Unique paper code	:	32347503_OC
Name of Paper	:	Operational Research for Computer Science (DSE)
Name of the Course	:	B.Sc. (H) Computer Science
Semester	:	V
Duration of Examination	:	Three Hours
Maximum Marks	:	75 Marks
Year of admission	:	2015-2018

Attempt any FOUR questions.
All questions carry equal marks

Q1 Consider the following Linear Programming Problem:

Maximize $Z = 6x_1 + 2x_2$

Subject to

$3x_1 + x_2 \leq 6$

$x_1 + 3x_2 \leq 6$

$x_1, x_2 \geq 0$

Find all the basic feasible solutions. Use the graphical method to find the optimal solution of the given Linear Programming Problem and show graphically that there are infinitely many solutions. List the corner points of the feasible solution space and prove that the solution space formed in the above Linear Programming Problem is convex.

Q2 Solve the following Linear Programming Problem using Big-M method.

Max $Z = 6x_1 + 4x_2$

Subject to constraints

$2x_1 + 3x_2 \leq 30$

$3x_1 + 2x_2 \leq 24$

$x_1 + x_2 \geq 3$

$x_1, x_2 \geq 0$

Comment on the nature of solution.

Q3 Write the dual of the following LPP.

Minimize $Z = 4x_1 + x_2$

Subject to,

$$3x_1 + x_2 = 3$$

$$4x_1 + 3x_2 \geq 6$$

$$x_1 + 2x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

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

Q4 A company has three production shops supplying a product to four warehouses. The cost of production varies from shop to shop, and the cost of transportation from one shop to a warehouse also varies. Each shop has a specific production capacity and, each warehouse has a certain amount of requirement. The cost of transportation is as given below.

WAREHOUSE

SHOP	I	II	III	IV	**SUPPLY**
A	19	30	50	10	7
B	70	30	40	60	9
C	40	8	70	20	18
DEMAND	5	8	7	14	

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

Q5 There are three categories of income taxpayers in India, those who never evade taxes, those who sometimes do it, and those who always do it. An examination of the audited tax returns from one year to the next shows that of those who did not evade taxes last year, 95% continue in the same category this year, 4% move to the "sometime" category, and the remaining moves to the "always" category. For those who sometimes evade taxes, 6% move to "never", 90% stay the same, and 4% move to "always". As for the "always" evaders, the respective percentages are 0%, 10%, and 90%.

Express the problem as a Markov chain and write the Transition Probability Matrix (TPM). Draw the transition diagram. In the long run, what would be the percentages of "never", "sometimes", and "always" tax categories? Statistics show that a taxpayer in the "sometimes" category evades taxes on about $5000 per return and in the "always" category on about $12,000. Assume income tax payers are 70 million, and the average income tax rate is 12% then determine the annual reduction in collected taxes due to evasion.

Q6 A departmental store employs one cashier at its counter. Customers arrive according to a Poisson distribution at the rate of 9 customers every 5 minutes. The service time per customer is Exponential at the rate of 10 customers every 5 minutes.

Determine, the average number of customers in the system, the average number of customer in the queue, the average time a customer spend in the system, the average time a customer wait before being served, the probability that cashier is idle, the probability that cashier is busy, and the probability that there are 2 customers in the system.