KATHMANDU UNIVERSITY
End Semester Examination
February/March, 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 : MAR 13 2018

SECTION "A"
[10 Q.×0.5=5 marks]

Fill in the blank(s) (question number 1 through 10) by the most appropriate word(s) or symbol(s):

1. For multi-server queueing system with 3 servers for the mean arrival time 3 minute and mean service time 9 minute the traffic intensity is.....

2. In final table of solution of LP problem the reduced cost corresponding to basic variables are.....

3. If in the initial solution table of transportation problem the degeneracy occurs then it is removed by assigning a small number $\varepsilon \to 0$ to the.....

4. Number with equal probability of pickup is called ----------

5. Assignment problem is the special type of .....

6. In salesman problem if traveling salesman has to travel n cities starting from any one of cities then number of ways of his tour plans = ----------

7. Generally the order of performance of NWCM, VAM and LCM better first is .....

8. The formula $E_j - E_i - t_{ij}$ in networking planning calculates the .....

9. Dual simplex method is also used in the study of .....

10. Kendall's notation A/B/C: D/E/F where F stands for .....

SECTION "B"
[10 Q.×0.5= 5 marks]

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. While solving LP problem by simplex method it is not possible to determine Pivot row leads to the problem to have ---------- solution
[Infeasible; optimal; unbounded multiple]

12. Dual constraints for the maximization LP-problem is .....
[$\sum a_{ij}\, y_i \geq C_j$, $\sum a_{ji}\, y_i \geq C_j$, $\sum a_{ij}\, y_j \leq C_j$, $\sum a_{ji}\, y_i \leq C_j$,]

13. On the critical path of network ----------holds
(i) $E_j - E_i = L_j - L_i = t_{ij}$; (ii) $E_j - L_j - E_i = L_i - t_{ij}$;
$(iii) E_i - E_j - L_i = E_i - t_{ij}$; (iv) $E_i - L_i = E_j - L_j = t_{ij}$

14. Indication of existence of multiple solution by simplex method is that
(i) Element of $Z_j - C_j$ row corresponding to basic variable is zero
(ii) Element of $Z_j - C_j$ row corresponding to non-basic variable is zero
(iii)Element of $Z_j - C_j$ row corresponding to slack variable is zero
(iv)Element of $Z_j - C_j$ row corresponding to surplus variable is zero

15. Artificial variable still stays in the basis even after the optimization criterion is met then the problem is said to have .....
[Feasible solution, infeasible solution, multiple solutions, non-basic solution]

16. The objective function of traveling salesman problem is .....
[$Minimize Z = \sum_{j=1}^{n}\sum_{i=1}^{n} c_{ij}x_{ij}$; $Minimize Z = \sum_{j=1}^{n+1}\sum_{i=1}^{n} c_{ij}x_{ij}$
$Minimize Z = \sum_{i=1}^{n+1}\sum_{j=1}^{n-1} c_{ij}x_{ij}$ $Minimize Z = \sum_{i=1}^{n-1}\sum_{j=1}^{n} c_{ij}x_{ij}$]

17. Branch and bound method of integer programming problem is referred to.....
a. Adding a constraint,
b. Removing a constraint,
c. Either adding or removing a constraint,
d. Removing constraint and extending the feasible solution region

18. Minimize $Z = 6x_1 + 4x_2 + 8x_3$ subject to the constraints $x_1 + x_2 \geq 5, x_2 \geq 8, 9x_1 + 10x_2 \leq 15; x_1, x_2, x_3, \geq 0$ has the auxiliary objective function for two phase method is .....
.....
[Min $Z = -A_1 - A_2 - A_3$ Min $Z = A_1 + A_2$, Min $Z = A_1 + A_2 + S_3$, Min $Z = A_1 * A_2$]

19. The rate by objective function value improves as the R.H.S quantity is increased by unity is called ---
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[Reduced cost, Opportunity cost, Relative cost, Dual price]

20. In branch and bound minimization tree, the lower bounds on objective functions value----------
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a. Do not decrease in value
b. Do not increase in value
c. Remains constant
d. Nothing can be said

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SECTION "C"
[3 Q.×7=21 marks]

1. State basic characteristics of queueing system. In a car-wash service facility, cars arrive for service according to Poisson distribution with mean 5 per hour. The time for washing and cleaning each car has exponential distribution mean 10 minutes per car. The facility cannot handle more than one car at a time and has a total of 5 parking spaces construct the network diagram for the project. [1+3+3]
   a) Find the probability that an arriving car will get service immediately upon arrival
   b) Find the expected number of parking spaces occupied.

2. The owner of a chain of fast food restaurants with branches in the country is considering a new computer system for accounting and inventory control. A computer company sent the following information about the computer installation: [3+2+2]

			Times(days)
A	Select the computer model	---	14
B	Design input/output systems	A	22
C	Design monitoring systems	B	10
D	Assemble computer hardware	B	16
E	Develop the main programs	B	12
F	Develop input/output routines	C	10
G	Create data base	C	6
H	Install the system	F,G	8
I	Test and packaging	D,E,H	24
J	Supply to branch restaurants	I	16

   a) Construct the network diagram for the project
   b) Find the expected completion time of the project
   c) Find the total floats for all the non-critical activities

3. The production of a certain manufacturing firm involves a machining process that requires raw materials and then converts them into (unassembled parts. These parts are then sent to one of the two divisions for being assembly into the final product .Division 1 is used for product X, and Division 2 for product Y. Product X requires 40 units of raw material and 10 hours of machine processing time .Product Y requires 80 units of raw material and 4 hours of machine processing time. During the period, 800 units of raw material and 80 hours of machine processing time are available. The capabilities of the two assembly division during the period are 6 and 9 units respectively. The profit contribution per unit to profit and overhead (fixed costs) is of Rs.200 for each unit of product X and of Rs.120 for each unit of product Y (a) Formulate the problem as the linear programming problem (b) determine the optimal level of product for the two products using the graphical method. [3.5+3.5]

OR

When do we enter phase II in the process of solving LP-problem by Two –Phase Method? Find the optimal solution of the following LP-problem by using Two-phase method: [1+6]

Minimize $Z = 5x_1 + 8x_2$ subject to $3x_1 + 2x_2 \geq 3$

$$x_1 + 4x_2 \geq 4$$
$$x_1 + x_2 \leq 5$$
$$x_1, x_2 \geq 0$$

SECTION "D"

[5 Q.× 5 = 25 marks]

4. What sort of LP problem does the dual-simplex method solve? By using this method find the optimal solution of following LP-problem: [1+4]

Minimize $Z = 3x_1 + x_2$ subject to $x_1 + x_2 \geq 1$

$$2x_1 + 3x_2 \geq 2$$
$$x_1, x_2 \geq 0$$

5. What is the significance of Big-M that is used in Big-M technique of Simplex method? By using this technique find the optimal solution of the following LP-problem: [1+4]

Maximize $Z = 2x_1 + 3x_2 + 4x_3$ subject to $3x_1 + x_2 + 4x_3 \leq 600$

$$2x_1 + 4x_2 + 2x_3 \geq 480$$
$$2x_1 + 3x_2 + 3x_3 = 450$$
$$x_1, x_2, x_3 \geq 0$$

OR

Find the optimal integer solution of the following integer programming problem by using Gomory' s cutting plane method [5]

Max $Z = x_1 + x_2$ subject to $3x_1 + 2x_2 \leq 5$

$x_2 \leq 2$, $x_1, x_2 \geq 0$ and integers

6. A company has factories at different places 1,2,3,4 which supply items to warehouses A,B,C,D,E.Monthly factory capacities are 200 ,175 ,150 ,325 ,respectively. Monthly warehouse requirements are 110, 90, 120, 230, and 160, respectively. Unit shipping costs (in rupees) are given in the following table: Find optimal distribution plan of items by using initial solution by Vogel's Approximation solution. [5]

Place ↓	Warehouse →				
	A	B	C	D	E
1	13	---	31	8	20
2	14	9	17	26	10
3	25	11	12	17	15
4	10	21	13	---	17

7. A salesman has to visit five cities A, B, C, D, E the distances (in hundred Km) between the five cities are as follows: If the salesman starts from city A and has to come back to city A. Find the optimal routing schedule so that distance travelled is minimum. [5]

Place ↓	Warehouse				
	A	B	C	D	E
A	--	1	6	6	4
B	7	--	8	5	6
C	6	8	--	9	7
D	8	5	9	---	8
E	4	6	7	8	---

8. In a single channel queuing system random numbers for arrivals of customers are 14,81,92,23,96 and random numbers for services of customers are 11,28,10,55,92, and using Monte Carlo simulation for the queuing system with the help of table given below: Find [5]
   (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

Inter-arrival time (min)	Probability	Service time (min)	Probability
5	0.10	7	0.10
6	0.40	10	0.35
7	0.40	9	0.45
8	0.10	15	0.10

SECTION "E"

[2 Q ×2=4 marks]

9. Show that the intersection of two convex sets is also a convex set

10. Define convex hull