



Strathmore
UNIVERSITY

STRATHMORE BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

END OF SEMESTER EXAMINATION

MDF 8103: QUANTITATIVE METHODS IN DEVELOPMENT FINANCE

Date: Thursday, 26th October 2017

Time: 3 hours

Instruction

1. Answer question **ONE** and any other **THREE** questions

Question 1 (15 Marks)

- a) *Rating employee performance:* Almost all companies utilize some type of year-end performance review for their employees. Human Resource (HR) at an audit firm provides guidelines for supervisors rating their subordinates. For example, raters are advised to examine their ratings for a tendency to be either too lenient or too harsh. According to HR, “If you have this tendency, consider using a normal distribution; rate 10% of employees as exemplary, 20% distinguished, 40% competent, 20% marginal, and 10% unacceptable.” Suppose you are rating an employee’s performance on a scale of 1 (lowest) to 100 (highest). Also, assume the ratings follow a normal distribution with a mean of 50 and a standard deviation of 15
 - (i) Determine the lowest rating you would give to an “exemplary” employee if you follow the rating guidelines **(4 Marks)**
 - (ii) Determine the highest rating you would give to an “competent” employee if you follow the rating guidelines **(4 Marks)**
- b) *Phishing attacks to email accounts:* Chance (Summer 2007) published an article on phishing attacks at a company. *Phishing* describes an attempt to extract personal or financial information through fraudulent e-mail. The company set up a publicized e-mail account called a “fraud box” that enabled employees to notify them if they suspected an e-mail phishing attack. If there is minimal or collaboration or collusion from within the company, the interarrival times (x), that is, the time between successive e-mail notifications

in seconds, have an approximate exponential distribution with mean of 95 seconds and a corresponding probability distribution function given by;

$$f(x) = \begin{cases} \frac{1}{95}e^{-x/95}, & x > 0 \\ 0, & \text{elsewhere} \end{cases}$$

- (i) Determine the probability of observing an interarrival time of at least 2 minutes **(3 Marks)**
- (ii) Determine the variance of the inter-arrival times **(4 Marks)**

Question 2 (15 Marks)

a) *Buy-side Vs Sell side analysts' earnings forecasts.* The *Financial Analysts Journal* (July/August 2008) did a study of earnings forecasts of buy-side and sell-side analysts. Buy-side analysts differ from sell-side analysts on a variety of factors, including scope of industry coverage, sources of information used and target audience. Data were collected on 3,526 forecasts made by buy-side analysts and 58,562 forecasts made by sell-side analysts, and the relative absolute forecast error was determined for each. A positive forecast error indicates that the analyst is overestimating earnings, while a negative forecast error implies that the analyst is underestimating earnings. Summary statistics for the forecast errors in the two samples are given in the table below.

	Buy-side Analysts	Sell-side Analysts
Mean	0.85	-0.05
Standard deviation	1.93	0.85

- (i) Conduct a test at 0.01 level to determine if the true mean forecast error for buy-side analysts is positive hence make your conclusions. **(4 Marks)**
- (ii) Test whether there is any significant difference between the buy-side analysts and sell-side analysts at 0.05 level. **(5 Mark)**
- b) *The Pepsi challenge.* “Take the Pepsi challenge” was a famous marketing campaign used by Pepsi-Cola company. Coca-Cola drinkers participated in a blind taste test where they were asked to taste unmarked cups of Pepsi and Coke and were asked to select their favorite. In one Pepsi television commercial, an announcer stated that “in recent blind taste tests, more than half the Diet Coke drinkers surveyed said they preferred the taste of Diet Pepsi.” Suppose 100 Diet Coke drinkers took the Pepsi Challenge and 56 preferred the taste of the Diet Pepsi.
- (i) Carry out a hypothesis test at 0.05 level to determine if more than half of all Diet Coke drinkers selected Diet Pepsi in the blind taste test **(4 Marks)**
- (ii) Explain the consequences of the test results from Coca-Cola’s perspective. **(2 Marks)**

Question 3 (15 Marks)

- a) 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 **(2 Marks)**
- (ii) Interpret β_1 and β_2 in this estimated regression equation **(2 Marks)**
- b) The following *Minitab* output shows the regression analysis of data on ages and incomes of random sample of executives working for a large multinational company, and the number of years each went to college:

Regression Analysis: Age (x1) versus Years in college (x2), Income (\$)

Predictor	Coef	SE Coef	T	P
Constant	8.5607	0.6783	12.62	0.006
Years in college (x2)	-3.04673	0.03503	-86.97	0.000
Income (\$)	0.00050963	0.00000917	55.56	0.000

S = 0.120886 R-Sq = 100.0% R-Sq(adj) = 99.9%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	2	113.171	56.585	3872.16	0.000
Residual Error	2	0.029	0.015		
Total	4	113.200			

- (i) Write the regression equation **(1 Mark)**
- (ii) Determine the sample size for each data set used in the survey **(2 Marks)**
- (iii) Explain the meaning of the coefficients in the model **(3 Marks)**
- (iv) Interpret the meaning of the R-square above **(2 Marks)**
- (v) Write down the null hypothesis and make your conclusions on the fit of the model. **(3 Marks)**

Question 4 (15 Marks)

- a) The first few weeks of 2017 were good for the stock market. A sample of 20 large open-end funds showed the following year-to date returns through January.

7.0	3.2	1.4	5.4	8.5	2.5	2.5	1.9	5.4	1.6
1.0	2.1	8.5	4.3	6.2	1.5	1.2	2.7	3.8	2.0

- (i) Determine the point estimator for the population mean year-to-date return for large open-end funds **(2 Marks)**
- (ii) Find the point estimator for the population standard deviation year-to-date return for large open end funds **(3 Marks)**
- (iii) Given that the population is approximately normal, develop a 95% confidence interval, hence interpret the meaning of the interval. **(3 Marks)**
- b) A financial analyst of a supermarket has found out that daily total sales (X) is approximately normally distributed with an unknown value of mean, μ and a standard deviation of 1 million dollars. If the corresponding distribution is defined by

$$f(x) = \begin{cases} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(x-\mu)^2}, & -\infty \leq x \leq \infty \\ 0, & elsewhere \end{cases}, \text{ where } \pi = \frac{22}{7}.$$

- (i) Determine the likelihood function for the above financial model **(4 Marks)**
- (ii) Show that the maximum likelihood estimator for the population mean μ is the sample mean \bar{X} **(3 Marks)**

Question 5 (15 Marks).

- a) Visa studied how frequently consumers of various age groups use plastic cards (debit and credit cards) when making purchases. Sample data for 300 customers show the use of plastic cards by four age groups.

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

- (i) Perform a test for independence between method of payment and age group at 0.05 level of significance **(5 Marks)**
- (ii) Explain the implications of the survey findings for companies such as Visa and Master Card. **(1 Mark)**
- b) *Investment risk analysis:* The risk portfolio of financial assets is sometimes called *investment risk*. In general, investment risk is typically measured by computing the variance or standard deviation of the probability distribution that describes the decision

maker's potential outcomes (gains or losses). The two discrete probability distributions given below were developed from historical data. They describe the potential total physical damage losses next year to the fleets of delivery trucks of two different firms.

Firm A		Firm B	
Loss next year (\$)	Probability	Loss next year (\$)	Probability
0	0.1	0	0.00
500	0.1	200	0.01
1000	0.2	700	0.3
1500	0.3	1200	0.15
2000	0.3	1700	0.45

- (i) Determine the expected total physical damage for both firms **(4 Marks)**
(ii) Compute the standard deviation for each probability distribution and determine which firm faces the greatest risk of physical damage to its fleet next year **(5 Marks)**