OR02

SECTION I (marks : 30)

Roll No.
Total No. of Questions : 9 **Total No. of Printed Pages :** 4
Duration(hrs.) : 3
Section 1 and 2 to be answered on separate sheets.
Note : Q1 is compulsory. Write any two questions from Q2 to Q4.

Q1] XYZ distributes a variety of food products that are sold through grocery store and supermarket outlets. The company receives orders directly from the individual outlets, with a typical order requesting the delivery of several cases of anywhere from 20 to 50 different products. Under the company's current warehouse operations, warehouse clerks dispatch order picking personnel to fill each order and have the goods moved to the warehouse shipping area. Because of the higher labor costs and relatively low productivity of hand order picking management has decided to automate the warehouse operation by installing a computer controlled order-picking system along with a conveyor system for moving foods from storage to the warehouse shipping with a conveyor system for moving foods from storage to the warehouse shipping area. XYZ's director of materials management is appointed as project manager in charge of the automated warehouse system. After consulting with members of engineering staff and warehouse management personnel, the director has compiled a list of activities associated with the project as follows. (10)

Activity	Predecessors	Optimistic time	Most probable time	Pessimistic time
A	-	4	6	8
B	A	5	7	15
C	A	4	8	12
D	B	15	20	25
E	B	10	18	26
F	C	8	9	16
G	E	4	8	12
H	D,F	1	2	3
I	G,H	6	7	8

(A)XYZ'S top management has established a required 52-week completion time for the project. Can this completion time be achieved? Include probability information in your discussion. What recommendations do you have if the 52-wweek completion time is required?

(B) If the management requests that activity times be shortened to provide an 80% chance of meeting the 50 week completion time. If the variance in the project completion time is the same as you found in part (a) above, how much should the expected project completion time be shortened to achieve the goal of an 80% chance of completion within 50 weeks?

Activity	A	B	C	D	E	F	G	H	I
Crashed Activity(weeks)	4	6	4	15	15	8	6	1	5
Normal cost(Rs.)	1000	1000	1500	2000	5000	3000	8000	5000	10000
Crashed Cost(Rs.)	1900	1800	2700	3200	8000	4100	10250	6400	12400

N.B. (i) The area for S.N.V. Z=0 and Z=1.4302 is given as 0.4236.
(ii) The area for S.N.V. Z=0 and Z=0.845 is given as 0.3009.

Q2] Four warehouses with capacities of 85, 35, 50 and 45 tons were receiving the materials from 3 factories with their supply capacity as 70, 55 and 90 tons on regular basis. The transportation costs per ton from factories to warehouses are given in the following table. (10)

Factory	Warehouse			
	1	2	3	4
I	6	1	9	3
II	11	5	2	8
III	10	12	4	7

A feasible solution states that from Factory I, 25 tons have to be transported to warehouse 3 and 45 tons to warehouse 4, simly 30 tons and 25 tons were transported from factory II to warehouse 1 & warehouse 3 resp. However from factory III, 55 tons and 35 tons were transported to warehouse 1 & 2 resp.
Is the transportation schedule optimum? If not, modify it and obtain optimum solution and optimum cost.

(2)

Q3] (a) How do you solve an unbalanced transportation problem of maximization type?
(b) A sales manager has to assign salesman to four territories. He has four candidates of varying experience and capabilities. The manager assesses the possible profit for each salesman in each territory if given below.

Salesman	Territory			
	T1	T2	T3	T4
S1	35	27	28	37
S2	28	34	29	40
S3	35	24	32	33
S4	24	32	25	28

Find the assignment of salesman to the territories so that total profit is maximum. (8)

Q4] Machine A costs Rs. 45,000 and the operating costs are estimated at Rs. 1,000 for the first year increasing by Rs. 10,000 per year in the second and subsequent years. Machine B costs Rs. 50,000 and operating costs are Rs 2,000 for the first year, increasing by Rs 4,000 in the second and subsequent years. If we now have a machine of type A, should we replace it with B? If so when? Assume that both machines have no resale value and future costs are not discounted. (10)

Section II (Marks : 30)

NB: 1) Attempt any three questions
2) Figures to the right of the question indicates full marks
3) Graph paper and statistical table will be provided on request

Q1 A: What is the –principal of duality in linear programming? Explain its advantages (3)

B: Solve the following LPP by Simplex Method

Maximize $Z = 30x_1 + 20x_2$

Subject to

$x_1 + 2x_2 \leq 80$

$3x_1 + 2x_2 \leq 120$

$x_1, x_2 \geq 0$ (7)

Q2 A: What are inventories? Why does firm carry inventories? (3)

B: The Demand rate of a particular item is 12000 units per year. The set up cost per run is Rs.350 and holding cost is Rs0.20 per unit per month. If no shortages are allowed and the replacemet is instantaneous , determine

i) Optimum run (lot) size
ii) The Optimum scheduling period
iii) Minimum Total expected annual cost

(7)

Q3 A: State advantages and uses of Simulation (3)

B: The following data is observed to a tea serving counter. The arrival is for one minute interval

No of persons arriving :	0	1	2	3	4	5
Probability :	0.05	0.15	0.40	0.20	0.15	0.05

The service is taken as 2 persons for one minute interval. Using thefollowing random numbers, simulate for 15 minutes period

69, 54, 94, 01, 80, 73, 20, 26, 90, 79, 25, 48, 99, 24, 89

Calculate also the average number of persons waiting in the queue per minute. (7)

Q4 : Write short notes on any two

i) Sensitivity analysis
ii) Graphical method in LPP
iii) Queuing theory (M/M/1:FCFS model)

(10)

Q5 : Solve any two

i) A television repairman finds that the time spent on his job has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets follow a Poisson distribution approx. with an average rate of 10 per 8 hour day, what is the repairmans idle time each day?
How many jobs are ahead of the average set just brought in?

ii) Use graphical method to solve the following LPP

Max $Z = 50x_1 + 30x_2$

Subject to (Raw material) $2x_1 + x_2 \geq 18$

(Labour Hours) $x_1 + x_2 \geq 12$

$3x_1 + 2x_2 \leq 34$

$x_1, x_2 \geq 0$

iii) Obtain dual of the following LPP

Max $Z = x_1 - x_2 + 3x_3$

Subject to $x_1 + x_2 + x_3 \leq 10$

$2x_1 - x_3 \leq 2$

$2x_1 - 2x_2 + 3x_3 \leq 6$

$x_1, x_2, x_3 \geq 0$

(10)
