PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
M.Tech., Summer 2017-18 Examination

Semester: 2   **Date: 23-05-2018**
Subject Code: 03218153   **Time: 02:00PM to 04:30PM**
Subject Name: Advanced Operation Research   **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) Convert below primal to dual.   **(05)**
    Minimize $z = x_1 + 3x_2 + 3x_3 + x_4$

    subject to $3x_1 + 4x_2 - 3x_3 + x_4 = 2,$
                  $3x_1 - 2x_2 + 6x_3 - x_4 = 1,$
                  $6x_1 + 4x_2 + x_4 = 4$

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

B) Four different jobs can be done on four different machines. The set-up and take down time   **(05)**
   cost are assumed to be prohibitively high for changeovers. The matrix below gives the cost
   in rupees of producing job i to machine j.

		M1	M2	M3	M4`
Jobs i	J1	5	7	11	6
	J2	8	5	9	6
	J3	4	7	10	7
	J4	10	4	8	3

(Header: Machines j)

C) Explain successive quadratic programming and write advantages and disadvantages of quadratic   **(05)**
   programming.

Q.2 **Answer the following questions**. (Attempt any three) (Each five mark)   **(15)**
    A) Explain the term crashing of network. Why it is required?
    B) Write and explain duality theorem of geometric programming.
    C) Explain separable programing and write its problem statement.
    D) Explain Resource levelling and resource allocation concept.

Q.3 A) The simplex tableau for a maximization problem of linear programming is given as follows: **(07)**

CBV	Basic	bi	x1	x2	S1	S1
0	S1	6	2	1	1	0
0	S1	16	3	4	0	1
		cj	6	20	0	0
		zj	0	0	0	0

Answer the following questions:

i.   Is this an optimal solution? If no, find out the optimal solution.
ii. Are there more than one optimal solution?
iii. If S1 is slack for machine A and S2 is slack for machine B, which of these machines is being
     used to full capacity when producing according to this solution?
iv. How much profit we lose if machine A goes down by 2 hours for maintenance?

v. A new product is proposed to be introduced which would require processing time ½ hour on machine A and 1/3 hour on Machine B. It would yield a profit Rs. 15 per unit. Do you think it is advisable to introduce this product?

B) Find the optimum solution to the following transportation problem in which the cells contain the transportation cost in rupees. Use VAM for IBFS and optimize it by MODI method. **(08)**

	W1	W2	W3	W4	W5	Available
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Required	30	30	15	20	5	100

OR

B) "A transportation problem is a special type of linear programming problem." Justify the statement with suitable example.

Q.4 A) A small project is composed of 7 activities whose time estimates are listed in the table below. Activities are identified by their beginning and ending node numbers. **(07)**

Activity		1-2	1-3	1-4	2-5	3-5	4-6	5-6
Time	Optimistic	1	1	2	1	2	2	3
Estimates	Most likely	1	4	2	1	5	5	6
(weeks)	Pessimistic	7	7	8	1	14	8	15

a. Draw the project network.
b. Find the expected duration and variance for each activity.
c. What is the expected project length and standard deviation?
d. What is the probability that the project will be completed 3 weeks later than the expected time?

OR

A) The following table gives data on normal time and cost and crash time and cost for a project. **(07)**

Activity	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (days)	Cost (Rs.)
1-2	6	60	4	100
1-3	4	60	2	200
2-4	5	50	3	150
2-5	3	45	1	65
3-4	6	90	4	200
4-6	8	80	4	300
5-6	4	40	2	100
6-7	3	45	2	80

The indirect cost per day is Rs. 100.

i. Draw the network for the project.
ii. Find the critical path.
iii. Determine minimum total time and its cost.

Q.4 B) In a cargo loading problem, there are 4 items of different units and different value/ unit is as given **(08)** below

Item	Weight/unit	Value/ unit
1	1	1
2	3	5
3	4	7
4	6	11

The maximum cargo loading is restricted to 17. How many of each item be loaded to maximize the value?