

**SOUTH EASTERN UNIVERSITY OF SRI LANKA**

**BACHELOR OF BUSINESS ADMINISTRATION & COMMERCE EXAMINATION – 2005/2006**

**THIRD YEAR, SEMESTER – II, APRIL 2007**

**MIS 3105R – MATHEMATICAL PROGRAMMING**

Answer all questions considering the marks given and allocate your time accordingly.  
You can use calculator and graph paper.

Time: 03 hours

01. Amana Furniture Company manufactures tables and chairs. The production process includes cutting, fitting, and finishing. The furniture company employs 50 workers in cutting department, 70 workers in fitting department, and 30 employees in finishing department. The workshop has 8 working hours per day and 5 working days per week.

The time requirement and profit per unit for two furniture are given below:

Furniture	Minutes Per Unit			Unit Profit
	Cutting Dept.	Fitting Dept.	Finishing Dept.	
Table	20	30	12	1800
Chair	30	30	15	1300

- a) Formulate the Linear Programming model for the above problem.

(5 Marks)

The LINDO solver gives you the following report. Explain the contents of the report in details.

(10 Marks)

LP OPTIMUM FOUND AT STEP 1

OBJECTIVE FUNCTION VALUE

1) 0.1008000E+08

VARIABLE	VALUE	REDUCED COST
T	5600.000000	0.000000
C	0.000000	500.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	8000.000000	0.000000
3)	0.000000	60.000000
4)	4800.000000	0.000000

NO. ITERATIONS= 1

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
T	1800.000000	INFINITY	500.000000
C	1300.000000	500.000000	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	120000.000000	INFINITY	8000.000000
3	168000.000000	12000.000000	167999.984375
4	72000.000000	INFINITY	4800.000000

- b) The finishing process has been sub-contracted to another company due to the reorganization of its processing system. However, the employees in the department have been equally distributed to other two departments and other conditions and requirements remain the same.

Determine the new optimal weekly production schedule for the Company.

(10 Marks)

02. a) Explain the term 'Dynamic Programming'.

(5Marks)

Use the Dynamic Programming approach (Backward recursive equation) to select shortest route between two cities (A-J). The distances (d) between possible routes are given below.

- d (A-B) = 7 , d (A-C) = 5
- d (B-D) = 9 , d (B-E) = 10
- d (C-E) = 8 , d (C-F) = 7
- d (D-G) = 10, d (D-H) = 11
- d (E-H) = 9
- d (F-H) = 7 , d (F-I) = 9
- d (G-J) = 4
- d (H-J) = 6
- d (I-J) = 5

(15 Marks)

- b) What are the advantages and disadvantages of Dynamic Programming?

(5 Marks)

03. a) What do you mean by **Branch and Bound Method**? And how does it differ from **Cutting and Plan Method**? (10 Marks)

b) Consider the following optimization problem:

$$\text{Maximize } 8X_1 + 11X_2 + 6X_3 + 4X_4$$

$$\text{S.T. } 5X_1 + 7X_2 + 4X_3 + 3X_4 \leq 14$$

END.

Ignoring integrality constraints, the optimal linear programming solution is,

$$X_1 = 1, \quad X_2 = 1, \quad X_3 = 0.5, \quad X_4 = 0, \quad \text{and } Z = 22$$

Find the optimal integer solution for the above problem using **Branch and Bound Method**. (15 Marks)

c) Considering the following table (with the updated columns and reduced costs shown for non basic variables), find the Gomory cuts.

Variable	$X_1$	$X_2$	$S_1$	$S_2$	$-Z$	RHS
$X_2$	0	1	$7/22$	$1/22$	0	$7/2$
$X_1$	1	0	$-1/22$	$3/22$	0	$9/2$
$-Z$	0	0	$28/11$	$15/11$	1	63

(5 Marks)

04. a) Interpret the following report derived from LINDO assuming a suitable example for it.

LP OPTIMUM FOUND AT STEP 5  
 OBJECTIVE VALUE = 26.0000000  
 FIX ALL VARS.( 5) WITH RC > 4.00000

NEW INTEGER SOLUTION OF 26.0000000 AT BRANCH 0 PIVOT 5  
 BOUND ON OPTIMUM: 26.00000  
 ENUMERATION COMPLETE. BRANCHES= 0 PIVOTS= 5

LAST INTEGER SOLUTION IS THE BEST FOUND  
 RE-INSTALLING BEST SOLUTION...

OBJECTIVE FUNCTION VALUE

1) 26.00000

VARIABLE            VALUE            REDUCED COST

A	1.000000	-4.000000
B	1.000000	-7.000000
C	1.000000	-6.000000
D	1.000000	-5.000000
E	1.000000	-4.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	87.000000	0.000000
3)	85.000000	0.000000

NO. ITERATIONS= 5  
 BRANCHES= 0 DETERM.= 1.000E 0

(5 Marks)

b) Explain the methodology of Management Science

(5 Marks)

c) Describe the following:

- 1) LINDO
- 2) Stochastic problem
- 3) Deterministic problem
- 4) Splitting lines in LINDO model
- 5) Case sensitive and LINDO

(10 Marks)