

**JAIPURIA INSTITUTE OF MANAGEMENT, NOIDA**  
**PGDM / PGDM (M) / PGDM (SM)**  
**THIRD TRIMESTER (Batch 2022-24)**  
**END TERM EXAMINATIONS, APRIL 2023**

Course Name	<b>Operations Research</b>	Course Code	<b>20521</b>
Max. Time	<b>2 hours</b>	Max. Marks	<b>40 MM</b>

INSTRUCTIONS: All questions are compulsory. Use of calculators permitted.

1. A production manager wants to determine how many units of each product to produce weekly to maximize weekly profits. Production requirements for the products are shown in the following table.

Product	Material 1 (lbs.)	Material 2 (lbs.)	Labor (hours)
A	3	2	4
B	1	4	2
C	5	none	3.5

Material 1 costs \$7 a pound, material 2 costs \$5 a pound, and labor costs \$15 per hour. Product A sells for \$101 a unit, product B sells for \$67 a unit, and product C sells for \$97.50 a unit. Each week there are 300 pounds of material 1; 400 pounds of material 2; and 200 hours of labor. Moreover, there is a standing order of 10 units of product C each week.

Sensitivity Report

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$B\$4	Optimal Values: A	0	-10	10	10	1E+30
\$C\$4	Optimal Values: B	82.5	0	10	1E+30	4.285
\$D\$4	Optimal Values: C	10	0	10	7.5	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H.S. Side	Allowable Increase	Allowable Decrease
\$E\$7	Constraint 1	132.5	0	300	1E+30	167.5
\$E\$8	Constraint 2	330	0	400	1E+30	70
\$E\$9	Constraint 3	200	5	200	35	165
\$E\$10	Constraint 4	10	7.5	10	47.142	10

Questions:-

(5X2=10)

- Determine the optimal objective function value?
- Suppose that we force the production of two units of product A. Determine the new objective function value.
- If production manager procures has an additional 10 labor hours then determine the impact will this have on the current optimal objective function value?

- d. Suppose that the objective function coefficient for product C increases by \$8. Determine the impact it will have on the current values of optimal solution?
- e. If availability of material 2 has reduced by 100 pounds then determine its impact on the current optimal objective function value?
2. The leading brewery on the west Coast (labeled A) has hired an OR analyst to analyze its market position. It is particularly concerned about its major competitor (labeled B). The analyst believes that brand switching can be modelled as Markov chain using three states, with states A and B representing customers drinking beer produced from the aforementioned breweries and C representing all other brands. Data are taken monthly, and the analyst has constructed the following one-step transition matrix from the data.

	A	B	C
A	0.80	0.15	0.05
B	0.25	0.70	0.05
C	0.15	0.05	0.80

Determine the steady state market share for the two major breweries. (8)

3. A company is currently involved in negotiations with its union on the upcoming wage contract. Positive signs in table represent wage increase while negative signs represent wage reduction. Evaluate the given situation and determine the optimal strategies and the game value? (7)

Company Strategies	Union Strategies			
	U1	U2	U3	U4
C1	25	27	35	26
C2	20	6	8	-8
C3	14	12	5	3
C4	30	14	19	0

4. The Apex Television Company has to decide on the number of 27- and 20-inch sets to be produced at one of its factories. Market research indicates that at most 40 of the 27-inch sets and 10 of the 20-inch sets can be sold per month. The maximum number of work-hours available is 500 per month. A 27-inch set requires 20 work-hours and a 20-inch set requires 10 work-hours. Each 27-inch set sold produces a profit of \$120 and each 20-inch set produces a profit of \$80. A wholesaler has agreed to purchase all the television sets produced if the numbers do not exceed the maxima indicated by the market research. Formulate a linear programming model for this problem and find out optimal solution. (5+5)

5. "McBurger" a fast food outlet sells burger. The burger is sold in dozens and the probability of demand is given below. Each dozen of burger costs Rs 260/- and is sold for Rs 300/-. The unsold burgers is scraped to a cattle food organization for Rs 180/- per dozen. Recommend the best policy for "McBurger". (5)

Demand in Dozens	10	15	25	30	35	40	45
Probability	0.1	0.15	0.25	0.3	0.1	0.05	0.05