

AC-3369

Seat No. _____

M. Phil. Examination

April / May – 2003

Mathematics : Paper-III

(Research Methodology)

Time : 3 Hours]

[Total Marks : 75

Instruction : Each question carries equal marks.

Q.1 a) The following table shows all the necessary information on the availability of supply to each warehouse, the requirement of each market and unit transportation cost (in rupees) from each warehouse to each market.

		Market				Supply
		P	Q	R	S	
Warehouse	A	6	3	5	4	22
	B	5	9	2	7	15
	C	5	7	8	6	8
Demand		7	12	17	9	45

The shipping clerk has worked out the following schedule from experience: 12 - units from A to Q, 1 - unit from A to R, 9 - units from A to S, 15 - units from B to R, 7 - units from C to P and 1 - unit from C to R.

- i) Check and see if the clerk has the optimal schedule.
 - ii) Find the optimal schedule and minimum total transportation cost.
- b) A department has five employees with five jobs to be performed. The time (in hours) each man will take to perform each job is given in the effectiveness matrix.

		Employees				
		I	II	III	IV	V
Jobs	A	10	5	13	15	16
	B	3	9	18	13	6
	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours ?

Q.2 a) Draw a net-work for the simple project of erection of steel works for a shed. The various elements of project are as under :

Active code	Description	Pre-requisites
A	Errect site workshop	-
B	Fence Site	-
C	Bend reinforcement	A
D	Dig foundation	B
E	Fabricate Steel work	A, C
F	Install concrete plant	B
G	Place reinforcement	C, D
H	Concrete foundation	G, F
I	Paint steel work	E
J	Erect steel work	H, I
K	Give finishing touch	J

b) A small assembly plant assembles PC's through 9 interlinked stages according to following precedence / process :

Stages from to	Duration in hours
1 - 2	4
1 - 3	12
1 - 4	10
2 - 4	8
2 - 5	6
3 - 6	8
4 - 6	10
5 - 7	10
6 - 7	0
6 - 8	8
7 - 8	10
8 - 9	6

- Draw net-work representing above assembly work.
- Tabulate earliest start, earliest finish, latest start and latest finish time for all stages.
- Find the critical path and assembly duration.
- Tabulate total float, free float and independent float.

Q.3 a) Derive lot - size model when shortages are allowed.

b) Discuss the probabilistic inventory model when demand is uniform, production of commodity is instantaneous and lead-time is zero.

Q.4 a) Derive the difference equations for the queueing model $\{(M / M / 1) : (\infty / FCFS)\}$ and solve them.

b) At a one-man barber shop, customers arrive according to poisson distribution with a mean arrival rate of 5 per hour and his hair cutting time was exponentially distributed with an average hair cut taking 10 - minutes. It is assumed that because of his excellent reputation, customers were always willing to wait. Calculate

i. Average number of customers in the shop and the average number of customers waiting for a hair cut.

ii. The per cent of time an arrival can walk right in without having to wait.

iii. The percentage of customers who have to wait prior to getting into the barber's chair.

Q.5 a) The cost of a machine is Rs. 6100 and its scrap value is Rs. 100. The maintenance costs found from experience are as follows :

Year	1	2	3	4	5	6	7	8
Maintenance cost	100	250	400	600	900	1200	1600	2000

When should the machine be replaced ?

b) A company has a steady demand of a product of 40 items per month. The purchase cost is Rs. 6 per item and the cost of ordering is Rs. 15 per order. If stock holding cost is 20 % per annum how frequently should the company replenish the stock ?