KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.E.
Year : III

Course : COMP 304
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date :

SECTION "A"
[10Q. × 1 = 10 marks]

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

1. _____ and _____ are the constraints of the transportation problem.

2. Elements of $Z_j - C_j$ row under non-basic variables are called _____ _____.

3. In project network analysis _____ is the amount of time that a task can be delayed without delaying project completion time.

4. Number of ways of traveling 5 cities and come back to home city for a salesman is ____ _____.

5. Operations Research technique which helps in minimizing total waiting and service cost of a customer is known as _____.

6. All the floating of critical activities have their values _____ _____.

7. Actually the solution method of salesman problem is also well-known method _____ _____.

8. Probabilistic approach of simulation is known _____ _____.

9. Elements of Linear Programming problem are _____ _____.

10. In the process of optimal solution of transportation problem looping starts from the_____ _____ cell with largest positive _____.

SECTION "B"
[10Q. × 1 = 10 marks]

Fill in the blank space(s), **DO NOT TICK**, by selecting the most appropriate answers from among the given ones.

11. CPM is the _____ oriented technique.
[Time; Activity; Event; Target]

12. In assignment problem $x_{ij} = 1$ indicates that _____.
[*jth* Machine is assigned to *ith* job; *ith* Machine is assigned to *jth* job;
jth Machine is idle machine; *ith* Machine is idle]

13. Which of the following method is also known as $u - v$ method _____.
[North-West Corner method; Least Cost method;
Vogel's Approximation method; MODI method]

14. In M/ M/ 1 queuing system if customer arrive at the rate 6 per hour and server serves the customers at mean time 18 minutes per customer then probability that system is busy is _____.
[0.5555; 0.3333; 0.4444; 0.6666]

15. While solving the LP problem by simplex method sometimes after the optimization criterion is met, value of Z_j -row element under the non-basic variable observe to be Zero this indicates that _____.
[Problem attains infeasible solution; Problem attains unbounded solution;
Problem attains multiple solutions; Problem attains degenerate solution]

16. Probability of 80% confidence of complete the project in expected 10 days is 0.4251, then for $\sigma_e = 4$ the scheduled days is computed as _____.
[11.7004; 11.1008; 11.1760; 11.3860]

17. The objective function of assignment problem for the assignment of i[th] job to j[th] machine is
[$Minimize Z = \sum_{j=1}^{n}\sum_{i=1}^{n} c_{ij}x_{ij}$; $Minimize Z = \sum_{j=1}^{n+1}\sum_{i=1}^{n} c_{ij}x_{ij}$;
$Minimize Z = \sum_{j=1}^{n+1}\sum_{i=1}^{n-1} c_{ij}x_{ij}$; $Minimize Z = \sum_{j=1}^{n}\sum_{i=1}^{n+1} c_{ij}x_{ij}$]

18. In degenerate solution value of objective function of linear programing problem
[increases infinitely; basic variables are nonzero;
decreases infinitely; One or more basic variables are zero]

19. The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are
[m + n; m × n; m + n - l; m + n + l]

20. In PERT activity time distribution is _____ .
[Normal; Binomial; Beta; Poisson]

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SECTION "C"
[3Q. × 7 = 21 marks]

1. Using Charne's big-M method solve the following linear programming problem. Also state the nature of the solution. [6+1]

Minimize $Z = 2x_1 + x_2$
Subject to
$3x_1 + x_2 = 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + 2x_2 \leq 4$
$x_1, x_2 \geq 0$

OR

Show that the following LP-problem has alternative optimum solution; also find the alternative solution [4+3]

Maximize $Z = 6x_1 + 3x_2$
Subject to
$2x_1 + x_2 \leq 8$
$3x_1 + 3x_2 \leq 18$
$x_2 \leq 3$
$x_1, x_2 \geq 0$

2. Explain types of simulation. In a single channel queuing system random numbers for arrivals of customers are 91,09,16,10,13,74,33,88 and random numbers for services of customers are: 09,94,23,89,34,76,66,12, and using Monte Carlo simulation for the queuing system for 10 periods for the table given below: Find [7]
   a. Mean queue length.
   b. Mean inter arrival time of a customer
   c. Mean service time of a customer.
   d. Mean idle time of server.
   e. Mean time that a customer spends in the system
   f. Mean number of customers waiting in the queue.

Inter-arrival time (min)	Probability	Service time (min)	Probability
6	0.15	7	0.15
7	0.35	6	0.30
2	0.40	9	0.45
8	0.10	10	0.10

3. What the project net analysis is about? With the help of following information. [1+2+2+2]
   a. Draw the network diagram
   b. Find the expected project length
   c. What is the probability that the project will be completed at least 4 weeks earlier than expected time?

	Predecessors	Optimistic time(Weeks)	Most likely (Weeks)	Most pessimistic(Weeks)
A	--	4	5	6
B	---	1	2	10
C	A	2	3	4
D	A	3	4	6
E	A	2	4	5
F	C	3	5	6
G	D	4	6	7
H	B,E	3	5	6
I	H	3	4	5
J	F,G,I	2	3	4

SECTION "D"
[5Q. × 6 = 30 marks]

4. What is the indication of transportation problem to be degeneracy? Goods have to be transported from factories F_1, F_2, F_3which supply to Cities C_1, C_2, C_3, C_4, Find the optimal quantities of goods to be transported so that following costs becomes minimum.

	C_1	C_2	C_3	C_4	Supply
F_1	8	6	7	8	10
F_2	9	4	10	6	80
F_3	3	2	5	5	15
Demand	50	20	50	25	

5. An airline company has drawn up a new flight schedule involving five flights. To assist in allocating five pilots to the flights, it has asked them to state their preference scores by giving each flight a number of 10. The higher the number, the greater is the preference. Some of these flights are unsuitable to pilots owing to domestic reasons. Find optimal allocation of pilots to flights in order to meet as many preferences as possible?

		Flight Numbers				
		P	Q	R	S	T
Pilots	A	10	2	---	5	4
	B	10	9	2	8	4
	C	5	4	9	6	---
	D	3	6	2	8	7
	E	5	6	10	4	3

6. Himalayan Distillery limited has two bottling plants, one located at Kathmandu and other at Biratnagar. Each plant produces three drinks, Whisky, Rum and beer. the number of bottles produced per day is given below: [3+3]

Drink	Plant at	
	Kathmandu	Biratnagar
Whisky	3000	2500
Rum	2000	1000
Beer	5000	4000

Market survey indicates that during the month of July, there will be a demand of 20,000 bottles of whisky, 10,000 bottles of Rum and 40,000 bottles of beer. The operating costs per day for plants at Kathmandu and Biratnagar are 600 and 500 monetary units.

a. Set up Mathematical model as the LP-problem
b. For how many days each plant be run in July so as to minimize the production cost while still meeting the market demand? Solve the problem by graphical method.

7. In a local election-2079, people (voters) arrive at polling booth according to Poisson distribution at the rate of 27 per hour. The waiting room does not accommodate more than 100 people. Pooling time is exponential with mean time 2 min. [3+3]

a. What is the probability that an arriving voter will not wait
b. What is the expected time spent until voter is depart from the voting-booth?

8. For the linear programming problem Minimize $Z = x_2 - 3x_3 + 2x_5$ subject to

$3x_2 - x_3 + 2x_5 \leq 7$; $-2x_2 + 4x_3 \leq 12$; $-4x_2 + 3x_3 + 8x_5 \leq 10$;

$x_2, x_3, x_5 \geq 0$

Whose optimal table is

		C_j	1	-3	2	0	0	0
C_B	Basis	$X_B = b$	x_2	x_3	x_5	s_1	s_2	s_3
1	x_2	4	1	0	4/5	2/5	1/10	0
-3	x_3	5	0	1	2/5	1/5	3/10	0
0	s_3	11	0	0	10	1	-1/2	1
		$Zj - C_j$	0	0	-12/5	-1/5	- 4/5	0

a. If we wish to introduce x_5 into solution then what is the new objective function value. [1.5]

b. List dual prices corresponding to S_i [1.5]

c. S_3 has the value 11, what does it mean? [1.5]

d. Does this problem have alternative solution? If yes/no why? [1.5]

OR

Find the optimal solution for following linear programming problem by using the slack variable simplex method. [6]

$Maximize\ Z = 2x_1 + x_2$

Subject to $4x_1 + 3x_2 \leq 12,\ \ 4x_1 + x_2 \leq 8,\ \ 4x_1 - x_2 \leq 8,\ \ x_1, x_2 \geq 0$

SECTION "E"

[2Q. × 2 = 4 marks]

9. Explain CPM and PERT.

10. State two examples of queueing system that is used in computer Engineering