COMM 215
Lecturer: S.L.S. Ly
FINAL EXAM STAR PROBLEMS

Star Problem F1

It costs more to produce defective items – since they must be scrapped or reworked – than it does to produce non-defective items. In order to better understand a particular metal-stamping process, a manufacturer wishes to estimate the mean length of items produced by the process during the past 24 hours.

a. How many parts should be sampled in order to estimate the population mean to within 0.1 millimeter (mm) with 90% confidence? Investigations in the past of this machine have indicated that the lengths of items produced by the stamping operation follow a normal distribution with a standard deviation of about 2 mm.
b. Time permits the use of a sample size no more than 100. If a 90% confidence interval for the true mean length in mm is constructed using 100 of the items produced over the period, will it be wider or narrower than would have been obtained using the sample size determined in part (a)? Explain.

Star Problem F2

A major transportation company operates a fleet of trucks and it claims that the mean monthly maintenance cost per truck is different from $80. To test this hypothesis, a random sample of 20 trucks provided a sample mean maintenance cost of $74 with a sample standard deviation of $10. Assume that the monthly maintenance cost per truck is normally distributed.

a. At a 2% level of significance, is there sufficient evidence to support the company's claim? What is the p-value of the test? Does the p-value confirm the original conclusion?
b. The manager is also interested in estimating the percentage of imported trucks in the current fleet. A sample of 40 trucks revealed 5 were imported. At a 5% level of significance, is there evidence that the true proportion of imported trucks exceeds 10%? What is the p-value of the test? Does the p-value confirm the original conclusion?
c. To learn the work satisfaction of her drivers, the manager also wishes to estimate proportion of truck drivers satisfied with their work within 10% of the true value 9 times out of 10. Determine the number of truck drivers that would have to be sampled.

Star Problem F3

A travel company wishes to determine if the type of vacation purchased in its market area is independent of income level of purchasers. A random survey of purchasers gave the following results:

Vacation Type	Income Level		
	High	Medium	Low
Domestic	50	120	65
Foreign	25	30	10

a. At the 0.05 level of significance, can it be concluded that vacation preference and income level are statistically independent?
b. Construct a 94 percent confidence interval estimate for the proportion of medium income individuals who purchase a foreign vacation.

Star Problem F4

The reasons given by workers for quitting their jobs generally fall into one of two categories: (1) worker quits seeking or taking a different job, or (2) worker quits withdrawing from the labor force. Economic theory suggests that wages and the quit rates are related. The table below lists quit rates (**y:** quits per 100 employees) and the average hourly wage (**x** in $) in a sample of fifteen manufacturing industries.

Industry	1	2	3	…	14	15
Average Wage (X)	8.20	10.35	6.18	…	10.93	8.80
Quit Rate (Y)	1.40	0.70	2.60	…	1.80	2.00

Assuming that a simple linear regression model is appropriate for analyzing the above data, the following results are obtained from a least squares fit of the model:

$$b_0 = 4.8615,\quad S_{b_0} = 0.5201,\quad b_1 = -0.3466,\quad S_{b_1} = 0.0587$$

$$\sum x = 129.05,\quad \sum y = 28.2,\quad SS_{xx} = 68.6999,\quad SS_{yy} = 11.324,\quad SSE = 3.0733$$

a. At 5% significance level, is there any evidence to conclude that average hourly rate contributes useful information for prediction of quit rates? What does the model suggest about the relationship between quit rates and wages?
b. What proportion of the variation in quit rate is accounted for by average hourly wage?
c. Estimate with a 95% confidence interval the mean quit rate in an industry with an average hourly wage of $9.00. Interpret the result
d. Find a 95% prediction interval for the quit rate in an industry with an average hourly wage of $9.00. Interpret the result

Star Problem F5

A multiple regression is used in cost analysis to shed light on the factors that cause costs to be incurred and the magnitudes of their effects. The sample data from a firm's accounting and production records for 20 weeks provide cost information about the firm's shipping department. LABOR (Y, in hours) is the dependent variable, while the independent variables are POUNDS shipped (X_1, in 1000s), percentage of UNITS shipped by truck (X_2, %) and average shipping WEIGHT (X_3, in pounds). The table below shows partial Excel results obtained from fitting a multiple regression model (Labor versus Pounds, Units, Weight):

	Coef	SE Coef	t	p
Intercept	131.92	25.69		
Pounds	2.726	2.275		
Units	0.04722	0.09335		
Weight	-2.5874	0.6428		

Analysis of Variance					
Source	**DF**	**SS**	**MS**	**F**	**P**
Regression					
Residual Error		1539.9			
Total		6698.2			

a. Is there sufficient evidence at the 5% level of significance to conclude that the model is useful in predicting labor cost? State your conclusion in the context of the problem.
b. Is there sufficient evidence at the 5% level of significance to conclude that firm's hours of labor are related to average shipping weight? What is the approximate *p*-value?
c. Estimate the coefficient of determination and explain its meaning in the context of the problem.
d. Estimate the average hours of labor based on a shipment of 6,000 pounds, 40% of which are trucked with average shipment weight of 20 pounds.