15. a) Illustrate the General structure of the queuing system in detail.

(OR)

b) The failure rates of 1000 street bulbs in a colony are summarized in the table.

End of month	1	2	3	4	5	6
Probability of failure to date	0.05	0.20	0.40	0.65	0.85	1.00

The cost of replacing an individual bulb is Rs. 60. If all the bulbs are replaced simultaneously, it would cost Rs. 25 per bulb. Any one of the following two options can be followed to replace the bulbs.

i) Replace the bulbs individually when they fail (individual replacement policy)

ii) Replace all the bulbs simultaneously at fixed intervals and replace the individual bulbs as and when they fail in service during the fixed interval (group replacement policy).

Find out the optimal replacement policy, i.e., individual replacement policy or group replacement policy. If group replacement policy is optimal, then find at what equal intervals should all bulbs are replaced.

PART – C (1×15=15 Mark

16. a) Solve the following linear programming problem using the graphical method.

Maximize $Z = 6X_1 + 8X_2$

Subject to

$$5X_1 + 10X_2 \leq 60$$

$$4X_1 + 4X_2 \leq 40$$

$$X_1 \text{ and } X_2 \geq 0$$

(OR)

b) What is a decision tree ? Illustrate with an example.

b) A local travel agent I planning a charter trip to a major seaport. The eight-day and seven-night package includes the fare for round trip, surface transportation, board and lodging and selected tour options. The charter is restricted to 200 persons and experience indicates that there will not be any problem for getting 200 clients. The problem for the travel agent is to determine the number of Deluxe, Standard and Economy tour packages to offer for this charter. These three plans differ according to seating and service for the flight, quality of accommodations, meal plans and tour options. The following table summarizes the estimated prices for the three packages and the corresponding expenses for the travel agent. The travel agent has hired an aircraft for the flat fee of Rs. 2,00,000 for the entire trip.

In planning the trip, the following considerations must be taken into account :

i) At least 10% of the packages must be of the deluxe type.

ii) At least 35% but not more than 70% must be of the Standard type.

iii) At least 30% must be of the Economy type.

iv) The maximum number of deluxe packages available in any aircraft is restricted to 60.

v) The hotel desires that at least 120 of the tourists should be on the Deluxe and Standard packages taken together.

Prices and Costs for Tour Packages per Person

Tour Plan	Price	Hotel Costs	Meal and Other Expenses
Deluxe	10,000	3,000	4,750
Standard	7,000	2,200	2,500
Economy	6,500	1,900	2,200

The travel agent wishes to determine the number of packages to offer in each type so as to maximize the total profit.

1) Formulate this as a linear programming problem.

2) Restate the above LPP in terms of two decision variables, taking advantage of the fact that 200 packages will be sold.

3) Find the optimal solution using graphical method for the restated problem and interpret your results.