KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May 2023

Level : B.Sc.
Year : III
Time : 2 hrs. 30 mins.

Course : COMP 317
Semester : I
F.M. : 50

SECTION "C"
[3Q × 7 = 21 marks]

1. Diet for a sick person must contain at least 4,000 units of vitamins, 50 units of minerals and 1,400 calories. Two foods A and B are available at a cost Rs.4 and Rs.3 per unit respectively. If one unit of A contains 200 units of vitamins, 1units of mineral and 40 calories and one units of B contains 100 units of vitamins, 2 units of minerals and 40 calories, find by graphical method what combinations of foods be used to have the least cost?

OR

Show that for maximizing linear programming problem the feasible optimal solution always exists in the vertex of the feasible region.

2. In Charne's Big-M method of solving LP problem, why the Big M is called penalty? By using this method find the optimal solution of the following LP problem:
$Minimize\ Z = 4x_1 + x_2$ Subject to the constraints

$$3x_1 + x_2 = 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 + 2x_2 \leq 3$$
$$x_1, x_2 \geq 0$$

3. Explain types of simulation. In a single channel queuing system random numbers for arrivals of customers are 99,05,16,,21,74,68 and random numbers for services of customers are: 17,80,88,,34,76,68, and using Monte Carlo simulation for the queuing System starts at 7:00 AM and Probability of arriving and servicing is given in the table below: Find [7]
   i. Mean queue length.
   ii. Mean inter arrival time of a customer
   iii. Mean service time of a customer.
   iv. Mean idle time of server.
   v. Mean time that a customer spends in the system
   vi. Percentage of the time during which server remains idle

Inter-arrival time (min)	Probability	Service time (min)	Probability
8	0.25	7	0.35
4	0.40	6	0.30
2	0.15	9	0.05
9	0.20	10	0.30

SECTION "D"

[5Q × 5 = 25 marks]

4. A manufacturer has distribution centers located at Butwal, Biratnagar and Pokhara. These centers have an available 40, 20, 40 units of the product respectively. His retail outlets at A, B, C, D and E require 25, 10, 20, 30, and 15 units of the products respectively. The shipping cost per unit (in rupees between each center and outlet is given in the following table: [5]

Distribution center	Retail outlets				
	A	B	C	D	E
Butwal	55	30	40	50	40
Pokhara	35	30	100	45	60
Biratnagar	40	60	95	35	30

Find the optimal units of goods that can be distributed over retailers from distribution centers so as to minimize the shipping cost.

5. By using the Simplex method, find the optimal solution of the following LP-problem: $Minimize\ Z = x_1 - 3x_2 + 3x_3$ Subject to the constraints [5]

$$3x_1 - x_2 + 2x_3 \leq 7$$
$$2x_1 + 4x_2 \geq -12$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0$$

OR

Find optimal solution of following LP- problem by using dual - simplex method: [5]

$$Minimize\ Z = 3x_1 + x_2\ subject\ to$$
$$x_1 + x_2 \geq 1\ ;\ 2x_1 + 3x_2 \geq 2\quad, x_1, x_2 \geq 0$$

6. A barber shop has space to accommodate only 5 customers. He can serve only one person at a time. If a customer comes to his shop and finds it full goes to next shop. Customers randomly arrive at an average rate of 10 per hour and the barber's service time is exponential with an average of 5 minutes per customer. Find [2.5+2.5]
   (a) Probability that the barber is idle
   (b) Average number of customers in the system

7. Discuss CPM of the network analysis? [1]
   Consider the following information.

Activity	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Time in days	4	6	8	7	4	6	5	19	10

   (a) Draw the network diagram of the following information [2]
   (b) Find the expected duration of completion of project [1]
   (c) Find free floating of non-critical activities [1]

8. A team of 5 horses and 5 riders has entered a jumping show contest. The number of penalty points to be expected when each rider rides any horse is shown below. Find the optimum assignment of horses to the riders so as to minimize the expected loss of the team? Also find expected minimum loss. [5]

	R_1	R_2	R_3	R_4	R_5
H_1	5	3	4	7	1
H_2	2	3	7	6	5
H_3	4	1	5	2	4
H_4	6	8	1	2	3
H_5	4	2	5	7	1

SECTION "E"

[2Q × 2 = 4 marks]

9. Differentiate between Linear programming problem and integer programming problem.

10. Discuss redundancy in constraints.

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H_5	4	2	5	7	1

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