BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

GRADUATE SCHOOL OF BUSINESS

MASTER OF BUSINESS LEADERSHIP (MBL)

BUSINESS STATISTICS AND MANAGEMENT SCIENCE (MBL528)

EXAMINATION PAPER

DURATION: 3 HOURS

Instructions and Information to Candidates

1. **Section A is compulsory and carries 40 marks.**
2. **Answer 'Question 1' from Section A and any three (3) questions from Section B.**
3. **The paper carries six questions.**
4. **All Questions in Section B carry equal marks of 20 each.**
5. **The use of cell phones is not allowed in the examination.**

SECTION A: [COMPULSORY]

QUESTION 1

(a) Distinguish between the following terms:

i. Descriptive and inferential statistics. **(3 marks)**

ii. Statistics and Parameter. **(3 marks)**

iii. Type I and Type II error as used in hypothesis testing. **(4 marks)**

(b) Suppose that a firm wants to know with a 95% confidence if it can claim that the boxes of detergents it sells contains more than 500g of detergent. From past experience, the firm knows that the amount of detergent in the boxes is normally distributed. The firm takes a random sample of n = 25 and finds that the sample mean $\bar{X}$ = 520g and the sample standard deviation s = 75g.

Required:

Test the firm's claim. **(15 marks)**

(c) A manager wants to determine at 5% level of significance if the hourly wages for semi-skilled workers are the same in two cities. In order to do this, the manager takes a random sample of hourly wages in both cities and finds that $\overline{X_1}$ = \$6.00, $\overline{X_2}$ = \$5.40, s_1 = \$2.00, s_2 = \$1.80 for n_1 = 40 and n_2 = 54 respectively.

Required:

Conduct a hypothesis test for the manager's case. **(15 marks)**

[Total: 40 marks]

SECTION B: ***(Answer any <u>three</u> (3) questions from this Section).***

QUESTION 2

A Jewellery Shop makes necklaces and bracelets from gold and platinum. The store has 12 grams of gold and 20 grams of platinum. Each necklace requires 3 grams of gold and 2 grams of platinum, whereas each bracelet requires 2 grams of gold and 4 grams of platinum. The demand for bracelets is no more than four. A necklace earns $300 in profit and a bracelet, $400. The store wants to determine the number of necklaces and bracelets to make in order to maximize profit.

Required:

(a) Formulate a linear programming model for this problem. **(8 marks)**

(b) Solve this model by using the graphical techniques. **(12 marks)**

[Total: 20 marks]

QUESTION 3

A company supplies goods to three customers, who each require 30 units. The company has two warehouses. Warehouse 1 has 40 units available, and warehouse 2 has 30 units available. The costs of shipping 1 unit from warehouse to customer are shown in Table 1. There is a penalty for each unmet customer unit of demand: With customer 1, a penalty cost of $90 is incurred; with customer 2, $80; and with customer 3, $110.

Table 1: Shipping Costs from Warehouse to Customer

	TO		
FROM	Customer 1	Customer 2	Customer 3
Warehouse 1	$15	$35	$25
Warehouse 2	$10	$50	$40

Required:

(a) Formulate a balanced transportation problem to minimise the sum of shortage and shipping costs. **(8 marks)**

(b) Use the Northwest Corner Method to find the basic feasible solution and its associated objective value. **(4 marks)**

(c) Use the Transportation Simplex Method to determine the optimal solution. **(8 marks)**

[Total: 20 marks]

QUESTION 4

Machineco has four machines and four jobs to be completed. Each machine must be assigned to complete one job. The time required to set up each machine for completing each job is shown in Table 2. Machineco wants to minimize the total setup time needed to complete the four jobs.

Table 2: Setup Times for Machineco

	Time (hours)			
Machine	Job 1	Job 2	Job 3	Job 4
1	14	5	8	7
2	2	12	6	5
3	7	8	3	9
4	2	4	6	10

Required:

(a) Formulate a linear programming model to minimise the setup time costs needed to complete the four jobs for Machineco. **(8 marks)**

(b) To minimise the setup time for Machineco, which machine should do which job? **(10 marks)**

(c) What is the associated optimal setup time? **(2 marks)**

[Total: 20 marks]

QUESTION 5

Alfa Computer Systems is a newly formed computer service firm that specializes in information services such as surveys and data analysis. The company is in the final stages of selecting a computer system for one of its branches. The company is currently attempting to determine the size of the computer system that would be most economical, between one of three computer systems which differ in size and capacity. The three decision alternatives are as follows: large computer system, medium computer system and small computer system.

The states of nature for the company are as follows: S_1 = high customer acceptance of the Company's services and S_2 = low customer acceptance of the company's services. The Payoff Table for Alfa Computer Systems is shown in Table 3.

Table 3: Pay-off Table (Profit in $) of Alfa Computer Systems

Decision Alternatives	High Acceptance (s_1)	Low Acceptance (s_2)
Large system **(d1)**	$200 000	-$20,000
Medium system **(d2)**	$150 000	$20,000
Small system **(d3)**	$100 000	$60,000
Probability	0.3	0.7

Required:

(a) For the Maximin, Maximax and Minimax Regret criteria, determine Alfa Computer System's choice of the size of the computer system to adopt. **(12 marks)**

(b) What is the optimal decision strategy if the Expected Monetary Value (EMV) is used? **(4 marks)**

(c) What is the Expected Value of Perfect Information (EVPI)? Give a brief explanation on how you would use the calculated EVPI in decision making. **(4 marks)**

[Total: 20 marks]

QUESTION 6

A company manufactures an item which is also used in the company. The demand for this item is 18 000 units/year, and the production rate is 3 000 units per month. The cost of one set-up is $500, and the holding cost of 1 unit per month is 15 cents. It is assumed that shortages are not allowed.

Required:

(a) Determine the optimum production run size. **(8 marks)**

(b) Determine the maximum attainable inventory. **(4 marks)**

(c) Determine the number of operation runs to be implemented to meet the demand.

(4 marks)

(d) Determine the total machine run time in each production run. **(4 marks)**

[Total: 20 marks]

END OF EXAMINATION PAPER