KANYASHREE UNIVERSITY

M.Sc. 2nd Semester Examination-2024
Subject: Mathematics
Course- CC 11
Operations Research

Full Marks-40   **Time-2.00 Hours**

GROUP - A
(Answer **any four** of the following)   **(5×4=20)**

1. Solve the travelling salesman problem with the following cost matrix $[c_{ij}]_{4\times4}$, where c_{ij} is the cost of travelling from city i to city j:

FROM \ TO	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

2. Use dual simplex method to solve the following LP problem:

    Minimize $Z = x_1 + x_2$

    subject to the constraints $(i)\,2x_1 + x_2 \geq 2,$

    $(ii)\,-x_1 - x_2 \geq 1$ and $x_1, x_2 \geq 0.$

3. In a railway marshalling yard, goods trains arrive at a rate of 48 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 30 minutes. Calculate:

    I.   the probability that the yard is empty

    II.   the average queue length, assuming that the line capacity of the yard is nine train.

4. Readymade garments manufacturer has to process 7 items through three stages of production, cutting, sewing and packing. The time taken for each of these items at the different stages are given below in appropriate units:

Item		1	2	3	4	5	6	7
Process time	Cutting	5	7	3	4	6	7	12
	Sewing	2	6	7	5	9	5	8
	Packing	10	12	11	13	12	10	11

Find an order in which these seven items are to be processed so as to minimize the time taken to process all the items through all the three stages and also find the idle time for each stage.

5. An architect has been awarded a contract to prepare plans for an urban renewal project. The job consists of the following activities and their estimated times:

Activity	Description	Immediate Predecessor	Time
A	Prepare preliminary sketches	----	2
B	Outline specifications	----	1
C	Prepare drawings	A	3
D	Write specifications	A, B	2
E	Run off prints	C, D	1
F	Have specification	D	3
G	Assemble bid packages	E, F	1

(a) Draw the network diagram of activities for the project.

(b) Indicate the critical path, and the total project duration.

6. Applying Dijkstra's algorithm to find the shortest path from the vertex v_1 to v_4 in the following graph.
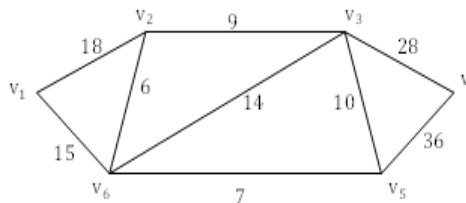
GROUP – B

(Answer **any two** of the following)   (10× 2=20)

1. Use the revised simplex method to solve the following LP problem:

Maximize $Z = x_1 + x_2$

subject to the constraints $(i) 3x_1 + 2x_2 \leq 6,$

$(ii) x_1 + 4x_2 \leq 4$ and $x_1, x_2 \geq 0.$

2. Derive the difference equations for a queuing model with a single service station, Poisson arrivals and exponential service time. Find the probability of exactly n units and no unit in the queuing system.

3. Solve the following all integer programming problem using the Gomary cutting plane method or branch and bound method.

Maximize $Z = 2x_1 + 3x_2$

subject to the constraints

(i) $6x_1 + 5x_2 \leq 25,$ (ii) $x_1 + 3x_2 \leq 10$ and $x_1, x_2 \geq 0$ and integers.

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