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Total Number of Pages : 03

**MCA**  
**MCA305**

**3<sup>rd</sup> Semester Regular/Back Examination 2019-20**  
**QUANTITATIVE TECHNIQUES (OR & SM)**

**BRANCH : MCA**

**Max Marks : 100**

**Time : 3 Hours**

**Q.CODE : HRB851**

**Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.**

**The figures in the right hand margin indicate marks.**

**Part-I**

**Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)**

- a) Differentiate between slack, surplus and artificial variables.
- b) Differentiate between a basic solution, a basic feasible solution and an optimal solution of a linear programming problem.
- c) How would you deal with the assignment problem where the objective function is of maximization type?
- d) How does the problem of degeneracy arise in a transportation problem?
- e) What is traffic intensity? Can the traffic intensity be more than 1?
- f) How are the expected duration of a project and its standard deviation calculated?
- g) State the necessary and sufficient conditions of critical path. Can a project have multiple critical paths?
- h) State the meaning of queue discipline and give its role in queueing problem.
- i) State the methods to generate random numbers.
- j) State different methods to reduce the variance.

**Part-II**

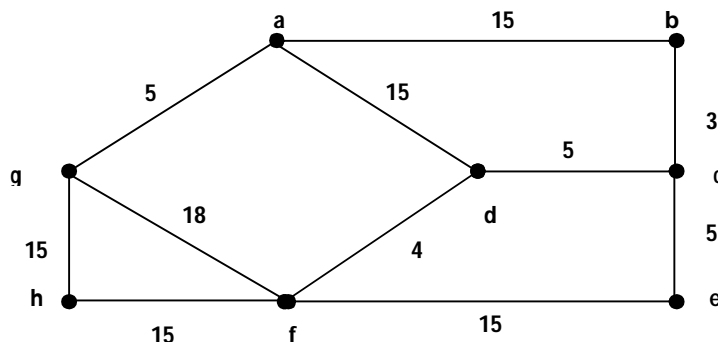
**Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)**

- a) Discuss the origin and development of operations research with suitable classification.
- b) Solve the following linear programming problem by using Two phase method:  
*Minimize*  
 $Z = 40x_1 + 24x_2$   
*Subject to the constraints:*  
 $20x_1 + 50x_2 \geq 4800$   
 $80x_1 + 50x_2 \geq 7200$   
 $x_1, x_2 \geq 0$
- c) Describe the general rules for writing the dual of a linear programming problem.
- d) Discuss integer linear programming. Give an example each of a pure and a mixed integer linear programming problem.
- e) The following information is available regarding four different jobs to be performed and about the clerks capable of performing the jobs:

		<b>Jobs (Time taken in hours)</b>			
		A	B	C	D
<b>Clerks</b>	I	4	7	5	6
	II	-	8	7	4
	III	3	-	5	3
	IV	6	6	4	2

Clerk II cannot be assigned to Job A and clerk III cannot be assigned to job B. Find out the optimal assignment schedule and the total time taken to perform the jobs.

- f) What are the major comparative characteristics of the PERT model and the CPM model? What are their limitations, if any?
- g) Find the minimal spanning tree of the following weighted graph by using Prim's algorithm:



- h) What are the basic characteristics of a queueing system?
- i) Give a general structure of the queueing system. Illustrate some queueing situations.
- j) What is random number? Why random numbers are used in simulation? Why it is necessary to test properties of random numbers?
- k) The cost of a machine is Rs.6500 and its scrap value is only Rs.500 whenever disposed. The maintenance costs are found to be as under on the basis of the experience:

Year:	1	2	3	4	5	6	7	8
Maintenance Cost (Rs.):	100	250	400	600	900	1,250	1,800	2,500

When should the machine be replaced to get maximum advantage?

- l) List different types of nonlinear programming problems. Also explain their application areas.

### Part-III

#### Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** A manufacturer employs three inputs: man hours, machine-hours and cloth material to manufacture two types of dresses. Type-A dress fetches him a profit of Rs. 160 per piece, while Type-B, that of Rs. 180 per piece. The manufacturer has enough man-hours to manufacture 50 pieces of Type-A or 20 pieces of Type-B dresses per day while the machine hours he possesses suffice only for 36 pieces of Type-A or for 24 pieces for Type-B dresses. Cloth material available per day is limited but sufficient enough for 30 pieces of either type of dress. Formulate the linear programming model and then solve. (16)
- Q4** The ABC tool company has a sales force of 25 men who work out from three regional offices. The company produces four basic product lines of hand tools. Mr. Panda, sales manager feels that 6 salesmen are needed to distribute product line 1, 10 salesmen to distribute product line 2, 4 salesmen to product line 3 and 5 salesmen to product line 4. The cost (in Rs.) per day of assigning salesmen from each of the offices for selling each product lines are as follows: (16)

Regional Office	Product lines			
	1	2	3	4
A	20	21	16	18
B	17	28	14	16
C	29	23	19	20

At the present time, 10 salesmen are allotted to office A, 9 salesmen to office B, and 7 salesmen to office C. How many salesmen should be assigned from each office to selling each product line in order to minimize costs? (Use MODI method to get the optimal solution.)

**Q5**

A project has the following characteristics :

**(16)**

<b>Activity</b>	<b>Preceding Activity</b>	<b>Activity completion time (in weeks)</b>
A	–	5
B	A	2
C	A	6
D	B	12
E	D	10
F	D	9
G	D	5
H	B	9
I	C, E	1
J	G	2
K	F, I, J	3
L	K	9
M	H, G	7
N	M	8

- Draw a project network for this project.
- Find the critical path and the project completion time.
- Prepare an activity schedule showing the ES, EF, LS, LF and slack for each activity.
- Will the critical path change if activity G takes 10 weeks instead of 5 weeks?

**Q6**

A repair shop attended by a single mechanic has an average of four customers an hour who bring small appliances for repair. The mechanic inspects them for defects and quite often can fix them right away or otherwise render a diagnostics. This takes him six minutes, on the average. Arrivals are Poisson and service time has exponential distribution.

**(16)**

- Find the proportion of time during which the shop is empty.
- Find the probability of finding at least one customer in the shop.
- What is the average number of customers in the system?
- Find the average time spent, including service.