Find the assignment of fielders to fielding positions to have maximum possible catches.

(c) A company manufacturing microwave ovens uses Rs. 1,05,000 worth of LED readout circuits annually in its production process. Cost per order is Rs. 55, and the carrying cost against this classification of inventory is 15% of the average balance per year. The company follows an EOQ purchasing system and to date has not been offered discounts on these circuits. Now the supplier has indicated that if the company would buy its circuits four times a year in equal quantities, a discount of 2.5% off list price would be given in return. Give your advice to the company in regard to that offer.   (10,10)

M.COM. : SEMESTER – II (NC)   F

Paper No. – 4201

Quantitative Techniques for Business Decisions

Time : 3 Hours

Maximum Marks : 100

(Write your Roll No. on the top immediately on receipt of this question paper.)

*Attempt **all** questions.*
*Attempt **all** parts of the question together.*
All questions carry equal marks.

1. (a) Given below is the LPP

   Maximize $Z = 2x + 3y + 4z$

   Sub to :

   $$3x + y + 6z \leq 600$$

   $$2x + 4y + 2z \geq 480$$

   $$2x + 3y + 3z = 540$$

   $$x, y, z \geq 0,$$

   (i) Use simplex method to solve the given problem.

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(ii) Write the dual and find out the solution of dual variables.

(iii) The coefficient of 'x' in the objective function changes to 5. What will be its effect on the optimality?

(b) Trucks in a service station arrive at rate of twenty per hour and workman can cope with thirty per hour for an eight hour day. You are required to calculate

(i) The average time in the queue

(ii) Probability that a truck arriving faces a queue

(iii) What hike in wages of workman is justified for a day who assures to raise the service rate to 40 per hour if waiting charges of each truck is Rs. 250 per hour? (12,8)

OR

(c) Arrivals at the enquiry counter of a transport company are poisson distributed with an average of 6 per hour. The time that the customers spend in seeking information from the clerk stationed at the counter is known to be exponentially distributed with an average of three minutes. Using this information determine:

(i) The probability that a customer reaching the counter shall have to wait for getting the needed information.

(ii) The probability that a queue shall be formed.

(iii) The expected time that a customer shall wait in the queue to obtain information.

Suppose that the company manager employs another clerk if he is convinced that the customer has to wait for at least 4 minutes for receiving information. What arrival rate would justify employing the second clerk?

(d) A truck company has a budget of Rs. 40,00,000 and it is deciding to buy 3 types of vehicles. Further details are as follows:

Vehicle type	Capacity	mileage	Cost	Crew requirement per shift	Average run per day
A	10 tonnes	35kmph	80,000	1	18 hrs in 3 shifts
B	20 tonnes	30kmph	1,30,000	2	18 hrs in 3 shifts
C	18 tonnes	30kmph	1,50,000	2	18 hrs in 3 shifts

Company has 150 drivers available and the total number of vehicles must not exceed 30. Company wants to maximise its capacity in tonne-kms per day. Formulate it as LPP.

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2. (a) Demand for an item is deterministic and constant over time at 500 units per year. The item costs Rs. 60 per unit and the cost of placing an order are estimated to be Rs. 10. The inventory carrying cost is 25% and the shortage cost is Rs. 2 per unit per month. Find the optimal ordering quantity if stockouts are permitted and the units can be back-ordered at the shortage cost indicated. What quantity should be allowed for back ordering ? What is the maximum inventory at any time of the year ? State the rules for constructing a project network.

(b) Given below is the information related to per kilometre cost of transportation

Factory	X	Y	Z	W	Supply
A	25	55	40	60	60
B	35	30	50	40	140
C	36	45	26	66	150
D	35	30	41	50	50
Demand	90	100	120	140	

(i) Solve and assess the optimal cost.

(ii) A new transporter agrees to transport goods from C to W at a unit cost of Rs. 50, analyse its impact on current optimal solution.

(6,14)

OR

(c) Machines in a repair station arrive at rate of forty per hour and workman can cope with sixty per hour for an eight hour day. You are required to calculate

(i) The average time in the system

(ii) The average length of the queue of machines that form from time to time

(iii) The implied cost of machine's time if owner of the system has rejected a faster service which could raise cost by Rs. 800 per day and would raise the service to eighty per hour.

(8)

(d) Formulate the given problem as LPP.

A firm is planning to advertise its product through two mediums, i.e., leading newspaper and billboards during the month of April-May 2016. The firm has the budget of Rs. 5 lack. Each newspaper ad of

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8" × 6" cost Rs. 50,000 and municipal charges for the billboard are Rs. 20,000 per day display excluding the cost of developing the bill-board of size 8' × 6'. The target audience size is estimated as 2 lakh and it is expected that newspaper ad will have 70% and billboards will have 50% reach among the target audience. Space in newspaper is available for maximum often continuous days and billboard to be displayed for at least fifteen continuous days. If the firm expects to maximize the total exposures (reach×frequency) among the target audience, what should be the optimum number of repetitions of newspaper ads and number of days for billboard display ? Use graphical method. (12)

3. (a) On January 16 (current year), Bakery A had 40% local market share while bakeries B and C had 40% and 20% respectively.

Based on a study by a marketing research firm, the following facts were stated;

Bakery A retains 90% of its customers, gains 5% of B's customers and 10% of C's customers.

Bakery B retains 85% of its customers, gains 5% of A's customers and 7% of C's customers.

Bakery C retains 83% of its customers, gains 5% of A's customers and 10% of B's customers.

What will be each firm's share on January 17 next year and their individual share at equilibrium ?

(b) A company has a total of Rs. 48,000 to invest in 5 different proposals. The NPV and Cash out-flows are as follows :

Investment	NPV (Rs.)	Cash outflow (Rs.)
I	20,000	12,000
II	28,000	14,000
III	18,500	7,000
IV	27,500	13,000
V	31,000	16,000

(i) The company should not make more than 3 investments.

(ii) The company should invest in investment II if it invests in investment III.

(iii) If the company invests in proposal IV, then it should not invest in proposal V.

Formulate the problem as IPP. Do not solve.

If for certain reasons, salesman D cannot be assigned to territory III, will the optimal assignment schedule be different ? If so, show the new assignment schedule. (10,10)

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OR

(c) ABC Ltd. Trade in perishable commodity. It purchases goods from a wholesaler which is a random variable and sells them to retailers. Both the supply and demand are expressed in batches of 50 units and over the past working year (300 days), the firm has produced the following records of supplies and demands:

Wholesaler Supplies	Number of days occurring	Customer's Demand	Number of days occurring
50	60	50	60
100	90	100	60
150	90	150	150
200	60	200	30

ABC Ltd. purchases the goods at Rs. 6 per unit and sells at Rs. 10 per unit. Unsold units at the end the days are worthless and there are no storage facilities. Unsatisfied demand on any day results in a loss of Rs. 2. Using the random numbers; 8, 4, 8, 0, 3, 3, 4, 7, 9, 6, 1 and 5, Simulate six days trading and estimate the annual profits.

(d) An insurance company has decided to modernize and refit one of its branch offices. Some of the existing office equipments will be disposed off and the remaining will be returned back to the offices after the completion of renovation work. Tenders are invited from selected contractors. The contractors will be responsible for all the activities connected with renovation work except the removal of old equipment and its subsequent replacement. Major activities of the project have been identified with their durations and immediately preceding activities.

Activity	Description	Duration (Weeks)	Immediate Predecessors
A	Design new premises	14	-
B	Obtain tenders from the contractors	4	A
C	Select the Contractor	2	B
D	Arrange details with selected Contractor	1	C
E	Decide which equipment is to be used	2	A
F	Arrange storage of equipment	3	E
G	Order disposal of other equipment	2	E
H	Order new equipment	4	E
I	Take delivery of new equipment	3	H,L
J	Renovation take Place	12	K
K	Remove old equipment for storage or disposal	4	D,F,G
L	Cleaning after the contractor has finished	2	J
M	Return old equipment for storage	2	H,L

Draw the network diagram and compute the earliest start time, the earliest finish time and latest start time, latest finish time of activities. (8,12)

4. (a) You are given the following details of a project:

Activity	Preceding activity	Normal		Crash	
		Time (weeks)	Cost (Rs 000)	Time (weeks)	Cost (Rs 000)
A	--	10	20	7	30
B	--	8	15	6	20
C	B	5	8	4	14
D	B	6	11	4	15
E	B	8	9	5	15
F	E	5	5	4	8
G	A,D,C	12	3	8	4

Overhead cost of the project is Rs. 400 per day.

(i) Compute the normal duration of the project, its cost and the critical path,

(ii) Compute the project cost and state the lowest cost with associated time and shortest time with associated cost. (20)

OR

(b) What is operation research? Discuss the importance of operation research in decision making process.

(c) Distinguish between fixed order quantity system and periodic review system. What are the assumptions of basic EOQ model and discuss it sensitivity? (8,12)

5. Attempt any **two** of the following :

(a) Explain the following :

(i) Merge and burst events

(ii) Infeasibility and unboundedness

(iii) Resource Levelling

(iv) ABC analysis of inventory management

(b) The captain of the team has to allot the fielding positions to five fielders on the field. The average number of catches taken by each one of them are :

Fielders	Fielding Positions				
	Point A	Point B	Point C	Point D	Point E
I	20	48	35	25	60
II	22	30	26	35	37
III	50	38	40	60	50
IV	20	39	30	18	35
V	58	50	59	65	53