Reg. No. : | | | | | | | | | | |

Question Paper Code: 12001

M.E. DEGREE EXAMINATION, DECEMBER 2013.

First Semester

Computer Science and Engineering

01PMA121 – OPTIMIZATION TECHNIQUES

[Common to Computer Science and Engineering (with Specialization in Networks)]

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What do you understand by Kendall's notation?

2. What do you understand by "Reneging"?

3. Write Pollaczek – Khintchine formula.

4. Write a steady state solution P_n of the open Jackson networks.

5. Define simulation.

6. Name any two methods for generating successive random samples from a distribution.

7. Define basic solution of a LPP.

8. Give a mathematical formulation of assignment problem.

9. Write the KKT necessary conditions for maximization problem.

10. Write a mathematical formulation of a quadratic programming problem.

PART -- B (5 x 16 = 80 Marks)

11. (a) A tax consulting firm has four service counters in the office to receive people who have problems and complaints about their income, wealth and sales taxes. Arrivals average *80* persons in an *8* hour service day. Each tax adviser spends an irregular amount of time in servicing the arrivals which have been found to have exponential distribution. The average service time is *20* minutes. Calculate

(i) the average number of customers in the system. (3)

(ii) the average number of customers waiting for service. (3)

(iii) average waiting time for the customer in the system and in queue. (3)

(iv) number of hours each week a tax consultant appends with customer. (3)

(v) the expected number of idle tax advisers at any specified time. (4)

Or

(b) Describe the following queuing models (i) *M/M/1* (ii) *M/M/c*. (16)

12. (a) Explain about open Jackson networks and derive its steady state solution (16)

Or

(b) (i) Show that the P-K formula reduces to L_s of the $(M/M/1)$: $(GD/\infty/\infty)$ when the service time is exponential with a mean of $1/\mu$ time units. (8)

(ii) Layson Roofing Inc. installs single roof on new and old residences in Arkansas. Prospective customers request the service randomly at the rate of nine jobs per *30* - day month and are placed on a waiting list to be processed on a *FCFS* basis. Home sizes vary, but it is fairly reasonable to assume that the roof areas are uniformly distributed between *150* and *300* squares. The work crew can usually complete *75* squares a day. Determine the following:

a) Layson's average backlog of roofing jobs. (4)

b) The average time a customer waits until a roofing job is completed. (4)

13. (a) Customers arrive at a milk booth for the required service. Assume that inter arrival and service time are constants and given by *1.5* and *4* minutes respectively. Simulate the system by hand computations for *14* minutes (Assume that the system starts at $t=0$)

(i) What is the waiting time per customer?

(ii) What is the percentage idle time for the facility? (16)

Or

(b) The following table represents the variation in the number of waiting customers in a queue as a function of the simulation time.

Simulation time, T (hr)	No. of waiting customers
$0 \le T \le 3$	0
$3 < T \le 4$	1
$4 < T \le 6$	2
$6 < T \le 7$	1
$7 < T \le 10$	0
$10 < T \le 12$	2
$12 < T \le 18$	3
$18 < T \le 20$	2
$20 < T \le 25$	1

Compute the following measures of performance:

(i) The average length of the queue.

(ii) The average waiting time in the queue for those who must wait. (16)

14. (a) Use two phase simplex method to solve Maximize $Z = 5x_1 + 8x_2$ (16)

Subject to the constraints

$$3x_1 + 2x_2 \ge 3$$
$$x_1 + 4x_2 \ge 4$$
$$x_1 + x_2 \le 5$$
$$x_1, \ x_2 \ge 0$$

Or

(b) Solve the following assignment problem: (16)

Machines

Jobs

	M_1	**M_2**	**M_3**	**M_4**	**M_5**
J_1	9	22	58	11	19
J_2	43	78	72	50	63
J_3	41	28	91	37	45
J_4	74	42	27	49	39
J_5	36	11	57	22	25

15. (a) (i) Solve the following problem by using Lagrangean method: (8)

$$\textit{Maximize } z = -(2x_1-5)^2 - (2x_2-1)^2$$

subject to

$$x_1 + 2x_2 \le 2$$
$$x_1, x_2 \ge 0$$

(ii) Solve the following problem using KKT conditions: (8)

$$\textit{Minimize } f(X) = x_1^2 + x_2^2 + x_3^2$$

subject to

$$g_1(X) = 2x_1 + x_2 - 5 \le 0$$
$$g_2(X) = x_1 + x_3 - 2 \le 0$$
$$g_3(X) = 1 - x_1 \le 0$$
$$g_4(X) = 2 - x_2 \le 0$$
$$g_5(X) = -x_3 \le 0$$

Or

(b) Solve the following QPP: (16)

$$\textit{Maximize } Z = 6x_1 + 3x_2 - 4x_1x_2 - 2x_1^2 - 3x_2^2$$

subject to

$$x_1 + x_2 \le 1$$
$$2x_1 + 3x_2 \le 4$$
$$x_1, x_2 \ge 0$$