



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

Course Name	Operations Research	Course Code	20521
Max. Time	2 hours	Max. Marks	40 MM

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

- Ken and Larry, Inc., supplies its ice cream parlors with three flavors of ice cream: chocolate, vanilla, and banana. Due to extremely hot weather and a high demand for its products, the company has run short of its supply of ingredients: milk, sugar, and cream. Hence, they will not be able to fill all the orders received from their retail outlets, the ice cream parlors. Due to these circumstances, the company has decided to choose the amount of each flavor to produce that will maximize total profit, given the constraints on supply of the basic ingredients. The chocolate, vanilla, and banana flavors generate, respectively, \$1.00, \$0.90, and \$0.95 of profit per gallon sold. The company has only 200 gallons of milk, 150 pounds of sugar, and 60 gallons of cream left in its inventory. The linear programming formulation for this problem is shown below in algebraic form. This problem was solved using the Excel Solver. The sensitivity report are shown below.

Microsoft Excel 12.0 Sensitivity Report

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$C\$9	Solution Chocolate	0	-0.0375	1	0.0375	1E+30
\$D\$9	Solution Vanilla	300	0	0.9	0.05	0.0125
\$E\$9	Solution Banana	75	0	0.95	0.021428571	0.05

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$F\$5	Milk Totals	180	0	200	1E+30	20
\$F\$6	Sugar Totals	150	1.875	150	10	30
\$F\$7	Cream Totals	60	1	60	15	3.75

For each of the following parts, answer the question as specifically and completely as is possible without solving the problem again on the Excel Solver.

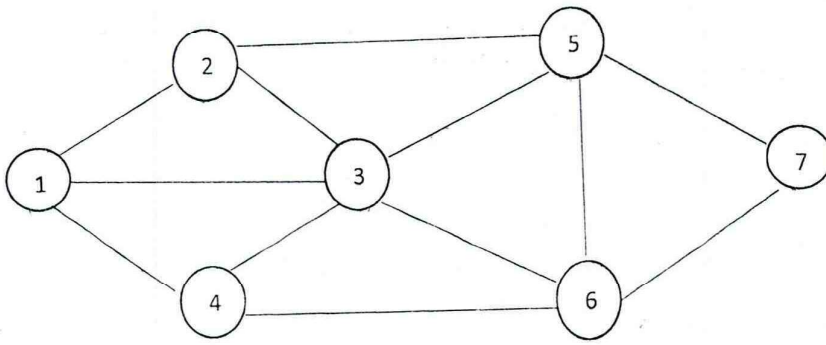
- determine is the optimal solution and total profit?
- Suppose the profit per gallon of banana changes to \$1.00. Determine the change in the optimal solution and its effect on total profit?
- Suppose the profit per gallon of banana changes to 92¢. Determine the change in the optimal solution and its effect on total profit?
- Suppose the company discovers that 3 gallons of cream have gone sour and so must be thrown out. Determine the change in the optimal solution and its effect on total profit?

- e. Suppose the company has the opportunity to buy an additional 15 pounds of sugar at a total cost of \$15. Should they? Explain. (5X2=10)
2. "Fresh - Cream" is a small town ice cream parlour in a local locality of Noida. The locality has only two ice cream parlours "Fresh - Cream" and "Cool-Ice". Mr Puri is the proprietor of "Fresh - Cream" who wishes to expand his business and gain more market share. Mr. Puri is evaluating three promotion options i.e.:- Local News Paper Advertising, Sale Promotion (One scoop free for each scoop of ice cream purchased) and Local Radio Promotion. His competitor is also considering the same options. Mr Puri calculated that if he opts for Local News Paper Advertising then his gain would be 6, 8, 3 if "Cool-Ice" chooses Local News Paper Advertising, Sale Promotion and Local Radio Promotion respectively. In case if Mr Puri opts for Sale Promotion than his gain would be 2, 5 and 3 if "Cool-Ice" chooses Local News Paper Advertising, Sale Promotion and Local Radio Promotion respectively. In the case of Radio promotion by "Fresh - Cream" the gain would be 7, 1 and 6 if "Cool-Ice" chooses Local News Paper Advertising, Sale Promotion and Local Radio Promotion respectively. Mr. Puri is in a dilemma. As a management expert, create a game theory model for the dilemma. Also solve this model and suggest appropriate strategies for Mr. Puri. (3+5)
3. Waldo books need to decide how many copy of new hard release to purchase for its shelves. The store has assumed that demand will be 50, 100, 150 or 200 copies next month, and it need to decide whether to order 50, 100, 150 or 200 copies for this period. Each book cost Waldo \$30 and can be sold for \$50. Waldo can sell any unsold books back to supplier in \$5. After researching the market, Waldo Books has concluded that the probabilities of selling 50, 100, 150 or 200 copies next month are 0.2, 0.35, 0.25 and 0.2 respectively. Propose the number of books Waldo should order? (8)
4. A market analysis group studying car purchasing trends in a certain region concluded that on average, a new car is purchased once every 3 years. The buying patterns are described by the following matrix

	Period-1	
	Small	Large
Period-0	80%	20%
	40%	60%

The first row indicates that of the current small cars, 80% will be replaced by with small car, and 20 % with large cars. The second row implies that 40% of the current large cars will be replace with small cars and 60 % replaced by large cars. If there are 40,000 small and 50,000 large cars in the region, estimate the distribution be in 2 years from now? (4)

5. You need to take a trip by car to another town (node 7) that you have never visited before. Therefore, you are studying a map to determine the shortest route to your destination. Depending on which route you choose, five other towns (node 2, 3, 4, 5 and 6) might pass through on the way. The table shows the mileage along each road that directly connects two towns without any intervening towns. A dash indicates that there is no road directly connecting these two towns without going through any other towns.



Town	Miles between Adjacent Towns					
	Node 2	Node 3	Node 4	Node 5	Node 6	Node 7
Node 1	40	60	50	---	----	-----
Node 2		10	-----	70	----	-----
Node 3			20	55	40	-----
Node 4				----	50	----
Node 5					10	60
Node 6						80

Formulate this problem as the shortest path problem.

(10)