Registration No. :

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Sixth Semester (Special / Back) Examination – 2013
OPTIMIZATION IN ENGINEERING

BRANCH : CSE, EEE, ELECTRICAL, ENV, FASHION, IT, MECH, MINING, MM, MME, PLASTIC, TEXTILE

QUESTION CODE : E 282

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2×10

    (a) What are artificial variables and why do we need them ? How do they differ from slack / surplus variables ?

    (b) What is the function of the minimum ratio rule in the simplex method ?

    (c) Write down the dual of the following linear program :

    Maximize : $Z = x_1 + 4x_2 + 3x_3$
    Subject to : $2x_1 + 3x_2 - 5x_3 \leq 2$
    $3x_1 - x_2 + 6x_3 \geq 1$
    $x_1 + x_2 + x_3 = 4$

    $x_1 \geq 0, x_2 \leq 0, x_3$ unrestricted in sign.

    (d) Explain why the transportation algorithm is not appropriate for solving the assignment problem ?

    (e) What is the advantage of revised Simplex method over regular simplex method in finding the solution of LPP ?

    (f) What is degeneracy in transportation problem ? How is it resolved ?

    (g) What is Little's formula and what is its use ?

    (h) What is a Markovian queueing model ?

    (i) What are the primary uses of Kuhn-Tucker necessary and sufficient conditions ?

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(j) Explain why Fibonacci search method is called sequential search technique.

2. (a) A company has manufacturing facilities at three locations (A,B, and C) and a single product is to the shipped to 5 customers. The capacities of plants A,B,C are 100, 70, and 50 units, respectively. The firm must ship at least 60 units to customer 1 and 40 units to customer 2. Customers 3, 4 and 5 would require at least 10 units each but want to buy as many of the remaining units as possible. The net profit associated with shipping a unit from each plant to every customer is given below : 5

		Customer				
		1	2	3	4	5
Plants	A	6	7	8	6	9
	B	10	8	9	5	3
	C	2	9	5	10	6

The company wants to know how many units to ship to each customer from plants A,B, and C in order to maximize their profits. Formulate this as an LP problem.

(b) Using graphical method, solve the following LPP : 5

Maximise $z = x_1 - 2x_2$

Subject to $-x_1 + x_2 \leq 1$

$6x_1 + 4x_2 \geq 24$

$0 \leq x_1 \leq 5, 2 \leq x_2 \leq 4$

3. (a) Using simplex method, solve the LPP : 5

Maximise $z = 4x_1 + 10x_2$

Subject to $2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90$

$x_1, x_2 \geq 0$

(b) Use dual simplex method to solve the following LPP : 5

Maximise $z = x_1 + 4x_2 + 3x_4$

Subject to $x_1 + 2x_2 - x_3 + x_4 \geq 3$

$-2x_1 - x_2 + 4x_3 + x_4 \geq 2$

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

4. The following table shows all the necessary information on the available supply to each warehouse, the requirement of each market and the unit transportation cost from each warehouse to each market. 2+6+2

Market

		I	II	III	IV	Supply
	A	5	2	4	3	22
Warehouse	B	4	8	1	6	15
	C	4	6	7	5	8
Requirement		7	12	17	9	

The shipping manager has worked out the following schedule from experience :
12 units from A to II. 1 unit from A to III, 9 units from A to IV, 15 units from B to III, 7 units from C to I, and 1 unit from C to III.

(a) Check that the manager has the optimal schedule.

(b) Find the optimal schedule and minimum total shipping cost (using MODI method).

(c) If the manager is approached by a carrier of route C to II who offers to reduce his rate in the hope of getting some business, by how much must the rate be reduced before the manager should give him an order.

5. (a) A department has five employees with five jobs to be performed. The time (in hours) each man will take to perform each job is given in the cost matrix

Employees

		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	8	10	4	12

How should the jobs be assigned, one per employee, so as to minimize the total man-hours ? 6

(b) A self service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming poission distribution for arrival rate and exponential distribution for service time find – 4

(a) Average number of customers in the system

(b) Average number of customers in the queue or average queue length

(c) Average time a customer spends in the system

(d) Average time a customer waits before being served.

6. Use branch and abound technique to solve the following integer programming problem : 10

Maximise $z = 7x_1 + 9x_2$
Subject to $-x_1 + 3x_2 \leq 6$
$7x_1 + x_2 \leq 35$
$x_1 \geq 0, x_2 \leq 7$
x_1, x_2 are integers.

7. Solve the following quadratic programming problems : 10

Minimize $f(x) = 3x_1^2 + 2x_2^2 + 3x_2x_2 - 25(x_1 + x_2)$
Subject to $2x_1 + x_2 \leq 5$
$x_1, x_2 \geq 6$

8. Write short notes on the following : 5×2

(a) Project gradient method

(b) Genetic Algorithm.

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