K. J. SOMAIYA INSTITUTE OF MANAGEMENT STUDIES AND RESEARCH,
Vidyavihar, Mumbai- 400077
Program: *PGDM – Exec 2017-18 trim V*
Subject: Data Models & Decision Making – OR/MS
(End-Term Examination) (In Computer Lab)

Maximum Marks: 25

Duration: 1.5 hours   **Date: Dec, 2018**

Instructions

➢ **Use Excel and solver as required and save your files on the computer following the instructions of data centre personnel. Write all relevant answers in the answer sheet.**

➢ *All italicized questions* **have to be answered clearly in the answer sheet, duly supported by excel sheet.**

➢ **If you assume any data not given, please provide suitable explanation of the same.**

Questions (answer any three out of five.) (3 x 8 +1 = 25 marks)

1. A dietician has been asked by the athletic director of a university to develop a snack that athletes can use in their training programmes. The dietician intends to mix three separate products together to make the snack. The following information has been obtained by the dietician:

Nutrient	Minimum amount required (grams)	Contribution per ounce (grams)		
		Product A	Product B	Product C
Carbohydrates	50	3	5	8
Protein	25	6	2	1
Calories	500	90	45	35

Product A cost Rs. 10 per gram, Product B Rs. 5 per gram, and Product C Rs. 7 per gram.

a. *Formulate* this problem as a linear programming model, indicating the decision variable, objective function, and constraints. (2 marks)
b. *Solve* with Excel solver.(4 marks)
c. *Interpret* the sensitivity report, with specific reference to reduced cost. (2 marks)

2. The Westchester Chamber of Commerce periodically sponsors public service seminars and programs. Currently, promotional plans are under way for this year's program. Advertising alternatives include television, radio, and newspaper. Audience estimates, costs, and maximum media usage limitations are as shown.

Constraint	Television	Radio	Newspaper
Audience per advertisement	100000	18000	40000
Cost per advertisement	20000	3000	6000
Maximum media usage	10	20	10

To ensure a balanced use of advertising media, radio advertisements must not exceed 50% of the total number of advertisements authorized. In addition, television should account for at least 10% of the total number of advertisements authorized and the promotional budget is limited to 200000.

a. *Formulate* this problem as a linear programming model, indicating the decision variable, objective function, and constraints. (2 marks)
b. *How many commercial messages* should be run on each medium to maximize total audience contact? *What is the allocation* of the budget among the three media, and what is the total audience reached? (5 marks)
c. *By how much would audience contact increase* if an extra 1000 were allocated to the promotional budget? (1 mark)

3. Arnoff Enterprises manufactures the central processing unit (CPU) for a line of personal computers. The CPUs are manufactured in Seattle, Columbus, and New York and shipped to warehouses in Pittsburgh, Mobile, Denver, Los Angeles, and Washington, D.C., for further distribution. The following table shows the number of CPUs available at each plant, the number of CPUs required by each warehouse, and the shipping costs (dollars per unit):

| Plant | | | | | | CPUs |
	Pittsburgh	Mobile	Denver	Los Angeles	Washington	Available
Seattle	10	20	5	9	10	9000
Columbus	2	10	8	30	6	4000
New York	1	20	7	10	4	8000
CPUs required	3000	5000	4000	6000	3000	21000

a. Develop a *network representation* of this problem. (2 marks)
b. Determine *the amount that should be shipped from each plant to each warehouse* to minimize the total shipping cost. (4 marks)
c. The Pittsburgh warehouse just increased its order by 1000 units, and Arnoff authorized the Columbus plant to increase its production by 1000 units. Will this production increase lead to an increase or decrease in total shipping costs? *Solve* for the new optimal solution. (2 marks)

4. The U.S. Cable Company uses a distribution system with five distribution centers and eight customer zones. Each customer zone is assigned a sole source supplier; each customer zone receives all of its cable products from the same distribution center. In an effort to balance demand and workload at the distribution centers, the company's vice president of logistics specified that distribution centers may not be assigned more than three customer zones. The following table shows the five distribution centers and cost of supplying each customer zone (in thousands of dollars):

Distribution centers	Los Angeles	Chicago	Columbus	Atlanta	Newark	Kansas City	Denver	Dallas
Plano	70	47	22	53	98	21	27	13
Nashville	75	38	19	58	90	34	40	26
Flagstaff	15	78	37	82	111	40	29	32
Springfield	60	23	8	39	82	36	32	45
Boulder	45	40	29	75	86	25	11	37

a. Determine *the assignment of customer zones to distribution centers* that will minimize cost. (4 marks)
b. *Which distribution centers*, if any, are not used? (1 mark)
c. Suppose that each distribution center is limited to a maximum of two customer zones. How does this constraint change the assignment and *the cost of supplying customer zones?* (3 marks)

5. Ryan is an electronics firm with production facilities in Dharwar and Adoni. Components produced at either facility may be shipped to either of the firm's regional warehouses, which are located in Kanpur and Jaipur. From the regional warehouses the firm supplies retail outlets in Delhi, Mumbai, Kolkata and Chennai. The transportation cost per unit for each distribution route is shown in the table below alongwith details of supply at each origin and demand at each destination.

Plant	Kanpur	Jaipur	Supply		
Dharwar	2	3	600		
Adoni	3	1	400		
Warehouse	Delhi	Mumbai	Kolkata	Chennai	
Kanpur	2	6	3	6	
Jaipur	4	4	6	5	
Demand	200	150	350	300	

a. Draw a *network representation* of the problem. (2 marks)
b. Develop a spreadsheet model and solve with Excel solver. (5 marks)
c. *What is the total cost* offered by the optimal solution? (1 mark)

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