



STRATHMORE UNIVERSITY BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

END OF SEMESTER EXAMINATION

MDF 8103 - Quantitative analysis for development finance - December 2019

Date: Thursday, 4th December 2019

Time: 3 Hours

Instructions

1. Answer Question 1 and **any other Four** Questions

Question 1 (COMPULSORY) (20 Marks)

- a) An insurance company is planning to market a new product. According to the financial analysis, it will earn an annual profit of \$ 4.5 million if this product has high sales, annual profit of \$ 1.2 million if the sales are average and it will lose \$ 2.3 million a year if the sales are low. The probabilities of these three scenarios are 0.32, 0.51 and 0.17 respectively. Suppose the profits earned is designated by a random variable X,
 - (i) Construct a probability distribution table for above problem **(1 Mark)**
 - (ii) Determine the expected profits **(2 Marks)**
 - (iii) Find the Variance of $Y = 3X + 4$ **(3 Marks)**
- b) The operations manager of a bank has established that the amount of time, X in minutes a bank teller spends with a customer is known to have an exponential distribution with an average amount of time of 4 minutes. The density function is defined below:

$$f(x) = \begin{cases} \frac{1}{4} e^{-\frac{1}{4}x}, & x > 0 \\ 0, & \text{elsewhere} \end{cases}$$

Find the probability that a clerk spends four to five minutes with a randomly selected customer

(4 Marks)

- c) Visa card Centre studied how frequently consumers of various age groups use plastic cards (debit and credit) when making purchases (Associated Press, January 16, 2006). Sample data for 300 customers shows the use of plastic cards by four age groups.

Payment	Age group			
	18-24	25-34	35-44	45and over
Plastic	21	27	27	36
Cash or check	21	36	42	90

- (i) Test for the independence between method of payment and age group at 0.05 level. Write your conclusions. **(4 Marks)**
- (ii) What implications does this study have for companies such as Visa and MasterCard? **(1 Mark)**
- d) An administrator for a large group of hospitals believe that of all patients 30% will generate bills that become at least overdue. A random sample of 200 patients are taken
- (i) Determine the standard error of sample proportion that will generate bills that become at least 2 months overdue. **(2 Marks)**
- (ii) Find the probability that the sample proportion is between 0.27 and 0.33 **(3 Marks)**

Question 2 (10 Marks)

- a) Suppose you work in Human Resource department. You plan to survey employees to find their average medical expenses. You want to be 95% confident that the sample mean is within $\pm \$50$. A pilot study showed that sample standard deviation was about \$400. Determine the sample size that would be adequate for this survey. **(2 Marks)**
- b) The average commission charged by full service brokerage firms on a sale of common stock is \$ 84, and standard deviation is \$ 10. Janet has taken a random sample of 75 traders by her clients and determined that they paid an average commission of \$ 81.50. At 0.10 significance level, can Janet conclude that her clients' commissions are higher than the industry average? **(4 Marks)**
- c) An airline promotion to business travellers is based on the assumption that two thirds of business travellers use laptop computers on overnight business trips. Determine the sample proportion from airline sponsored survey that found 355 of 546 business travellers use laptop computer on overnight business trip. Hence, use $\alpha = 0.05$ to conduct the hypothesis test. Hence write your conclusion. **(4 Marks)**

Question 3 (10 Marks)

- a) Explain any three assumptions of a binomial experiment **(3 Marks)**
- b) An economist has established that the proportion of customers that will pay their loans on time is p while the proportion of size q will not pay their loans on time. For n number of

customers, the probability model that may be used to estimate the number of customers that will pay on time, x is defined by the density function

$$f(x) = \begin{cases} \binom{n}{x} p^x q^{n-x}, & x = 0, 1, 2, \dots, n, q = 1 - p \\ 0, & \text{otherwise} \end{cases}$$

Find

(i) The moment generating function of x **(4 Marks)**

(ii) Hence, using the moment generating function technique, find the mean of x **(3 Marks)**

Question 4 (10 Marks)

An economist projected that the average expenditure on Valentine's Day was expected to be \$100.89. Do male and female consumers differ in the amounts they spend? The average expenditure in a sample of 40 male consumers was \$135.67, and the average expenditure in a sample survey of 30 female consumers was \$68.64. Based on the past surveys, the standard deviation for the male consumers is assumed to be \$35, and the standard deviation for female consumers is assumed to be \$20.

- Determine the point estimate of the difference between the population mean expenditure for males and the population mean expenditure for females. **(2 Marks)**
- Construct the 99% confidence interval the difference between the population mean expenditure for males and the population mean expenditure for females. **(4 Marks)**
- Write the null and alternative hypothesis. Hence at 0.01 level of significance carry out the hypothesis test and draw your conclusion. **(4 Marks)**

Question 5 (10 Marks)

A consulting firm advises its clients about sampling and statistical procedures that can be used to control their manufacturing processes. In one particular application, a client gave Quality Associates a sample of 800 observations taken during a time in which that client's process was operating satisfactorily. The sample standard deviation was assumed to be 0.21. Quality Associates then suggested that random samples of size 30 be taken periodically to monitor the process on an basis. By analysing the new samples, the client could learn whether the process was operating satisfactorily. When the process was not operating satisfactorily, corrective action could be taken to eliminate the problem. The design specification indicated the mean for the process should be 12. The hypothesis tested by quality Associates follows

$$H_0 : \mu = 12$$

$$H_a : \mu \neq 12$$

Corrective action will be taken anytime H_0 is rejected. The summary for descriptive statistics computed from data taken at hourly intervals during the first day of operation through the new statistical process control procedure are given below

Descriptive Statistics: Sample 1, Sample 2, Sample 3, Sample 4

Variable	N	N*	Mean	StDev	CoefVar	Median
Sample 1	30	0	11.959	0.220	1.84	11.955
Sample 2	30	0	12.029	0.220	1.83	12.025
Sample 3	30	0	11.889	0.207	1.74	11.920
Sample 4	30	0	12.081	0.206	1.71	12.080

Required: Perform statistical analysis and prepare a managerial report using the following guide lines:

- Conduct a hypothesis test for each sample at 0.01 level of significance and determine which action, if any, should be taken. **(4 Marks)**
- Compute control limits for the sample mean and explain situations when the process should be stopped and checked. **(4 Marks)**
- Discuss the implications of changing the level of significance to a larger value.

(2 Marks)

Question 6 (10 Marks)

- The reasons given by government workers for quitting their jobs generally fall into one of the two categories: (1) worker quits to seek or take a different job, or (2) worker quits to withdraw from the labor force. Economic theory suggests that wages and quit rates are related. Consider the simple linear regression *Minitab* output of quit rate (quits per 100 employees), Y, on average hourly wage, X in a sample of public servants below.

Regression Analysis: QuitRate versus AveWage

Predictor	Coef	SE Coef	T	P
Constant	4.8615	0.5201	9.35	0.000
AveWage	-0.34655	0.05866	-5.91	0.000

S = 0.486220 R-Sq = 72.9% R-Sq(adj) = 70.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	8.2507	8.2507	34.90	0.000
Residual Error	13	3.0733	0.2364		
Total	14	11.3240			

Required:

- Write the regression model **(1 Mark)**
- Interpret the coefficients in the regression model **(2 Marks)**
- Write the null and alternative hypothesis for this problem and deduce whether the data present sufficient evidence to conclude that average hourly wage rate contributes useful information for the prediction of quit rates. **(2 Mark)**

- b) The descriptive statistics for weekly wages (in hundred Kshs) of 40 company employees are given below:

Total							
Variable	Count	Mean	StDev	Minimum	Q1	Median	Q3
weekly wages	40	32.83	10.12	15.00	25.00	31.50	41.75

Variable	Maximum	Kurtosis
weekly wages	54.00	-0.77

(i) Develop the 95% and 99% confidence intervals for the mean weekly wages. Interpret both the intervals **(3 Marks)**

(ii) Suppose the board of directors recommend salary increments for these workers. Which confidence level would you recommend when implementing this recommendation? Why?

(2 Marks)