



STRATHMORE BUSINESS SCHOOL
BACHELOR OF SCIENCE IN SUPPLY CHAIN AND OPERATIONS MANAGEMENT
SPECIAL EXAMINATION
SCM 3104: QUANTITATIVE ANALYSIS MODELLING AND DECISION ANALYSIS

DATE: Friday, 8th May 2026

TIME: 10:00 – 12:00

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

QUESTION ONE

[30 MARKS]

- a) i) With reference to the null hypothesis, fill the table below with correct statement from the following list: Type I error, Type II error, correct decision, No decision **(4 marks)**

	Reject H_0	Accept H_0
H_0 False	*	*
H_0 True	*	*

- ii) Which of the following statements sounds like an alternative hypothesis? **(2 marks)**
- a. The coin is not fair
 - b. There is a correlation in the population
 - c. There is no difference between male and female incomes in the population
 - d. The defendant is guilty
- b) Investigate, at 5% level of significance, if there is a significance difference in the average monthly bonuses received by two groups of salesmen. Random samples of 14 and 10 are taken from the two groups and it can be assumed that the bonuses in both groups are approximately normally distributed and that the standard deviations are about the same. The sample results were ($t_{19} = 2.074$) **(9marks)**

$n_1 = 14$	$n_2 = 10$
$\bar{X}_1 = 550$	$\bar{X}_2 = 450$
$s_1 = 50$	$s_2 = 35$

- c) A company developed the regression equation for sales (y , in \$1000s) based on advertising budget (x_1 , in \$1000s) and store size (x_2 , in square feet):

$$\hat{Y} = 50 + 5x_1 + 0.02x_2$$

- i) Estimate sales for an advertising budget of \$20,000 and a store size of 10,000 square feet. **(2 marks)**
- ii) Interpret the coefficients $\beta_1 = 5$ and $\beta_2 = 0.02$. **(4 marks)**

- d) Describe the **four** components of a time series. (4 marks)
- e) Explain **five** components of a linear programming problem. (5 marks)

QUESTION TWO (20 MARKS)

- a) A bottling plant fills bottles with a mean volume of 400 ml and a standard deviation of 10 ml. A sample of 25 bottles has a mean volume of 385 ml.
- Formulate the null and alternative hypotheses. (2 marks)
 - Using the critical value approach ($t_{24} = |2.064|$), should the bottling process be stopped? Use $\alpha = 0.05$ (4 marks)
 - Construct a 95% confidence interval for the true mean volume. (2 marks)
- b) A supermarket chain believes a loyalty program will increase weekly customer spending. Previously, the mean spending was \$60.
- Formulate a hypothesis test to determine if the mean spending has increased. (2 marks)
 - After the program, a sample of 200 customers shows a mean spending of \$54 with standard deviation of \$10. Is there sufficient evidence to Conclude the program increased spending? Use $\alpha = 0.05$ (5 marks)
 - For a second group of 500 customers, the mean spending is \$49.5 with a standard deviation of \$10. Is there evidence of increased spending in this group? Use $\alpha = 0.05$ (5 marks)

Level of significance	0.10	0.05
Critical value of z for one tailed test	1.28	1.650
Critical value of z for two tailed test	1.645	1.96

QUESTION THREE (20 MARKS)

- a) A study on employee productivity (y , in units produced per hour) and years of experience (x) yields the regression equation:
- $$y = 20.5 + 3.2x, \quad R\text{-squared} = 0.784$$
- Interpret the value of R-squared. (2 marks)
 - Compute the correlation coefficient (R) and interpret it. (3 marks)
 - Estimate the productivity for an employee with 5 years of experience. (2 marks)
- b) Regression analysis on employee performance (y), years of experience (x_1), and training hours (x_2) yields:

Predictor	Coef	SE Coef	T	P
Constant	10.5	1.2	8.75	0.000
Years in college	2.5	0.3	8.33	0.000
Training hours	0.8	0.1	8.00	0.000
$S = 0.15, R^2 = 98.5\%, R^2(\text{adj}) = 98.0\%$				

- Write the regression equation. **(1 mark)**
- Determine the sample size if the degrees of freedom for the residual error is 7. **(2 marks)**
- Explain the meaning of the coefficients. **(5 marks)**
- Interpret the R^2 value. **(2 marks)**
- Write the null hypothesis and conclude on the model's fit given (F-statistic=3826.7 and p-value=0.000). **(3marks)**

QUESTION FOUR **(20 MARKS)**

- Plot a times plot for the data below and comment on underlying trend
 - Compute a 3point-moving average and plot in the same axes in (i) **(8 marks)**

Date	01/05/25	02/05/25	03/05/25	04/05/25	05/05/25	06/05/25	07/05/25	08/05/25
Price (\$)	15.50	15.60	15.80	16.00	16.20	16.10	16.30	16.50

- A company produces products X and Y, each requiring time in two processes.

Process	Product X	Product Y	Capacity (hours)
Process 1	2 hr/unit	3 hr/unit	100 hours
Process 2	3 hr/unit	2 hr/unit	90 hours
Profit	\$4/unit	\$5/unit	

- Formulate a linear programming problem to maximize profit. **(4 marks)**
- Determine the maximum profit using the graphical method. **(8 marks)**

QUESTION FIVE**(20 MARKS)**

- a) A decision problem has two alternatives and two states of nature. The payoff table (in \$1000s) is:

Action	S1	S2
A1	15	5
A2	20	2

Which action should be chosen using?

- i) Maxmax criterion **(2 marks)**
 - ii) Maxmin criterion **(2 marks)**
 - iii) Laplace criterion **(2 marks)**
 - iv) Hurwicz criterion with $\alpha = 0.05$ **(4 marks)**
- b) A company must choose between two projects, P and Q, with the following profits

Project	Strong Demand	Weak Demand	Probability
P	\$5,000	\$(500)	0.4 (Strong), 0.6 (Weak)
Q	\$3,000	\$1,000	0.4 (Strong), 0.6 (Weak)

- i) Determine the decision based on expected values. **(4 marks)**
- ii) Calculate the value of perfect information about demand. **(6 marks)**