KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E.
Year : III
Course : COMP 304
Semester : II
Exam Roll No. :
Time: 30 mins.
F. M. : 20
Registration No.:
Date 26 NOV 2023

SECTION "A"

[10Q. × 1 = 10 marks]

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

1. If the 5th primal constraint of a linear programming problem is in equal sign, then it impacts in dual LP problem is that _____
2. The rate by which the objective function value improves when the particular resource is increased by unit amount is called _____.
3. Objective function of travelling salesman problem is _____ _____.
4. Primal linear programing problem $Maximize\ Z = \sum_{j=1}^{n} C_{ij}x_j$ subject to constraints $\sum_{i=1}^{n} a_{ij}\, x_j \leq b_i, \forall\, x_j \geq 0$ has dual linear programming problem as _____ _____.
5. _____ is the deterministic network analysis technique.
6. If dual variables $y_3 = 10$ then it gives the economics meaning that _____ _____.
7. Actually the solution method of salesman problem is also well-known method _____
8. In the transportation and Assignment problems the non-allocated cells are called _____ _____.
9. While numbering the nodes the tail nodes get _____number than head nodes.
10. In the solution of linear programming problem by the Simplex method when we encounter the problem that we have to divide by the zero to find the minimum ratio then the problem is said to have _____.

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. Which of the following terms is not of queuing system? _____
(i) Discipline (ii) priority (iii) impatient (iv) Event

12. If $E_2 = 6, t_{23} = 4$ *then* $E_3 =$ _____
(i)10 (ii) 2 (iii) 24 (iv) -2

13. At least one $d_{ij} = 0$ in final optimal transportation table indicates that problem gets _____
(i) Degenerate solution (ii) Non-degenerate solution
(iii) Multiple optimal solution (iv) Infeasible solution

14. In M/ M/ 1 queuing system if customer arrive at the rate 4 per hour and server serves the customers at mean time 12 minutes per customer then probability that system consists of more than 5 customers is _____
(i) 0.0014 (ii) 0.2621 (iii) 0.8000 (iv) 0.004

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 _____.
(i) Problem attains infeasible solution (ii) Problem attains unbounded solution
(iii) Problem attains multiple solutions (iv) Problem attains degenerate solution

16. Probability of 95% confidence of complete the project in expected 16 days is 0.5346 , then for $\sigma_e = 3$ the scheduled days is computed as _____
(i) 17.6038 (ii) 60.1738 (iii) 38.1760 (iv) 17.3860

17. Effective arrival rate of the M/M/1/N queueing system is given by_____
(i) $\lambda_e = \lambda(1 - P_N)$ (ii) $\lambda_e = \lambda(1 + P_{N+1})$
(iii) $\lambda_e = \lambda(1 - P_{N+1})$ (iv) $\lambda_e = \lambda(1 - P_{N-1})$

18. Slack variable $s_3 = 10$ indicates that_____
(i) The solution is optimal with objective function value =10
(ii) The solution is infeasible until third resource is 10
(iii) Third resource has not been used by 10 amount
(iv) Shortage of third resource by 10 amount

19. _____is not the assumption of travelling salesman problem.
(i) Traveler should know
(ii) Cost of travelling from one city to another
(iii) City from which the tour to be started
(iv) Number of travelers per route per day

20. When N=3,$\lambda = 2, \mu = 3$ then M/M/1/N queueing system has probability of system empty = _____
(i) 0.0207 (ii) 0.0307 (iii) 0.0407 (iv) 0.0507

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SECTION "C"
[3Q. × 7 = 21 marks]

1. With the following descriptions. [2+2+1.5+1.5]
   a. draw project network diagram
   b. Find expected time to complete the project
   c. Find free float
   d. Find independent float

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Preceded by	-----	A	A	B	B	C	C	E,F	D	G,H	E,F	I
Times(Weeks)	10	9	7	6	12	6	8	8	4	11	5	7

2. Use big –M method to find optimal solution of the following linear programming problem:

$$Maximize\ Z = 6x_1 - 3x_2 + 2x_3$$

Subject to

$$2x_1 + x_2 + x_3 \leq 16,\ 3x_1 + 2x_2 + x_3 \leq 18,\quad x_2 - 2x_3 \geq 8\ , x_1, x_2, x_3 \geq 0$$

OR

Use two phase-method to find the optimal solution of the following linear programming problem

$$Maximize\quad Z = 5x_1 - 4x_2 + 3x_3 \text{ Subject to}$$
$$2x_1 + x_2 - 6x_3 = 20,$$
$$6x_1 + 5x_2 + 10x_3 \leq 76,$$
$$8x_1 - 3x_2 + 6x_3 \leq 50\ , x_1, x_2, x_3 \geq 0$$

3. An EV motor company wishes to plan its advertising strategy. There are two media under consideration, call them TV-1 and TV-2 respectively .TV-1 has a reach of 2,000 potential customers and TV-2 has reach of 3,000 potential customers. The cost per minute of advertising is Rs.400/- and Rs.600/- of TV-1, TV-2 respectively. The company has monthly budget of Rs. 6,000. There is an important requirement that the total reach for the income group under Rs. 20,000 per annum should not exceed 4,000 potential customers. The reach in TV-1 and TV-2 for this income group is 400 and 200 potential customers. Model the problem as linear programming problem and find by graphical method, the number of minutes in two media to maximize the total reach. [3.5+3.5]

SECTION "D"

[5Q. × 6 = 30 marks]

4. Automobile inspection station has 3 stalls to inspect and station can accommodate 4 cars waiting. The arrival pattern is Poisson with a mean of 1 car every minute. The service time is exponential with mean of 6 minutes per car. Find [2+4]
   a. station's utilization factor
   b. Expected number of customers in the queue.

5. Maximize the following transportation problem:

Furnaces	Rolling Mills					
	M_1	M_2	M_3	M_4	M_5	Capacity
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	3	14
Requirement	4	4	6	8	8	

6. Maximize $Z = 2x_1 + x_2$ Subject to

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

7. A sales manager has to assign 4 salesmen to 4 territories. The possible profit for each salesman in each territory is given below. Find the assignment that maximizes the profit.

Salesmen	Territories			
	A	B	C	D
S_1	35	27	28	37
S_2	28	37	29	40
S_3	35	24	32	33
S_4	24	32	25	28

OR

State the assumptions of travelling salesmen problem and find the optimal routing scheduling of the following travelling salesman problem: [2+4]

From City	To City			
	A	B	C	D
A	∞	5	4	6
B	2	∞	7	5
C	3	2	∞	4
D	4	6	8	∞

8. Highway construction work causes one way to pass the vehicles (Bottle neck) plying in two ways-directions. The arrival of vehicles has the random numbers: 98,59,23,37,07 and random numbers for their service (passes of the vehicles through bottle neck road) has 79,15,99,54,10 . Simulate the problem and answer the questions given below with the help of following table:

Inter-arrival times (Min)	2	3	6	1	2	4
Probability	0.09	0.21	0.35	0.17	0.10	0.08
Service time(Min)	5	6	3	2	6	7
Probability	0.20	0.30	0.15	0.10	0.13	0.12

a. Expected number of customers waiting in queue.
b. Expected time that the server remains idle.
c. Expected waiting time of a customer.
d. Mean inter arrival time of a customer.
e. Mean service time of a customer.
f. Mean time that a customer spent in the system.

SECTION "E"

[2Q. × 2 = 4 marks]

9. Differentiate between CPM and PERT methods.

10. Change following assignment problem into linear programming problem.

35	45	55
20	40	50
10	15	23

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SECTION "A"

I. Mark [X] to the most appropriate option. **[10Q. × 1 = 10 marks]**

1. Which sequencing method utilizes Sulfurylase enzyme?
[ ] Sanger Sequencing [ ] Roche Pyrosequencing
[ ] Illumina Sequencing by Synthesis [ ] SoLiD sequencing

2. A structured database that contains information about metabolic pathways is
[ ] Uniprot [ ] PDB [ ] KEGG [ ] TAIR

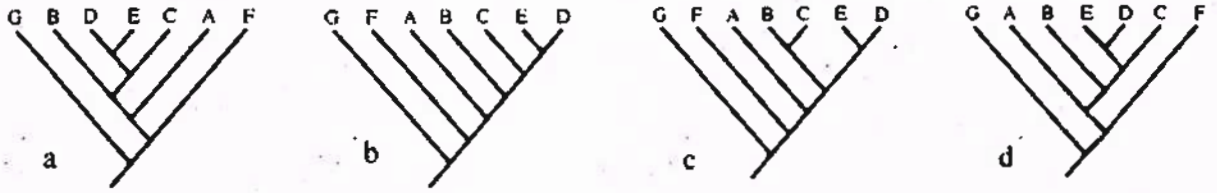
3. The type of data stored in the 4th column of Gene Feature Format is:
[ ] chromosome name [ ] source
[ ] feature name [ ] feature start coordinate

4. Nucleotide query against a Nucleotide database is made through
[ ] BLASTP [ ] BLASTX [ ] TBLASTN [ ] TBLASTX

5. Calculate sequence similarity percentage for the sequences:
i) ATATCTGTTTAT ii) ATCTGTTTATAT
[ ] 25% [ ] 33.33% [ ] 66.66 % [ ] 75%

6. The number of rooted trees (NR) for 8 taxa is
[ ] 945 [ ]10,395 [ ] 135,135 [ ] 2,027,025

7. Which of the four trees below depicts a different pattern of relationships than the others?



[ ] a [ ] b [ ] c [ ] d

8. During prediction of operon, if the distance of the two gene is between 30 and 60 bp with the linkage shared in less than five genomes; then
[ ] score is assigned 1 [ ] score is assigned 2
[ ] score is assigned 3 [ ] score is assigned 4

9. Which of the amino acid has higher tendency to be found in beta sheets?
[ ] Methionine [ ] Lysine [ ] Serine [ ] Threonine

10. Which of the RNA base pairing is not possible?
[ ] G-C [ ] A-U [ ] G-U [ ] A-C

II. Fill in the blanks. **[5Q. × 1 = 5 marks]**

11. PAM 200 matrix equates to _____ percent sequence identity.

12. The default word size in megablast is _____.

13. Probability of current state is determined by previous 2 states in _____ order Markov model.

14. _____ test compares two tree topologies and distinguished whether one tree is significantly better than other or not.

15. A right handed, spiral alpha helix has _____ amino acids per turn.

III. Describe in one sentence: **[5Q. × 1 = 5 marks]**

16. Gene ontology:

17. Orthologs:

18. Paraphyletic clade:

19. Shine Delgarno Sequence:

20. Phi angle: