

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.Sc.
Year : III

23 FEB 2025

Course : COMP 304
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date :

SECTION "A"
[10Q. \times 1 = 10 marks]

Fill in the blank space(s) by the most appropriate word(s) or symbol(s).

1. Linear programming is used to allocate _____ to activities so as to optimize the value of the objective function.
2. In M/M/1 queueing system arrival rate $\lambda = 8$ per hour and service rate $\mu = 9$ per hour then average number of customers in the system is _____.
3. Unbalanced assignment problem does not have _____.
4. If you find too long line in NIMB counter in KU then you don't join the queue but you go for launch then you are called _____.
5. If the expected time 9, variance of the network is 4, for $Z_{0.4689} = 2.12$, then schedule time = _____.
6. If $r_0 = 373, m = 1000, p = 763$ then $r_1 =$ _____.
7. The Simulation is not _____ technique.
8. Subject of study that reduces the congestion either by providing the additional server or by increasing the service rate is called theory of _____.
9. If minimize $Z = 8x_1 + 9x_2$ subject to $10x_1 + 20x_2 \geq 50$ and $30x_1 + 40x_2 \geq 60, x_1, x_2 \geq 0$ has dual objective function as _____.
10. If x_{ij} is the quantity to be transported from i^{th} city to j^{th} city, d_{ij} is the distance from i^{th} city to j^{th} city, then objective function of travelling salesman problem is _____.

19. Loop starts from the non-basic cell that has _____ in MODI method of transportation problem.
[Largest $d_{ij} > 0$ Largest $d_{ij} < 0$ $d_{ij} = 0$ Least $d_{ij} > 0$]

20. $S_3 = 10$ is the value of surplus variable then which one of the following does it indicate? _____

[Objective function value increases by 10 units when third resource is increased by 1 unit.

Objective function value decreases by 10 units when third resource is increased by unit amount.

Third resource has been shortage by 10 units while producing all the products

Third resource has been unused by 10 units while producing all the products]

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SECTION "C"
[3Q. × 7 = 21 marks]

1. Optimal solution of linear programming problem is not unique justify it. Use Big-M in method to find the optimal solution of following LP-problem:
Minimize $Z = 600x_1 + 500x_2$ Subject to the constraints
 $2x_1 + x_2 \geq 80$; $x_1 + 2x_2 \geq 60$; $x_1, x_2 \geq 0$ [1+6]

OR

In what way does the Two-Phase method differ from Big-M method? Find optimal solution of the following linear programming problem by using two phase method

[1+6]

Minimize $Z = 6x_1 + 3x_2$
subject to the constraints $x_1 + x_2 \geq 1$; $2x_1 - x_2 \geq 1$; $3x_2 \leq 2$, $x_1, x_2 \geq 0$

2. A project has the following activities then [2+1+2+2]
a. Draw the network diagram of the project
b. Find the longest time to complete the project
c. Find the probability that the project can be completed within 45 days
d. Find the time schedule during which 80% of the project can be completed

Activity	Immediate predecessors	t_0	t_m	t_p
1 - 2	---	3	4	5
2 - 3	1 - 2	1	2	3
2 - 4	1 - 2	6	7	8
2 - 5	1 - 2	5	6	7
3 - 6	2 - 3	4	6	8
4 - 7	3 - 6	6	8	10
5 - 8	2 - 4	2	5	8
6 - 9	2 - 5	5	7	9
7 - 9	4 - 7	7	9	11
5 - 9	2 - 5	4	11	12
9 - 10	5 - 8	8	10	12
8 - 10	6 - 9, 5 - 9, 4 - 7	4	6	8

P.T.O.

3. A diet conscious housewife wishes to ensure certain minimum intake of vitamins A, B, C for the family. The minimum daily (quantity) needs of vitamins A,B,C for the family are respectively 42,20,16 units. For the supply of these vitamin requirements, the housewife relies on two fresh foods X and Y. The food X provides 7, 5, 2 units of three vitamins per gram, respectively and the second one Y provides 2, 4, 8 units of the same three vitamins per gram of the foodstuff, respectively. First foodstuff X costs Rs.3 per gram and the second Y Rs.2 per gram
- Formulate this problem as linear programming problem
 - Find by graphical method how many grams of each foodstuff should the housewife buy every day to keep her food bill as low as possible?

SECTION "D"
[5Q. × 6 = 30 marks]

4. Find two optimal solutions of the following linear programming problem by using Simplex method: [1+5]
 Maximize $Z = 3x_1 + 3x_2$
 Subject to the constraints $x_1 + x_2 \leq 5$; $x_1 + 2x_2 \leq 6$; $x_1, x_2 \geq 0$

OR

Maximize $Z = 5x_1 + 3x_2$ Subject to the constraints
 $x_1 + x_2 \leq 2$; $5x_1 + 2x_2 \leq 10$; $3x_1 + 8x_2 \leq 12$; $x_1, x_2 \geq 0$
 Subject to the constraints has the following optimal solution table:

			C_j				
			5	3	0	0	0
C_B	B	X_{B_i}	x_1	x_2	s_1	s_2	s_3
5	x_1	2	1	1	1	0	0
0	s_2	0	0	-3	0	1	0
0	s_3	6	0	5	0	0	1
Z_j			5	5	5	0	0
$Z_j - C_j$			0	2	5	0	0

- What is the new objective function value when x_2 is introduced into solution
- State from the table the solution for dual variables.
- State whether the solution is non-degenerate or not
- State basic variables and non-basic variables
- Value of $s_3 = 6$ what does it mean?
- Does this problem possess alternative solution? give reason

5. A salesman must travel from city to city to maintain his accounts, He has to leave his home city and visit other cities and return home. The table shows the distances in (KM) between the various cities. Find the optimal travelling schedule and total minimum distances [4+2]

From city	To city					
		A	B	C	D	E
	A	---	375	600	150	190
	B	375	---	300	350	175
	C	600	300	---	350	500
	D	160	350	350	---	300
	E	190	175	500	300	-----

6. In a single server queueing system, the arrival random number numbers 07,86,65,91,39 and service random numbers 08,56,98,76,85 with the following probabilities distributions of the inter-arrival and service times. System starts at 7:00 AM.

Inter-arrival time (Min)	Prob	Service time (Min)	Prob.
15	0.15	5	0.20
10	0.25	10	0.15
3	0.17	5	0.35
8	0.13	8	0.30
9	0.40	10	

- Find the mean number of customers waiting in queue.
 - Find the mean time that a customer has to wait in queue
 - Find the mean time that the server remains idle
 - Find the mean inter-arrival time
 - Find the percentage of time during which server remains busy
 - Find the mean service time of a customer that he/she receives
7. A diet conscious housewife wishes to ensure certain minimum intake of vitamins A, B, C for the family. The minimum daily (quantity) needs of vitamins A,B,C for the family are respectively 42,20,16 units. For the supply of these vitamin requirements, the housewife relies on two fresh foods X and Y. The food X provides 7, 5, 2 units of three vitamins per gram, respectively and the second one Y provides 2, 4, 8 units of the same three vitamins per gram of the foodstuff, respectively. First foodstuff X costs Rs.3 per gram and the second Y Rs.2 per gram
- Formulate this problem as linear programming problem
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8. Why to study queueing theory? In a KUSMS Teaching hospital, Dhulikhel in psychiatry OPD patients' arrival are considered to be Poisson with an inter-arrival time of 20 minutes. The doctor's examination time assumed to be exponentially distributed with an average of 15 minutes. Only 3 patients can wait at a time in doctor's out cabin. [1+3+3]
- What is the chance that a new patient directly sees the doctor?
 - What is the average number of patients in the system?

SECTION "E"

[2 Q. × 2 = 4 marks]

- Why Project Network Analysis is made?
- Discuss Assignment Problem