PG/IS/COMM/CM–1103/08

2008

[1st Semester]

COMMERCE

(*Operations Research*)

PAPER—1103

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

UNIT – I

[*Marks* : 20]

1. Answer any *two* of the following : 5×2

(*a*) Assignment is primarily for minimisation. How can you transform it into a model for solution of maximisation model ?

(*b*) What is degeneracy in a transportation problem ? How can it be removed ?

(*c*) Write a short note on the shadow price in simplex solution of a linear programming problem.

(*d*) What are the advantages in dual conversion of an LPP ? Convert the following problem into its dual form :

$$\begin{aligned} \text{Minimise} \quad & Z = 4x_1 + 6x_2 + 3x_3 \\ \text{subject to} \quad & 3x_1 + 4x_2 + x_3 \geq 10 \\ & -2x_1 - 3x_2 + 2x_3 \leq -5 \\ & x_1 - 2x_2 - 3x_3 \leq -1 \\ & 3x_1 + 2x_2 + 2x_3 \geq 5 \\ \text{where} \quad & x_1, x_2, x_3 \geq 0. \end{aligned}$$

2. Answer any *one* of the following : 10×1

(*a*) Solve the following problem by simplex method :

Maximise $Z = 3x + 2y$

subject to $x + y \leq 18$

$x + 3y \leq 36$

$2x + y \leq 26$

$3x + y \leq 36$

where x and $y \geq 0$.

(*b*) Solve the following travelling salesman problem to minimise the distance (in km.) travelled.

	A	*B*	*C*	*D*	*E*
A	–	14	26	27	17
B	8	–	18	20	9
C	12	13	–	20	14
D	16	19	24	–	18
E	14	15	25	27	–

UNIT - II

[*Marks* : 20]

3. Answer any *two* of the following : 5×2

(*a*) What statistical properties are usually assumed as to the arrival pattern of the arriving units and to the inter-arrival times between each two successive arrivals ?

(*b*) Explain, in detail, what constitutes the ordering cost and carrying cost in inventory problems.

(*c*) Choose the *correct* statement and justify your choice :

(*i*) All paths of a network may be non-critical.
(*ii*) All paths of a network must be critical.
(*iii*) At least one path of a network must be critical.
(*iv*) At least one path of a network must be non-critical.

(*d*) What do you mean by a 'non-empty queue' ? How can you determine the average length of such a queue ? What is jockeying ?

4. Answer any *one* of the following : 10×1

(*a*) Below is given a related set of activity time estimates (in days) for a PERT network :

Activity → / Time ↓	1-2	1-4	1-3	2-6	3-4	3-5	3-7	4-6	5-6	5-7	6-8	7-8
t_o	10	12	8	4	0	12	6	9	4	0	5	9
t_m	13	15	11	7	0	18	12	12	6	0	8	12
t_p	22	18	20	16	0	36	18	27	8	0	11	33

You are required to find

(*i*) Expected completion time of each activity.

(*ii*) The critical path and its duration.

(*iii*) Standard deviations of expected completion times of activities on the critical path.

(*iv*) Standard deviation of the expected completion time of the project.

(*v*) Independent floats of the critical activities.

2×5

(*b*) (*i*) Find the optimal order quantity for the price break inventory problem which is given as follows :

Annual demand – 200 units

Carrying charges – 10% p.a.

Ordering cost – Rs. 20 per order

Quantity (Q)	Price (Rs./ Unit)
$Q \leq 50$	10·00
$50 < Q \leq 100$	9·00
$100 < Q$	8·00

(*ii*) Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially, with mean 3 minutes.

(*I*) What is the probability that a person arriving at the booth will have to wait ?

(*II*) What is the average number of arrivals who are waiting for their turn to make a call ? 6 + 4

[*Internal Assessment* : 10 Marks]