Reg. No. : | | | | | | | | | | | |

Z 3543

M.C.A. DEGREE EXAMINATION, MAY/JUNE 2008.

Fourth Semester

MC 1752 — RESOURCE MANAGEMENT TECHNIQUES

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Use of Statistical Table is permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is a feasibility region?

2. Solve the following LP problem by graphical method.

   Maximize $z = 6x_1 + 4x_2$

   Subject to the constraints :

   $$x_1 + x_2 \leq 5$$
   $$x_2 \geq 8$$
   $$x_1, x_2 \geq 0.$$

3. Explain how the profit maximization transportation problem can be converted to an equivalent cost minimisation transportation problem.

4. What is an unbalanced assignment problem?

5. Explain the merits and demerits of 'rounding-off' a continuous optimal solution to an LP problem to obtain an integer solution.

6. What are the methods to use for solving an integer programming problem.

7. What is float? What are the different types of floats?

8. Explain the term in PERT : Three time estimates.

9. Explain queue discipline and its various forms.

10. Write the steady state probability of the Queuing model (M/M/1) : (FIFO/N / ∞) .

PART B — (5 × 16 = 80 marks)

11. (a) Use Artificial variable technique to solve the following LP problem.

Maximize $z = x_1 + 2x_2 + 3x_3 - x_4$

Subject to $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + x_4 = 10$

$x_1, x_2, x_3, x_4 \geq 0.$

Or

(b) A firm plans to purchase atleast 200 quintals of scrap containing high quality metal X and low quality metal Y . It decides that the scrap to be purchased must contain atleast 100 quintals of X -metal and no more than 35 quintals of Y -metal. The firm can purchase the scrap from two suppliers (A and B) in unlimited quantities. The percentage of X and Y metals interms of weight in the scrap supplied by A and B is given below :

Metals	Supplier A	Supplier B
X	25 %	75 %
Y	10 %	20 %

The price of A's scrap is Rs. 200 per quintal and that of B's Rs. 400 per quintal. Determine the quantities that it should buy from the two suppliers so that total cost is minimised. (Use graphical method).

12. (a) A product is manufactured by four factories *A*, *B*, *C* and *D*. The unit production costs in them are Rs. 2, Rs. 3, Re.1 and Rs. 5 respectively. Their production capacities are 50, 70, 30 and 50 units respectively. These factories supply the product to four stores, demands of which are 25, 35, 105 and 20 units respectively. Unit transportation cost in rupees from each factory to each store is given in the table below :

		Stores			
		1	2	3	4
Factories	*A*	2	4	6	11
	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost in minimum.

Or

(b) A city corporation has decided to carry out road repairs on main four arteries of the city. The government has agreed to make a special grant of Rs. 50 lakh towards the cost with a condition that the repairs be done at the lowest cost and quickest time. If the conditions warrant than a supplementary token grant will also be considered favourably. The corporation has floated tenders and five contractors have sent in their bids. In order to expedite work. One road will be awarded to only one contractor.

		Cost of Repairs (Rs. Lakh)			
		R_1	R_2	R_3	R_4
Contractors/Road	C_1	9	14	19	15
	C_2	7	17	20	19
	C_3	9	18	21	18
	C_4	10	12	18	19
	C_5	10	15	21	16

(i) Find the best way of assigning the repair work to the contractors and the costs.

(ii) Which of the five contractors will be unsuccessful in his bid?

13. (a) Solve the following mixed-integer programming problem by using Gomory's cutting plane method.

Maximize $z = x_1 + x_2$

Subject to the constraints :

$$3x_1 + 2x_2 \leq 5$$
$$x_2 \leq 2$$

and $x_1, x_2 \geq 0$; x_1 is an integer.

Or

(b) Solve the following all-integer programming problem using the Branch and Bound method.

Minimize $z = 3x_1 + 2.5x_2$

Subject to the constraints :

$$x_1 + 2x_2 \geq 20$$
$$3x_1 + 2x_2 \geq 50$$

and x_1, x_2 are non-negative integers.

14. (a) A project has the following activities and other characteristics :

Activity (*i-j*)	Estimated Duration (in weeks) Optimistic	Most likely	Pessimistic
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(i) What is the expected project length?

(ii) What is the probability that the project will be completed no more than 4 weeks later than expected time?

Or

(b) Listed in the table are the activities and sequencing requirements necessary for the completion of research report.

Activity :	A	B	C	D	E	F	G	H	I	J	K	L	M
Duration (weeks) :	4	2	1	12	14	2	3	2	4	3	4	2	2
Immediate prodecessors :	E	A	B	K	–	E	F	F	F	I, L	C, G, H	D	I, L

(i) Find the critical path.

(ii) Find the total Float and the Free Float for each non-critical activity.

15. (a) Arrivals of a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially, with mean 3 minutes.

(i) What is the probability that a person arriving at the booth will have to wait?

(ii) The telephone department will install a second booth when convinced that an arrival would expect waiting for atleast 3 minutes for a phone call. By how much should the flow of arrivals increase in order to justify a second booth?

(iii) What is the average length of the queue that form from time to time?

(iv) What is the probability that it will take him more than 10 minutes altogether to wait for the phone and complete his call?

Or

(b) (i) Write the steady-state equations for the model (M/M/C):(FIFO/∞/∞)

(ii) Obtain the expected waiting time of a customer in the queue of the above model.

(iii) In the above model λ = 10/hour, μ = 3/hour C = 4, what is the probability that a customer has to wait before he gets service?
