PGDM-IB, 2018-20

Management Science

IB-304

Trimester – III, End-Term Examination: March 2019

Time allowed: 2 Hrs 30 Min

Roll No: _____

Max Marks: 50

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means.** All other instructions on the reverse of Admit Card should be followed meticulously.

Sections	No. of Questions to attempt	Marks	Marks
A	3 out of 5 (Short Questions)	5 Marks each	3*5 = 15
B	2 out of 3 (Long Questions)	10 Marks each	2*10 = 20
C	Compulsory Case Study	15 Marks	15
		Total Marks	**50**

SECTION A

A1. The Bradley family owns 410 acres of farmland in North Carolina on which they grow corn and tobacco. Each acre of corn costs $105 to plant, cultivate, and harvest; each acre of tobacco costs $210. The Bradleys have a budget of $52,500 for next year. The government limits the number of acres of tobacco that can be planted to 100. The profit from each acre of corn is $300; the profit from each acre of tobacco is $520. The Bradleys want to know how many acres of each crop to plant in order to maximize their profit.

A2. Using Lowest-cost method, minimize the total cost of transportation of food grains from ports to the destinations:

	Delhi	Hyderabad	Mysore	Nagpur	Stock (in 1000 tonnes)
Bombay	9	5	8	5	225
Calcutta	9	10	13	6	75
Madras	14	5	3	7	100
Requirements (in 1000 tonnes)	125	80	95	100	

A3. Explain the role of shadow prices in decision making process?

A4. Discuss the assumptions for a linear Program. Are these assumptions realistic?

A5. What are assignment problems? Explain using suitable Examples. Also, discuss the nature of decision variables for such problems.

SECTION B

B1. The library committee is deciding on the criteria for ordering the text books. The pairwise comparison for the criteria is given below:

	Coverage	Readability	Cost	Supplements
Coverage	1	1/2	1/4	2
Readability	2	1	1/3	5
Cost	4	3	1	3
Supplements	½	1/5	1/3	1

Using AHP, determine the criteria weights. Check the consistency of this pairwise-comparison matrix.

B2. The Bay City Parks and Recreation Department has received a fedral grant of $600000 to expand its public recreation facilities. City council representatives have demanded four different type of facilities- facilities—gymnasiums, athletic fields, tennis courts, and swimming pools. In fact, the demand by various communities in the city has been for 7 gyms, 10 athletic fields, 8 tennis courts, and 12 swimming pools. Each facility costs a certain amount, requires a certain number of acres, and is expected to be used a certain amount, as follows:

Facility	Cost	Required Acres	Expected usage (people/week)
Gymnasium	$80000	4	1500
Athletic field	24000	8	3000
Tennis Court	15000	3	500
Swimming pool	40000	5	1000

The Parks and Recreation Department has located 50 acres of land for construction (although more land could be located, if necessary). The department has established the following goals:

(1) The department wants to spend the total grant because any amount not spent must be returned to the government.
(2) The department wants the facilities to be used by a total of at least 20,000 people each week.
(3) The department wants to avoid having to secure more than the 50 acres of land already located.
(4) The department would like to meet the demands of the city council for new facilities. However, this goal should be weighted according to the number of people expected to use each facility.

Formulate a goal programming model to determine how many of each type of facility should be constructed to best achieve the city's goals.

B3. Construct a project network for the following set of activities, compute the length of each path in the network, and indicate the critical path:

Activity	Activity Predecessor	Time (in months)
1	-	4
2	-	7
3	1	8
4	1	3
5	2	9
6	3	5
7	3	2
8	4,5,6	6
9	2	5

SECTION C

Case Study:

Island Publishing Company publishes two types of magazines on a monthly basis: a restaurant and entertainment guide and a real estate guide. The company distributes the magazines free to businesses, hotels, and stores on Hilton Head Island in South Carolina. The company's profits come exclusively from the paid advertising in the magazines. Each of the restaurant and entertainment guides distributed generates $0.50 per magazine in advertising revenue, whereas the real estate guide generates $0.75 per magazine. The real estate magazine is a more sophisticated publication that includes color photos, and accordingly it costs $0.25 per magazine to print, compared with only $0.17 for the restaurant and entertainment guide. The publishing company has a printing budget of $4,000 per month. There is enough rack space to distribute at most 18,000 magazines each month. In order to entice businesses to place advertisements, Island Publishing promises to distribute at least 8,000 copies of each magazine. The company wants to determine the number of copies of each magazine it should print each month in order to maximize advertising revenue. Formulate a linear programming model for this problem.

Given the sensitivity report answer the following questions:

Variable Cells

Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
No. of Restaurant & Entertainment guide	8000	0	0.5	0.25	1E+30
No. of Real estate guide	10000	0	0.75	1E+30	0.25

Constraints

Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
Budget	3860	0	4000	1E+30	140
Rack space	18000	0.75	18000	500	2000
Restaurant & Entertainment guide	8000	0.25	8000	2000	1750
Real estate guide	10000	0	8000	2000	1E+30

a) Determine the sensitivity range for the advertising revenue generated by the real estate guide.
b) Does the company spend all of its printing budget? If not, how much slack is left over?
c) What would be the effect on the optimal solution if the local real estate agents insisted that 12,000 copies of the real estate guide be distributed instead of the current 8,000 copies, or they would withdraw their advertising?
d) How much would it be worth to Island Publishing to reduce the requirement to distribute the entertainment guide from 8,000 to 7,000 copies?