[This question paper contains 6 printed pages.]

1273 *Your Roll No.* .....

B.A. Programme / III **C**

OPERATIONAL RESEARCH

(T)

Paper III – Operational Research – II

(Admissions of 2004 and onwards)

Time : 3 Hours *Maximum Marks : 75*

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

Answer any **six** *questions.*
All *questions carry equal marks.*

1. Estimated times of the jobs of a project are given below :-

Jobs	A	B	C	D	E	F	G	H	I	J	K	L
Time	13	5	8	10	9	7	7	12	8	9	4	17

The constraints governing the jobs are as follows

A and B are start jobs

A controls C, D, and E

B controls F and J

P.T.O.

G depends on C

H depends on D

E and F controls I and L

K depends on J

I. is also controlled by K

G. H. I. L are last jobs

Draw a network. find project duration and critical path of the network. Determine earliest start and finish time. latest start and finish of the activity. total float. free float. independent float of the activities. (12½)

2. The data for the PERT network is displayed in the table given below. Determine the critical path and expected duration of completion of the entire project. variance of each activity and variance of project length. Give answer to the following —

(a) What is the chance of completing the project between 45 and 54 days ?

(b) If becomes later known that the three time estimates for activity 4-6 have to be revised to 14-20-32. What impact does this have on project duration. What will be the probability that the project can now be completed, before 46 days

Activity	Optimistic time (a)	Most likely time (b)	Pessimistic time (c)
1 – 2	2	4	6
1 – 3	6	6	6
1 – 4	6	12	24
2 – 3	2	5	8
2 – 5	11	14	23
3 – 4	15	24	45
3 – 6	3	6	9
4 – 6	9	15	27
5 – 6	4	10	16

Z	$P(Z \leq Z)$	Z	$P(Z \leq Z)$	Z	$P(Z \leq Z)$
0	0.5	0.5	0.692	1	0.841
0.25	0.599	0.75	0.778	1.5	0.692
				1.67	0.953
				2	0.977

(12½)

3. (a) Differentiate between flow shop and job shop sequencing problems.

(b) Solve the following 2-job, 4 machines job shop problem –

The technological ordering of jobs is :

Job 1 : A B C D

Job 2 : D B A C

P.T.O.

The processing times of jobs on the machines are –

Processing Time

	A	B	C	D
Job 1	2	4	6	2
Job 2	3	4	2	5

(3½,9)

4. Solve the following integer programming problem –

Max $Z = 2x_1 + 20x_2 - 10x_3$

S.t. $2x_1 + 20x_2 + 4x_3 \leq 15$

$6x_1 + 20x_2 + 4x_3 = 20$

x_1, x_2, x_3 are nonnegative integers. (12½)

5. (a) Explain dynamic programming. How it is different from linear programming.

(b) State Bellman's principle of optimality and use it to solve :–

Max $Z = x_1 x_2 \cdots x_n$

S.t. $x_1 + x_2 + \cdots + x_n = c$

$x_1 x_2 \cdots x_n \geq 0$ (4,8½)

6. The owner of a chain of four grocery stores has purchased six crates of fresh strawberries. The estimated probability distribution of potential sales of

the strawberries before spoilage differ among four stores. The following table gives the estimated total expected profit at each store, when it is allocated various no. of crates –

No. of boxes	Store 1	2	3	4
0	0	0	0	0
1	4	2	6	2
2	6	4	8	3
3	7	6	8	4
4	7	8	8	4
5	7	9	8	4
6	7	10	8	4

For administrative reasons, the owner does not wish to split crates between stores. However he is willing to distribute Zero crates to any one of his stores.

Find the allocation of six crates to four stores so as to maximize the expected profit. (12½)

7. (a) Define reliability function, Hazard rate function and MTBF. Formulate the relationship of hazard rate function and MTBF with reliability function.

(b) Define preventive maintenance, corrective maintenance and age replacement. (8.4½)

P.T.O.

8. (a) Discuss the replacement policy for the equipment which deteriorates gradually with time where time is continuous and the value of money does not change with time.

   (b) Prove that the hazard rate for a series system is the sum of hazard rates of its components.

(7½,5)

9. (a) Describe branch and bound method for solving integer programming problem.

   (b) Explain Johnson's optimality rule for solving n-jobs & m machines flow shop problem.

(6½,6)