



Strathmore
UNIVERSITY

STRATHMORE BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

END-OF-SEMESTER EXAMINATION

MDF 8103: QUANTITATIVE METHODS IN DEVELOPMENT FINANCE

Date: Monday 4th December 2023

Time: 3 Hours

Instructions:

1. This examination consists of SIX questions.
2. Answer question **ONE** and any other **THREE** questions.
3. You are expected to work independently
4. Question one carries **34** marks and the rest of the questions carry **22** marks each
5. Marks may be awarded for neatness of work

Question 1 (34 Marks) (Compulsory)

- (a) A regression performed to predict the selling price of houses found the equation to be:

$$\widehat{Price} = 169,328 + 35.3Area + 0.718Lotsize - 6543Age$$

Where *Price* is in dollars, *Area* is in square feet, *Lot size* is in square feet, and *Age* is in years. The R^2 is 92%. One of the interpretations below is correct. Which is it? Explain what's wrong with the others.

- i) Each year a house *Ages* it is worth \$6543 less. **[4 marks]**
 - ii) Every extra square foot of *Area* is associated with an additional \$35.30 in average price, for houses with a given *size* and *Age*. **[4 marks]**
 - iii) Every dollar in price means *Lotsize* increases by 0.718 square feet. **[4 marks]**
 - iv) This model fits 92% of the data points exactly. **[4 marks]**
- (b) A management consultant was hired to analyze the salary structure in a large multinational company. As part of the analysis, he interviewed 50 employees and asked each to provide his or her annual income (in thousands of dollars), the number of years of education, the number of years of experience, and his or her age. The multiple regression model:

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \varepsilon$$

was estimated where y = Income, x_1 = Education, x_2 = Experience, and x_3 = Age. The Minitab computer output appears below.

The regression equation is

$$y = 6.111 + 1.261x_1 + 0.836x_2 + 0.373x_3$$

| Predictor | Coef | Stdev | t-ratio | p |
|-----------|-------|-------|---------|--------|
| Constant | 6.111 | 4.883 | 1.251 | 0.2172 |
| x1 | 1.261 | 0.351 | 3.593 | 0.0008 |
| x2 | 0.836 | 0.390 | 2.144 | 0.0374 |
| x3 | 0.373 | 0.214 | 1.743 | 0.0880 |

s=1.483 R-sq=59.8% R-sq(adj)=57.2%

Analysis of Variance

| SOURCE | DF | SS | MS | F | p |
|------------|----|-------|------|------|--------|
| Regression | 3 | 150.5 | 50.2 | 22.8 | 0.0000 |
| Error | 46 | 101.2 | 2.2 | | |
| Total | 49 | 251.7 | | | |

- i) Interpret each coefficient **[8 marks]**
- ii) Test at the 5% level to determine x_1 , x_2 and x_3 are linearly related to y . **[10 marks]**

Question 2 (22 Marks)

(a) A textile firm employs three knitting machines to produce bedspreads. Forty percent of the firm's daily bedspread production comes from machine A, while the remainder of the production is split equally between machines B and C. One percent of the bedspreads produced on machine A are flawed, while the flaw rates for machines B and C are 2% and 3%, respectively. If one bedspread is selected at random from a day's production and is found to contain a flaw, what is the probability that it was produced on machine B? **[13 marks]**

(b) The time required to assemble a part of a machine follows an exponential probability distribution. The average time of assembling the part is 10 minutes.

- i) Give the appropriate probability density function. **[4 marks]**
- ii) What is the probability that the part can be assembled in 7 minutes or less? **[4 marks]**
- iii) Find the probability of completing the assembly in 3 to 7 minutes. **[4 marks]**

Question 3(22 marks)

- (a) The Globe and Mail (3 September 1987) has reported that 80% of Wall Street firms that speculate on corporate takeovers before they become public also help to underwrite such deals. A random sample of 10 firms that speculate on corporate takeovers is selected.
- i) Find the probability that at least half the firms selected underwrite takeovers. **[7 marks]**
- ii) Find the probability that at most three of the firms selected do not underwrite takeovers. **[5 marks]**
- iii) Find the expected value and variance of the number of firms selected that underwrite takeovers. **[4 marks]**
- (b) Records show that there is an average of three accidents each day in Nairobi (the capital city of Kenya) between 2 and 3 P.M.
- i) Use the Poisson probability formula to find the probability that there will be exactly one accident between 2 and 3 P.M. on a particular day. **[3 marks]**
- ii) Find the probability that there will be at least three accidents between 2 and 3 P.M. on a particular day. **[3 marks]**

Question 4 (22 marks)

- (a) When a new shopping center is built, the electric company must assign a transformer to the location. Since this is done before the occupants of the shopping center are known, there is uncertainty about the amount of electricity to be used (for example, beauty salons use more electricity than toy stores) and hence, uncertainty about the size of the transformer needed. A too-small transformer would have to be replaced, and one too-large would result in more expense than necessary. A table giving these costs in (1000s) of US dollars is shown below:

| <i>Size of Transformer Originally Installed</i> | | | |
|-------------------------------------------------|--------------|---------------|--------------|
| <i>Amount of Electricity Ultimately needed</i> | Small | Medium | Large |
| Little | 50 | 100 | 150 |
| Medium | 140 | 100 | 150 |
| Much | 190 | 190 | 150 |

Suppose, for a given shopping center, the following probabilities are assigned to the amount of electricity ultimately needed:

| <i>Need</i> | <i>Probability</i> |
|---------------|--------------------|
| Little | 0.2 |
| Medium | 0.7 |
| Much | 0.1 |
| | 1.0 |

- i) Using the maximin criteria, what decision should be made? **[5 marks]**
- ii) Draw up an opportunity loss table. **[5 marks]**
- iii) What decision should be made? Why? **[5 marks]**
- iv) What is the expected value of perfect information? **[5 marks]**
- v) Interpret your answer from (iii). **[2 marks]**

Question 5 (22 marks)

- (a) An essential aspect of managing any organization is planning for the future. Indeed, the long-run success of an organization is closely related to how well management is able to anticipate the future and develop appropriate strategies. Good judgment, intuition, and an awareness of the state of the economy may give a manager a rough idea or ‘feeling’ of what is likely to happen in the future. Explain the importance of **Business Forecasting**.

[5 marks]

(b) Consider the following time series data.

| | | | | | | |
|-------|---|----|----|----|----|---|
| Week | 1 | 2 | 3 | 4 | 5 | 6 |
| Value | 8 | 13 | 15 | 17 | 16 | 9 |

- i) Develop a three-week moving average for this time series. What is the forecast for week 7? **[3 marks]**
- ii) Compute the MSE for the three-week moving average. **[3 marks]**
- iii) Use $\alpha = 0.2$ to compute the exponential smoothing values for the time series. What is the forecast for week 7? **[5 marks]**
- iv) Compare the three-week moving average forecast with the exponential smoothing forecast using $\alpha = 0.2$. Which appears to provide the better forecast? **[2 marks]**
- v) Use a smoothing constant of 0.4 to compute the exponential smoothing values. Does a smoothing constant of 0.2 or 0.4 appear to provide a better forecast? Explain. **[7 marks]**

Question 6 (22 marks)

The Compulynx computer company based in Nairobi makes its own computers and delivers them directly to customers who order them via the Internet. Compulynx competes on price and speed of delivery. To achieve its objective of speed, Compulynx makes each of its five most popular computers and transports them to storage warehouses across the country, from which it generally takes 1 day to deliver a computer to the customer. This strategy requires high levels of inventory that add considerably to the cost. To lower these costs, the operations manager wants to employ an inventory model. He notes that both daily demand and lead time are random variables. He concludes that demand during lead time is normally distributed and he needs to know the mean in order to compute the optimum inventory level. He observes 60 lead time periods and records the demand for each period. These data are stored in a file and listed below. The manager would like a 95% confidence interval estimate of the mean demand during lead time. Assume that the manager knows that the standard deviation is 50 computers

DEMAND DURING LEAD TIME

514 493 497 638 514 504 456 460 429 505
 525 519 510 476 457 484 512 476 514 529
 509 500 490 497 479 555 543 510 510 471
 423 474 575 507 505 464 561 556 505 548
 441 414 486 490 516 481 392 555 554 479
 452 480 481 518 598 505 496 491 486 476