Registration no:

Total Number of Pages: 3

6th Semester Regular / Back Examination 2015-16
OPTIMIZATION IN ENGINEERING
BRANCH: CSE, ENV, FASHION, FAT, IT, ITE, METTA, MME, PLASTIC, TEXTILE
Time: 3 Hours
Max Marks: 70
Q.CODE: W427

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

Q1   Answer the following questions: **(2 x 10)**

a) Explain how you handle a variable unrestricted in sign during the solution process of simplex method.

b) In a linear programming problem what are shadow prices? How we locate these in simplex method?

c) What is degeneracy in a transportation problem? How do you handle it?

d) Find the dual of the given LPP
Maximize $Z = 3x_1 + 4x_2 - x_3$
Subject to $2x_1 + x_2 + 3x_3 \leq 20$; $3x_2 - x_3 \leq 12$; $4x_1 + 5x_3 \leq 18$;
$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

e) Define a convex function and a concave function.

f) Write the LPP model of an assignment problem with cost coefficient c_{ij}, $i, j = 1, 2, ..., n$

g) In an M/M/1 queue the arrival rate is 10 per minute and the service rate is 15 per minute. What proportionate of the time the system is empty?

h) Explain the notations L, L_q, W and W_q for a queuing model.

i) $F(x)$ is a unimodal function over the interval [2, 7] which is to be minimized. In a process of search the minimum we get $F(3.5) = 12.6$ and $F(5.4) = 9.7$. Which will be the next interval of your search?

j) During the process of Genetic Algorithm two strings as given below are considered for a cross over operation.
                        1100100110
                        0011101100
Perform a cross over operation with mentioning the details.

Q2 **a)** The following table provides information about two products A and B   **(5)**
and the resources Q, R, S required to produce them.

Resources	Required resource per unit product		Resource Available
	Product A	Product B	
Q	2	1	2
R	1	2	2
S	3	3	4
Profit per unit	3	2	

Formulate the LPP and solve it using graphical method.
Note: Provide only a rough sketch of the feasible region without using any graph paper. Show all mathematical details of your calculations.

b) Solve the given LPP by simplex method **(5)**
Maximize $Z = 3x_1 + 5x_2 + 6x_3$
Subject to $2x_1 + x_2 + x_3 \leq 4$; $x_1 + 2x_2 + x_3 \leq 4$; $x_1 + x_2 + 2x_3 \leq 4$; $x_1 + x_2 + x_3 \leq 3$; $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

Q3 a) Solve the given LPP using the Big-M method **(5)**
Maximize $Z = 2x_1 + 5x_2 + 3x_3$
Subject to $x_1 - 2x_2 + x_3 \geq 20$; $2x_1 + 4x_2 + x_3 = 50$; $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$.

b) Solve the given LPP using revised simplex method **(5)**
Maximize $Z = 5x_1 + 4x_2 - x_3 + 3x_4$
Subject to $3x_1 + 2x_2 - 3x_3 + x_4 \leq 24$; $3x_1 + 3x_2 + x_3 + 3x_4 \leq 36$; $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, x_4 \geq 0$.

Q4 a) Find a starting solution to the given transportation problem by Vogel's Approximation Method and then optimize it. **(5)**

	D_1	D_2	D_3	D_4	Supply
S_1	7	6	5	4	50
S_2	9	7	3	6	50
S_3	8	8	7	3	5
Demand	20	40	30	60	

b) Solve the given assignment problem by Hungerian method. **(5)**

10	11	4	2	8
7	11	10	14	`12
5	6	9	12	14
13	15	11	10	7

Q5 a) Solve the given LPP by dual simplex method. **(5)**
Maximize: $Z = 4x_1 + 5x_2 + 3x_3$
subject to $x_1 + x_2 + 2x_3 \geq 20$, $15x_1 + 6x_2 - 5x_3 \leq 50$, $x_1 + 3x_2 + 5x_3 \leq 30$
$x_1, x_2, x_3 \geq 0$

b) Solve the given integer programming problem by branch & bound method. **(5)**
Maximize: $Z = 6x_1 + 8x_2$
Subject to $x_1 + 4x_2 \leq 8$, $7x_1 + 2x_2 \leq 14$, x_1, x_2, are non negative integers.

Q6 a) In a supermarket average arrival rate of customers is 5 per 30 minutes. The average time it takes to list and calculate customers purchase at the cash desk is 4.5 minute and this is exponentially distributed. What is the probability that the cashier is working? How long will the customer expect to wait at the cash desk? **(5)**

b) Consider a barbershop with two barbers and two chairs with no room for waiting. If both chairs are occupied when a customer arrives, the customer leaves immediately. On the average a customer arrives every 10 minutes and each haircut takes an average time of 15 minutes. Calculate the expected number of busy barbers. Calculate the expected number of customers turned away per hour. **(5)**

Q7 a) Minimize the function $f(x) = 2(x-3)^2 + e^{x^2/2}$ over the interval [0, 100] using the golden section search. Perform 5 iterations to do it. **(5)**

b) Minimize $f(x) = x^2 + y^2 + z^2$ subject to $\dfrac{1}{x} + \dfrac{1}{y} + \dfrac{1}{z} = 1$ using Lagrange multiplier method. **(5)**

Q8 a) Solve the following problem using Kuhn-Tucker conditions. **(5)**
Minimize $f(x) = 100 - 1.2x_1 - 1.5x_2 + 0.3x_1^2 + 0.05x_2^2$
Subject to $g_1(X) = x_1 + x_2 \geq 35, \ g_2(X) = x_1 \geq 0, \ g_3(X) = x_2 \geq 0$

b) Solve the given quadratic programming problem using the simplex method for the quadratic programming. **(5)**
Maximize $f(X) = 8x_1 - x_1^2 + 4x_2 - x_2^2$
Subject to $x_1 + x_2 \leq 2, \ x_1 \geq 0, \ x_2 \geq 0$