

**Total No. of Questions: 15**

**MBA (2012 & Onward) (Sem. – 3)  
APPLIED OPERATIONS RESEARCH**

**M Code: 70735**

**Subject Code: MBA-301**

**Paper ID: [C1169]**

**Time: 3 Hrs.**

**Max. Marks: 60**

**INSTRUCTIONS TO CANDIDATES:**

1. **SECTION-A** contains **SIX** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
2. **SECTIONS-B** consists of **FOUR** Subsections: Units-I, II, III & IV. Each Subsection contains **TWO** questions each carrying **EIGHT** marks each and student have to attempt any **ONE** question from each Subsection.
3. **SECTION-C** is **COMPULSORY** and consist of **ONE** Case Study carrying **EIGHT** marks.

**SECTION A**

1. What are the three types of estimates used in the context of PERT? How are the expected duration of a project, and its standard deviation calculated?
2. What are decision trees? How and in what type of situations are they employed for decision making?
3. What are the essential characteristics of O.R?
4. What is a redundant constraint? What does it imply?
5. Explain and graphically illustrate infeasibility and unboundedness. How can each of these be detected while applying simplex technique?
6. What is a queuing problem? What are the basic characteristics of a queuing system?

**SECTION B**

**Subsection-I**

7. Consider the following schedule of activities and related information for the construction of a new plant.

Activity	Months	Variances	Expected Cost (Rs.0,000's)
1-2	4	1	5
2-3	2	1	3
3-6	3	1	4
2-4	6	2	9
1-5	2	1	2
5-6	5	1	12
4-6	9	5	20
5-7	7	8	7
7-8	10	16	14
6-8	1	1	4

You should assume that the cost and time required for one activity are not dependent upon the cost and time of any other activity and variations are expected to follow a normal distribution. You are required to calculate:

- (i) the critical path
  - (ii) expected cost of construction of the plant
  - (iii) expected time required to build the plant
  - (iv) the standard deviation of the expected time.
8. What is Operation Research? Account for the growing importance of Operations Research in business decisions.

**Subsection-II**

9. Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do a job is known and is given in the following matrix.

Men	Jobs				
	I	II	III	IV	V
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

Find the assignment of men to jobs that will minimize the total time taken.

10. Explain the mechanism and managerial significance of post-optimality analysis of simplex linear programming solution.

**Subsection-III**

11. a) Discuss the limitations of Game Theory.  
 b) Apply rule of Dominance and solve the game for optimal strategy based on probability concept.

	B1	B2	B3
A1	9	8	-7
A2	3	-6	4
A3	6	7	7

12. Find the optimal sequence for processing nine jobs through the machines A, B, C in the order ABC. Processing times are given below in hours. Find the total elapsed time for optimal sequences.

Jobs	1	2	3	4	5	6	7	8	9
Machine A	4	9	5	10	6	12	8	3	8
Machine B	6	4	8	9	4	6	2	6	4
Machine C	10	12	9	11	14	15	10	14	12

**Subsection-IV**

13. Determine the age at which the following type of machine be replaced:

Cost Price	Rs.8000
Operating Costs	Rs.1000 for the first year, increasing by Rs.500 every year
Resale Value	Rs.4000 for the first year, decreasing by Rs.500 every year

14. The Mechanic at Car Point is able to install new mufflers at an average of three per hour while customers needing this service arrive at an average rate of 2 per hour. Assuming that the conditions for a single-server infinite population model are all satisfied, calculate the following:

- a) The utilization parameter.
- b) The average number of customers in the system.
- c) The average time a customer spends in the system.
- d) The average time a customer spends in the queue.
- e) The probability that there are more than three customers in the system.

**SECTION C**

**(Compulsory)**

15. The Beaver Furniture Company manufactures and assembles chairs, tables, and bookshelves. The plant produces semi-finished products that are assembled in the company's assembling facility. The (unassembled) monthly production capacity of the plant includes 3000 chairs, 1000 tables and 580 bookshelves. The assembling facility employs 150 workers in two 8-hour shifts a day, 5 days a week. The average assembly times per chair, table and bookshelves are 20, 40 and 15 minutes respectively.

The size of the labor force in the assembly facility fluctuates because of the annual leaves taken by the employees. Pending requests for leaves include 20 workers for May, 25 for June and 45 for July.

The sales forecast for the three products for the months of May, June and July is estimated by the marketing department as:

Product	Sales Forecast Units			End-of-April Inventory
	May	June	July	
Chair	2800	2300	3350	30
Table	500	800	1400	100
Bookshelf	320	600	600	50

The production cost and selling price for the three products are:

Product	Unit Cost (\$)	Unit Price (\$)
Chair	150	250
Table	400	750
Bookshelf	60	120

If a unit is not sold in the month in which it is produced, it is held over for possible sale in a later month. The storage cost is about 2% of the unit production cost. Should Beaver approve the proposed annual leaves? (8 Marks)