. Do the above sign test by using the z-statistic assuming that n =25 and p = 0.5. [2 points]

f. What conclusion do you make? [2 points]