1505E557   Candidate's Seat No

M.Phil Science Examination
Paper-II : Mathematics
Time : 3 Hours]   May-2017   [Max. Marks : 70]

1 (a) Find an optimal sequence for the following sequencing problem of four jobs and five   7
machines when passing is not allowed, of which processing time (in hours) is given
below :

Job	Machine				
	A	B	C	D	E
1	7	5	2	3	9
2	6	6	4	5	10
3	5	4	5	6	8
4	8	3	3	2	6

Also find the total elapsed time and idle time of each machine.

(b) There are nine jobs, each of which must go through two machines P and Q in the   4
order PQ, the processing times (in hours) are given below:

Machine	Job(s)								
	A	B	C	D	E	F	G	H	I
P	2	5	4	9	6	8	7	5	4
Q	6	8	7	4	3	9	3	8	11

Find the sequence that minimizes the total elapsed time T. Also calculate the total
idle time for the machines in this period.

(c) Discuss the steps when there are four machines and processing time required for   3
second and third machines are equal.

2 (a) Solve the following game using the dominance principle.   7

$$\begin{array}{ccccc} & a & b & c & d \\ p & 3 & 2 & 4 & 0 \\ q & 3 & 4 & 2 & 4 \\ r & 4 & 2 & 4 & 0 \\ s & 0 & 4 & 0 & 8 \end{array}$$

(b) Let $E(p,q)$ be such that both $\min_{q} \max_{p} E(p,q)$ and $\max_{p} \min_{q} E(p,q)$ exist, then   4

(P.T.O)

$$\max_{p} \min_{q} E(p, q) \le \min_{q} \max_{p} E(p, q).$$

(c) Discuss zero-sum game.

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3 **(a)** Given the following table, develop a network.

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Beginning event	Ending event	Activity
1	2	1–2
1	3	1–3
2	4	2–4
3	4	3–4
3	5	3–5
4	6	4–6
5	6	5–6

(b) Discuss rules of constructing network.

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(c) What is dummy activity and why it is used?

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4 **(a)** Consider the following information on the activities required for a project.

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Activity:	A	B	C	D	E	F	G	H	I	J	K	L
Immediate:	–	–	–	A	A	E	B	B	D,F	C	H,J	G,I,K
Duration:	2	2	2	3	4	0	7	6	4	10	3	4

Find the critical path.

(b) Consider the details of a project involving 11 activities.

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Activity	Predecessor (s)	Duration (weeks) a	m	b
A	–	6	7	8
B	–	1	2	9
C	–	1	4	7
D	A	1	2	3
E	A, B	1	2	9
F	C	1	5	9
G	C	2	2	8
H	E, F	4	4	4
I	E, F	4	4	10
J	D, H	2	5	14
K	I, G	2	2	8

Find the expected completion of the project.

(a) What is the probability of completing the project on or before 25 weeks?

(b) If the probability of completing the project is 0.84, find the expected project completion time.

5 (a) An office equipment manufacturer produces two kinds of products, chairs and lamps. 7 The production of either a chair or a lamp requires 1 hour of production capacity in the plant. The plant has a maximum production capacity of 10 hours per week. Because of the limited sales capacity, the maximum numbers of chairs and lamps that can be sold are 6 and 8 per week respectively. The gross margin from the sales of a chair is Rs. 80 and Rs. 40 for that of a lamp.

The plant manager has a set of the following goals arranged in order of importance:

(i) He wants to avoid underutilization of production capacity.

(ii) He wants to sell as many as possible.

(iii) Overtime should not exceed 20% of the production time.

Formulate and solve this problem as a GP model so that the plant manager may achieve his goals as closely as possible.

(b) A production unit produces the chair and the table. The unit profit per chair is Rs. 100 4 and that per table is Rs. 50. The goal of a production unit is to earn a total profit of exactly Rs. 700 during the sale season of a week. Formulate GP.

(c) Differentiate between Linear programming and Goal Programming. 3