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Name of Paper	:	Operational Research for Computer Science
Name of the Course	:	B.Sc. (H) Computer Science
Semester	:	V
Duration of Examination	:	Three Hours
Maximum Marks	:	75 Marks
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Attempt any FOUR questions.
All questions carry equal marks

Q1 ONGC wants to build a refinery in Mumbai to produce four products: diesel, gasoline, lubricants and jet fuel. The minimum demand (in bbl/day) for each of these products is 14000, 30000, 10000, and 8000, respectively. Dubai and Iraq are under the contract to ship crude to ONGC. Because of the production quotes specified by OPEC (Organisation of Petroleum Exporting Countries), the new refinery can receive at least 40% of its crude from Iraq and the remaining amount from Dubai. ONGC predicts that demand and crude oil quotes will remain steady over the next ten years.

The specifications of the two crude oils lead to different product mixes: one barrel of Iraq crude yields of 0.2 bbl of diesel, 0.25 bbl of gasoline, 0.1 bbl of lubricants, and 0.15 bbl of Jet fuel. The corresponding yields from Dubai crude are 0.1, 0.6, 0.15 and 0.1, respectively. ONGC needs to determine the minimum capacity of the refinery (in bbl /day).

Formulate the above as a linear programming problem. Classify the basic solutions as feasible and Infeasible. Solve the problem graphically and obtain the optimal solution.

Q2 Consider the following Linear Programming Problem(LPP):

Maximize $Z = 107x_1 + x_2 + 2x_3$

Subject to,

$$14x_1 + x_2 - 6x_3 + 3x_4 = 7$$

$$16x_1 + 0.5x_2 - 6x_3 \leq 5$$

$$3x_1 - x_2 - x_3 \leq 0$$

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

Find the basic feasible solution of the above LPP. Also find the optimal solution for above Linear Programming Problem using Two-Phase method. Comment on the nature of solution.

Q3 Write the dual of the following LPP.

Minimize $Z = x_1 + 2x_2$

Subject to,

$$2x_1 + 4x_2 \leq 160$$

$$x_1 - x_2 = 30$$

$$x_1 \geq 10$$

$$x_1, x_2 \geq 0$$

Solve the dual and obtain the value of the primal variable from the optimal table of the dual.

Q4 A company has five plants P_1, P_2, P_3, P_4, and P_5 from which it supplies to four markets M_1, M_2, M_3, and M_4. The following table gives the cost of shifting from plant to market, quantities available at each plant and quantities required at each market:

		Plant					
		P_1	**P_2**	**P_3**	**P_4**	**P_5**	**Required**
Market	**M_1**	10	2	3	15	9	**35**
	M_2	5	10	15	2	4	**40**
	M_3	15	5	14	7	15	**20**
	M_4	20	15	13	25	8	**30**
	Available	**20**	**20**	**40**	**10**	**35**	

Find an initial basic feasible solution of the above transportation problem by using Northwest-Corner method. Obtain the optimum solution using U-V/Iterative method.

Q5 Three children Huey, Dewey, and Louie, are playing a game in which they throw a ball to each other. Huey always throws the ball to Dewey. Dewey always throws the ball to Louie. Louie is just as likely to throw the ball to Huey as to Dewey.

Show that the process is a Markov chain. Draw the transition diagram and Transition Probability Matrix (TPM). Determine the period of every state and prove that the Markov chain is ergodic.

Q6 In a hospital, ward-boy comes to the dispensary to receive medicine for a patient as per the prescription given by the doctor. The arrival of ward-boy follows the Poisson distribution, and the average time between two arrivals is one minute. The average service time is 40 seconds and follows the Exponential distribution.

Determine, the average queue length, the average length of the non-empty queue, the average number of ward-boy in the system including the ward-boy being attended, average waiting time in the system, the probability that the dispensary attendant remain idle, the probability that there are two ward-boy in the dispensary , and the probability that attendant in the dispensary is busy.