KATHMANDU UNIVERSITY
End Semester Examination
August, 2018

Marks scored:

Level : B.Sc.
Year : III

Course : COMP 317
Semester: I

Exam Roll. No:

Time: 30 mins.

F.M. : 10

Registration No.:

Date AUG 2 3 2018

SECTION "A"
[10 Q. × 0.5=5]

Fill in the blank space(s) by most appropriate words or symbol(s):

1. Intersection of closed half planes is called .....
.....

2. The word "Fathom" is the term of .....

3. You go to petrol station to get fuel filled to your motorcycle, after waiting in line for a while you become impatient and leave the station then you are called .....
..... Customer

4. The variable used only for solution purpose that has no impact on the solution of LP-problem is called .....

5. The solution of LP-problem obtained by putting all x_j=0 is called .....
.....

6. The general formula for salesman problem is .....
.....

7. If maximization $Z= 9x_1 + 5x_2$ is the object function of LP-problem then meaning of 9 is .....
.....

8. If the initial solution of transportation problem remains degenerate then allocation of small positive number is made to that non- basic cell which has .....
.....

9. Sequence of number which has same probability that of other is called .....
.....

10. Formula for total float is .....
... .

SECTION "B"
[10 Q.× 0.5=5]

Fill in the blank spaces (Question number 11 through 20) by choosing the most appropriate answers from among the given ones. Do not tick the answers.

11. Matrix - form of constraints of LP-problem .....
[$A^{-1}X = B$, $AX^{-1} = B$, $AX^{-1} = B$, $AX = B$]

12. Linear programming is the technique of .....
[Optimization, Sensitivity, Networking Analysis]

13. The shadow price ..... objective function value
[improves, worsens,
does not change, makes constant to the]

14. If constraint-coefficient of non-basic variable of LPP that is to enter the basis is zero or negative then this is the indication that .....
[LPP has multiple optimal solution, LPP has degenerate solution,
LPP has infeasible solution, LPP has unbounded solution]

15. If aϵE^n, b is scalar then set of points $u = \{x_1, x_2, \cdots x_n\}$ satisfying **a.u** =b is called .....
[Convex set, hyperplane, polyhedral, convex hull]

16. M/M/ 2queueing model has arrival rate = 15 per unit time and service rate = 10 per unit time then traffic intensity is .....
[3, 1.33, 0.75, 1.5]

17. ..... means that the decision variables must be positive or zero.
[None–negativity, Negativity, Continuous, Integer]

18. General objective function of assignment problem is = ...
[$\sum_{i=0}^{n-1}\sum_{j=0}^{n} C_{ij}x_{ij}$, $\sum_{i=0}^{n}\sum_{j=0}^{n} C_{ij}x_{ij}$,
$\sum_{i=1}^{n}\sum_{j=1}^{n} C_{ij}x_{ij}$, $\sum_{i=1}^{n}\sum_{j=1}^{n-1} C_{ij}x_{ij}$,]

19. Which of the following is a valid objective function for a linear programming problem?
.....
[Max xy, Min x + 3y + (2/3)z,
Max $5x^2 + y^2$, Min $(x_1 + x_2)/x_3$]

20. Simulation is not ..... technique.
[*Optimization*, *Approximation*,
Probabilitic, Iconic representative]

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SECTION "C"
[3 Q. × 7=21 marks]

1. Explain why simulation is considered to be expensive? In a single channel queuing system random numbers for arrivals of customers are : 82, 14, 62, 62, 10, 55 and random numbers for services of customers are : 10, 31, 62, 48, 73, 81 and using Monte Carlo simulation for the queuing system for 6 periods for the table given below: Find [7]

(i) Mean inter arrival time of a customer.
(ii) Mean service time of a customer.
(iii) Mean idle time of server.
(iv) Mean time that a customer spends in the system.
(v) Mean number of customers waiting in the queue.
(vi) Percentage of time that the server remains busy.

Inter-arrival time (min)	Probability	Service time (min)	Probability
5	0.15	7	0.05
6	0.35	12	0.35
7	0.40	9	0.45
8	0.10	10	0.15

2. How does two –Phase method show whether given problem has optimal solution or not? Use this method to optimize the following LP-problem. [2+5]

Minimize $Z = 2x_1 + 3x_2 + 2x_3 - x_4 + x_5$ *subject to* $3x_1 - 3x_2 + 4x_3 + 2x_4 - x_5 = 0$

$x_1 + x_2 + x_3 + 3x_4 + x_5 = 2; x_j \geq 0, j = 1 \text{ to } 5$

OR

By using dual simplex method find the solution of following LP-problem

Minimize $Z = x_1 + 4x_2 + 3x_3$ *subject to* $x_1 + 2x_2 - x_3 + x_4 \geq 3$

$-2x_1 - x_2 + 4x_3 + x_4 \geq 2; \quad x_j \geq 0, \quad j = 1 \text{ to } 4$

3. The following are the jobs that a limited domestic product has to be made and also following various activities have to be made for marketing tasks

Task	Description	Immediate predecessors	Time(days)
A	Collect the data on specifications	------	4
B	Prepare operation manual	A	4
C	Chart out promotion program	B	4
D	Make copies of manual and promotion materials	B	9
E	Produce first batch for demonstration	B	16
F	Prepare press representatives	C	2
G	Chief executive conference with managers	C	1
H	Press representatives reach head office	F,G	2
I	Promotional meetings	D,H	4
J	Product demonstrations	E,I	2
K	Press representatives return home	J	2

(i) Draw a network diagram of activities for the project [2]
(ii) What is the expected days to complete the project [2]
(iii) Find total float and free float and independent float [3]

SECTION "D"
[5Q. × 5=25 marks]

4. A person requires 10, 12, 12 units of chemicals X, Y, Z respectively for his garden. A liquid product contains 5, 2, 1 units of X, Y, Z respectively per jar. A dry product contains 1, 2, 4 units of X, Y, Z per carton. If the liquid product for Rs. 3 per jar and the dry product sell for Rs. 2 per carton then set up the mathematical model for the linear programming problem and find graphically how many of each should be purchased in order to minimize the cost and meet the requirement. [2.5+2.5]

5. What sort of problem does the transportation model solve? A steel company has three hearth furnaces and five rolling mills. Transportation costs in rupees per ton for shipping steel from furnaces to rolling mills are given in the following table. Determine the optimal transportation cost. [1+4]

		Mills					
Furnaces		A	B	C	D	E	Supply
	X	40	20	30	20	60	8
	Y	52	42	50	22	12	12
	Z	60	50	45	72	35	14
	Requirements	4	4	6	8	8	

6. Linear programming problem: Maximize $Z = 2x_1 + 4x_2 + x_3 + x_4$ Subject to the constraints $x_1 + 3x_2 + x_4 \leq 4$; $2x_1 + x_2 + \leq 3$; $x_2 + 4x_3 + x_4 \leq 3$; $x_1, x_2, x_3, x_4 \geq 0$ has the following optimal table :

C_j			2	4	1	1	0	0	0
C_B	B	X_B	x_1	x_2	x_3	x_4	s_1	s_2	s_3
4	x_2	1	0	1	0	2/5	2/5	−1/5	0
2	x_1	1	1	0	0	−1/5	−1/5	3/5	0
1	x_3	½	0	0	1	3/20	−1/10	1/20	1/4
Z	13/2	$Z_j - C_j$	0	0	0	7/20	11/10	9/20	1/4

(a) Does the problem possess alternative solution? give reason [1]

(b) Find new objective function value in the case when x_4 is forced into solution. [2]

(c) What is the new objective function value when second resource is increased by unit amount? [2]

OR

If S_F is the non-empty set of feasible solutions to the given linear programming problem then prove that its basic feasible solutions lie at the vertex of a convex polygon. Prove it. [5]

7. A barber shop has space to accommodate only 10 customers. He can serve only one person at a time. If a customer comes to his shop and finds it full, he goes to the 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 (a) Probability that the server being idle (b) Find average number of customers in the system. [2.5+2.5]

8. A traveling salesman has planned to visit 5 cities .He would like to start from a particular city, visit each city only once and return to the starting city. The distance (in Km) travelled is given below. Find the optimal routing schedule with minimum distance. [5]

		To City				
		A	B	C	D	E
From City	A	----	12	24	25	15
	B	6	----	16	18	7
	C	10	11	----	18	12
	D	14	17	22	---	16
	E	12	13	23	25	---

SECTION "E"

[2Q×2 =4 marks]

9. Discuss the integer programming problem

10. What is convex hull?