Strathmore
UNIVERSITY

STRATHMORE UNIVERSITY BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

END OF SEMESTER EXAMINATION

MDF 8103: QUANTITATIVE ANALYSIS FOR DEVELOPMENT FINANCE

Date: Wednesday, 5th December 2018 **Time**: 3 Hours

Instructions

1. This examination consists of **SIX** questions.
2. Answer Question **ONE** and **ANY OTHER FOUR** questions.

Question 1 (Compulsory) (20 Marks)

a) A consumer group would like to estimate the mean monthly electricity bill for a single-family house in November. Based on similar studies the standard deviation is estimated to be \$20.00. A 99% level of confidence is desired, with an accuracy of ± \$5.00. Determine how large a sample is required **(2 Marks)**

b) A company that sells annuities must base the annual pay-out on the probability distribution of the length of life of the participants in the plan. Suppose the probability distribution of the lifetimes of the participants in the plan is approximately normally distributed with mean 68 years and a standard deviation of 3.5 years. Determine the proportion of the plan participants that would receive payments beyond age 70. **(4 Marks)**

c) A manufacturing company developed the following estimated regression equation relating sales to inventory investment and advertising expenditures.

$$\hat{y} = 25 + 10x_1 + 8x_2$$

where $x_1 =$ inventory investment (\$1000s)

$x_2 =$ advertising expenditures (\$1000s)

$y =$ sales (\$1000s)

(i) Estimate the sales resulting from \$15,000 investment in inventory and an advertising budget of \$10,000 **(1 Mark)**

(ii) Interpret $\beta_1 = 10$ and $\beta_2 = 8$ in this estimated regression equation **(2 Marks)**

d) To compare the rate of return an investor can expect on tax free government bonds with the rate of return on taxable bonds, an investment advisory firm randomly samples ten bonds of each type and computes annual rate of return over the past 3 years for each bond. The rate of return is then adjusted for taxes, assuming the investor is in a 30% tax bracket. The means and standard deviations for the adjusted returns are shown below

	Tax free bonds	**Taxable bonds**
Mean	7.8%	7.3%
Standard deviation	1.1%	1.0%

Required:

(i) Test to determine whether there is a difference in the mean rates of return between tax-free and taxable bonds for investors in the 30% tax bracket. Use $\alpha = 0.05$ **(4 Marks)**

(ii) Explain the assumptions necessary for the validity of the testing procedure used in (i) above. **(2 Marks)**

e) An insurance company has established that the number of car accident claims they receive are uniformly distributed on an interval $(0, \beta)$. Determine

(i) The Maximum likelihood estimator for β **(3 Marks)**

(ii) The mean number of claims and the variance. **(2 Marks)**

Question 2 (10 Marks)

A manufacturing company is considering a plant expansion to enable the company begin production of a new computer product. The company's managing director must determine whether to make the expansion a medium or a large-scale project. Demand for the new product is uncertain, which for planning purposes may be low demands, medium demand, or high demand. The probability estimates for the demand are 0.20, 0.50, and 0.30 respectively. Letting X and Y indicate the annual profit in thousands of dollars, the firm's planners developed the following profit forecasts for the medium-and large -scale expansion projects.

	Medium scale expansion profit		Large scale expansion profit	
Demand	X	P(X)	Y	P(Y)
Low	50	0.2	0	0.2
Medium	150	0.5	100	0.5
High	200	0.3	300	0.3

(i) Determine the decision that would be preferred if the objective is to maximize the expected profits. **(4 Marks)**

(ii) Compute the variance for the profit associated with the two expansion alternatives.

(4 Marks)

(iii) Which decision is preferred for the objective of minimizing the risk of uncertainty. Explain your answer. **(2 Marks)**

Question 3 (10 Marks)

a) *The Economics of Education Review (Vol. 21, 2002)* published a paper on the relationship between education level and earnings. The data for the research was obtained from the National Adult Literacy Survey of more than 25,000 respondents. The survey revealed that males with post graduate degree have a mean salary of $61,340 with a standard error of $2,185, while females with a postgraduate degree have a mean of $32,227 with a standard error of $932

(i) The article reports that a 95% confidence interval for μ_m, the population mean salary of the males with postgraduate degrees, has a range of $57,050 and $65,631. Based on this interval, is their evidence to say that μ_m differs from $60,000? Explain

(2 Marks)

(ii) Use the summary information to test the hypothesis that the true mean salary of males with postgraduate degrees differs from $60,000. Use $\alpha = 0.05$

(4 Marks)

b) The distribution of starting salaries of men who received Master of Science in Development Finance (MDF) degrees last year had a mean equal to $15,000 and a standard deviation equal to $1,200. A random sample of 36 starting salaries of women who received (MDF) degrees last year had a sample mean equal to $15,600

(i) Determine the probability that a randomly selected sample of 36 stating salaries of men who graduated last year would have a sample mean at least as large as $ 15,600.

(3 Marks)

(ii) Based on your findings in part a (i) above, does it appear that the starting salaries of women should also be characterized by the same probability distribution that characterizes men's starting salaries? Explain. **(1 Mark)**

Question 4 (10 Marks)

Cost analysis for shipping department: Multiple regression can be used by accountants in labor cost analysis. A researcher points out that multiple regression models can be used to shed light on "factors that cause labor costs to be incurred and the magnitudes of their effects". The independent variables; pounds shipped (x1), percentage of units shipped by truck (x2) and average shipment weight (x3), of such a regression model are the factors believed to be related to labor cost, the dependent variable. The estimates of the coefficients provide the measures of magnitude of the

factors' effects on labor cost. The regression model analysis below is obtained from a sample data collected from a firm's accounting and production records.

Regression Analysis: Labor,y versus Pounds,x1, PctShip,x2, AveWt,x3

Predictor	Coef	SE Coef	T	P
Constant	131.92	25.69	5.13	0.000
Pounds,x1	2.726	2.275	1.20	0.248
PctShip,x2	0.04722	0.09335	0.51	0.620
AveWt,x3	-2.5874	0.6428	-4.03	0.001

S = 9.81035 R-Sq = 77.0% R-Sq(adj) = 72.7%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	3	5158.3	1719.4	17.87	0.000
Residual Error	16	1539.9	96.2		
Total	19	6698.2			

Required:

a) Determine the least squares prediction equation **(1 Mark)**

b) Interpret the coefficients of the independent variables **(3 Marks)**

c) Interpret the value of coefficient of determination R-square above **(2 Marks)**

d) Write the hypothesis and deduce on the test for goodness of fit **(2 Marks)**

e) If shipping department employees are paid $7.50 per hour, on average, find how much less it will cost the company per week if the average number of pounds per shipment increases from a level of 20 to 21. **(2 Marks)**

Question 5 (10 Marks)

a) A research student studied the duration of interruptions by advertising during a favorite Television program. The following data shows the number, on average, of programming minutes in a half-hour TV program

21.06	22.4	20.62	21.66	21.23	23.86	23.82	20.30	21.52
21.52	21.92	23.14	20.02	22.20	22.37	22.19	22.34	

Assume that the population is approximately normal

(i) Determine the point estimate of for the mean **(2 Marks)**

(ii) Determine a 95% confidence interval for mean number of programming during half hour television program **(4 Marks)**

(b) With double digit annual percentage increases in the cost of health, more and more workers are likely to lack health insurance coverage. The following sample data provide a comparison of workers with and without health insurance coverage for small, medium and large companies.

Size of the company	**Health Insurance**		**total**
	HAVE	DO NOT HAVE	
Small	36	14	50
Medium	65	10	75
Large	88	12	100

Conduct a hypothesis test to determine whether employee health insurance coverage is independent of the company size. Use 0.05 level of significance. **(4 Marks)**

Question 6 (10 Marks)

a) The amount of time, X in minutes a bank teller spends with a customer is known to have an exponential distribution defined by

$$f(x) = \begin{cases} 0.25e^{-0.25x} & , x \geq 0 \\ 0 & , elsewhere \end{cases}$$

(i) Find the probability that a clerk spends four to five minutes with a randomly selected customer **(4 Marks)**

b) Let $X_1, X_2, X_3, ..., X_n$ be a random sample from a uniform distribution from $(\theta - 2, \quad \theta + 2)$

(i) Determine the moment estimator for θ **(4 Marks)**

(ii) Given the following observations, 10.6, 12.3, 4.8, 11.0, 12.37, determine the moment estimator for θ **(2 Marks)**