Post Graduate Diploma in Management,2013-15

Advanced Management Science

DM-201A

Trimester-II, End Term Examination, December 2010

Time: 2 Hrs 30 min Marks: 50

Roll No._____

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.** *In case of rough work please use answer sheet.*

Section A

(Attempt any three 5 x 3=15 marks)

QA1. Describe 100% rule of sensitivity analysis.

QA2. The following are the four goals of the city council of a small city.

Goal 1: $550x_p+35x_f+55x_c+0.75x_g >= 16$

Goal 2: $35x_f <= 0.1(550x_p+35x_f+55x_c+0.75x_g)$

Goal 3: $55x_c <= 0.2(550x_p+35x_f+55x_c+0.75x_g)$

Goal 4: $x_g <= 2$

Develop a minimum objective function considering all above four goals.

QA3. Write your understanding on reduced cost, shadow price, complementary slackness of dual.

QA4. Write the dual of the following primal problem

Minimize $3x_1-2x_2+x_3$

Subject to

$2x_1-3x_2+x_3 = 1$

$2x_1+3x_2 <= 8$

$x_j>=0$ for all j

QA5. Enumerate typical inputs and outputs with justification for performance measurement of Business Schools.

Section B

(Attempt any two 10 x2=30 marks)

QB1. Hardgrave Machine Company produces computer components at its factories in Cincinnati, Kansas city, and Pittsburg. These factories have not been able to keep up with demand for orders at Hardgrave's four warehouses in Detroit, Houston, New York and Los Angeles. As a result, the firm has decided to build a new factory to expand its productive capacity. The two sites being considered are

Seattle and Birmingham. Both cities are attractive in terms of labor supply, municipal services, and ease of factory financing.

Hardgrave Demand and Supply data

Ware House	Monthly Demand (units)	Production Plant	Monthly Supply	Cost to Produce One Unit
Detroit	10000	Cincinnati	15000	$46
Houston	12000	Kansas City	6000	$48
New York	15000	Pittsburgh	14000	$50
Los Angeles	9000			

Estimated Production cost per unit at proposed plants	
Seattle	$51
Birmingham	$47

Hardgrave Machine's Shipping Cost

From	To			
	Detroit	Houston	New York	Los Angeles
Cincinnati	$25	$55	$40	$60
Kansas City	$35	$30	$50	$40
Pittsburgh	$36	$45	$26	$66
Seattle	$60	$38	$65	$27
Birmingham	$35	$30	$41	$50

In addition to this information, Hardgrave estimates that monthly fixed cost of operating the proposed facility in Seattle would be $400,000. The Birmingham plant would be somewhat cheaper, due to lower cost of living at the location. Hardgrave therefore estimates that the monthly fixed cost of operating the proposed facility in Birmingham would be $325000.

Note that the fixed costs at existing plants need not be considered here because they will be incurred regardless of which new plant Hardgrave decides to open.

Question: *Develop an appropriate mathematical model which can find out the new location, in combination with the existing plants and warehouses, to yield the lowest cost.*

QB2. A new author sets three criteria for selecting a publisher for an OR text book: royalty percentage (R), marketing (M) and advance payment (A). Two publishers H and P have expressed interest in the book. Using the following comparison matrix, rank the two publishers and asses the consistency of the decision.

$$A = \begin{array}{c} \\ R \\ M \\ A \end{array} \begin{array}{c} \begin{array}{ccc} R & M & A \end{array} \\ \begin{pmatrix} 1 & 1 & \frac{1}{4} \\ 1 & 1 & \frac{1}{5} \\ 4 & 5 & 1 \end{pmatrix} \end{array}$$

$$A_R = \begin{array}{c} \\ H \\ P \end{array} \begin{array}{c} \begin{array}{cc} H & P \end{array} \\ \begin{pmatrix} 1 & 2 \\ \frac{1}{2} & 1 \end{pmatrix} \end{array} \qquad A_M = \begin{array}{c} \\ H \\ P \end{array} \begin{array}{c} \begin{array}{cc} H & P \end{array} \\ \begin{pmatrix} 1 & 2 \\ \frac{1}{2} & 1 \end{pmatrix} \end{array} \qquad A_A = \begin{array}{c} \\ H \\ P \end{array} \begin{array}{c} \begin{array}{cc} H & P \end{array} \\ \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix} \end{array}$$

QB3. Develop the output maximization CCR model for the firm D from the following data:

Firm	Capital Employed (Rs million)	Value Added (Rs million)	No. of employees (in 000)
A	8.6	1.8	1.8
B	2.2	0.2	1.7
C	15.6	2.8	2.6
D	31.6	4.1	12.3

Write the model which determine peers for inefficient firms.

Section C

(Compulsory question: 15 marks)

Godwell Engineering products is an agricultural equipment manufacturer which faces cash flow problem because of the cyclic nature of agricultural sector.

The company has the following short-term financing problem:

Month	Jan	Feb	Mar	Apr	May	Jun
Net cash flow	-150	-100	200	-200	50	300

Net cash flow requirements are given in thousands of dollars. The company has the following sources of funds:

- A line of credit of up to $100k at an interest rate of 1% per month;
- In any of the first three months, it can issue 90-day commercial paper bearing a total interest of 2% for the three-month period;

- Excess funds can be invested at an interest rate of 0.3% per month.

The variable of the problems are defined as follows:

Decision variables (DVs)

x_i= the amount of line of credit in month i
y_i= the amount of commercial paper issued in month i
z_i= the excess fund in month i
v= company's wealth in month June.

The sensitivity report of the problem is as follows:

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B3	DVs x1	0	-0.003213864	0	0.003213864	1E+30
C3	DVs x2	50.98039216	0	0	0.003182043	0
D3	DVs x3	0	-0.007118643	0	0.007118643	1E+30
E3	DVs x4	0	-0.003150847	0	0.003150847	1E+30
F3	DVs x5	0	0	0	0	1E+30
G3	DVs y1	150	0	0	0.003997536	0.003213864
H3	DVs y2	49.01960784	0	0	0	0.003182043
I3	DVs y3	203.4343636	0	0	0.007069307	0
J3	DVs z1	0	-0.003997536	0	0.003997536	1E+30
K3	DVs z2	0	-0.00714	0	0.00714	1E+30
L3	DVs z3	351.9441675	0	0	0.00393091	0.003160299
M3	DVs z4	0	-0.003919153	0	0.003919153	1E+30
N3	DVs z5	0	-0.007	0	0.007	1E+30
O3	DVs v	92.49694915	0	1	0	1

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
P6	Jan LHS	150	-1.037288136	150	89.17189542	150
P7	Feb LHS	100	-1.0302	100	49.01960784	50.98039216
P8	Mar LHS	-200	-1.02	-200	90.68328348	203.4343636
P9	Apr LHS	200	-1.016949153	200	90.95533333	204.0446667
P10	May LHS	-50	-1.01	-50	50	52
P11	June LHS	-300	-1	-300	92.49694915	1E+30
P12	x1 limit LHS	0	0	100	1E+30	100
P13	x2 limit LHS	50.98039216	0	100	1E+30	49.01960784
P14	x3 limit LHS	0	0	100	1E+30	100
P15	x4 limit LHS	0	0	100	1E+30	100
P16	x5 limit LHS	0	0	100	1E+30	100

Based on above data and report, answer the following.

1. Develop the LP model.
2. Assume that the net cash flow in January is -$200K (instead of -$150K). By how much would the company's wealth decrease at the end of June?
3. Now assume that the net cash flow in March was $250K (instead of $200K). By how much would the company's wealth increase at the end of June?
4. Assume that the negative net cash flow in January is due to the purchase of a machine worth $150000. The vendor allows the payment to be made in June at an interest rate of 3% for the five month period. Would the company's wealth increase or decrease by using this option? What if the interest rate for this five-month period was 4%?