PRINCE SULTAN UNIVERSITY

Department of Mathematical Sciences
Second Mid -Term Examination (091)
Fall Semester 2009-10
STAT 271

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

Time allowed: **100 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.
You must mention the formula or formulae in different questions.

$Z_{0.10}$	$Z_{0.05}$	$Z_{0.025}$	$\mathbf{Z_{0.01}}$	$Z_{0.005}$
1.285	1.645	1.96	2.325	2.575

Question 1 (10 points): Independent random samples of 37 and 50 observations are drawn from two quantitative populations, 1 and 2, respectively. The sample data summary is shown here:

	Sample 1	**Sample 2**
Sample size	37	50
Sample mean	1.39	1.48
Sample variance	0.065	0.522

Do the data present sufficient evidence to indicate that the mean for population 1 is smaller than the mean for population 2?

a. Set up the null and alternative hypotheses [2]

b. Find the value of the appropriate test statistic [5]

c. Use the p-value **<u>or</u>** the critical value approach to **explain** your conclusions (Use α = 0.05). Mention the rejection region. [3]

Question 2 (10 points) A manufacturing plant has two assembly lines for producing plastic bottles. The plant manager was concerned about whether the proportion of defective bottles differed between the two lines. Two independent random samples were selected and the following summary data computed:

	Line 1	*Line* 2
Sample Proportion of Defectives	0.10	0.133
Number of defectives	5	6
Sample Size	50	45

Perform the appropriate test of hypothesis using α = 0.05. **Show all steps.**

a. Set up the appropriate null and alternative hypotheses [2]

b. Find the value of the appropriate test statistic [5]

c. Use the critical value approach to **explain** your conclusions [3]

Question 3 (12 points) A customer service representative was interested in comparing the average time (in minutes) customers are placed on hold when calling Southern California Edison and Southern California Gas companies. The representative obtained two independent random samples and calculated the following summary information:

	Southern California Edison	Southern California Gas
Sample Size	9	12
Sample Mean	3.2 min	2.8 min
Sample Standard deviation	0.5 min	0.7 min

Assume the distributions of time a customer is on hold are approximately normal.

a. State the appropriate null and alternative hypotheses to test whether there is a significant difference in average time a customer is on hold between the two companies. [2]

b. Calculate the value of the test statistic.[4]

c. Set up the appropriate rejection region for the hypotheses in question, assuming $\alpha = 0.10$. Mention the rejection region. [3]

d. What is the appropriate conclusion? [3]

Question 4: (14 points) These data are observations collected using a completely randomized design: **(Show all steps)**

Sample 1	**Sample 2**	**Sample 3**
5	3	5
3	5	2
7	4	3
2	6	4
	9	3

a. Calculate CM and Total SS [3]

b. Calculate SST and MST [3]

c. Calculate SSE and MSE [2]

d. Construct an ANOVA table for the data [2]

e. State the null and alternative hypotheses for an analysis of variance F-test [2]

f. Use the critical value approach to determine whether there is a difference in the three population means **(that is, state your conclusions using α = 0.10)** [2]

Question 5 (14 points): Let *x* be the number of vending machines and let *y* be the time (in hours) it takes to stock them. The data are as follows.

X	4	8	10	13	16	11	5	9
Y	1	2	3	6	8	4	2	3

a. Estimate the least squares regression line [3]

b. Obtain the ANOVA table including the F-value [3]

c. State the null and alternative hypotheses to determine the usefulness of the regression. Do the t-test **<u>or</u>** the F-test [3]

d. State your conclusions mentioning the critical value at 5% level of significance [3]

e. What percentage of the total variation in *y* can be explained by the simple linear regression model in question? **Explain**. [2]