

L1B  
23/5/13 AN

Reg. No. : 

--	--	--	--	--	--	--	--	--	--	--	--

**Question Paper Code : 65034**

5 Year M.Sc. DEGREE EXAMINATION, MAY/JUNE 2013.

Fifth Semester

Computer Technology

XCS 351/10677 SW 501 — OPERATIONS RESEARCH

(Common to 5 Year Information Technology/5 Year M.Sc. Software Engineering)

(Regulation 2003/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write down the general form of an LP model in algebraic form.
2. What are the three important properties of feasible extreme points in an LP problem?
3. The transportation model can be used for a wide variety of situations. List any four such situations.
4. Define the assignment problem.
5. What do you mean by 'Project Scheduling'?
6. What is a 'dummy activity'? How is it represented in a network diagram?
7. Enumerate the costs considered in inventory control models.
8. A stockist has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed to be infinite. The inventory holding cost is ₹ 0.20 per unit per month and the ordering cost per order is ₹ 350/-. Determine the optimum lot size.
9. With the help of a schematic diagram show the major constituents of a queuing system.
10. Differentiate between 'queue length' and 'system length'.

PART B — (5 × 16 = 80 marks)

11. (a) The standard weight of a special purpose brick is 5 kg and it contains two basic ingredients B<sub>1</sub> and B<sub>2</sub>. The cost of B<sub>1</sub> is ₹ 5/- per kg and B<sub>2</sub> costs ₹ 8/- per kg. Strength considerations dictate that the brick contains not more than 4 kg of B<sub>1</sub> and a minimum of 2 kg of B<sub>2</sub>. Since the demand for the product is likely to be related to the price of the brick, find graphically the minimum cost of the brick satisfying the above conditions.

Or

- (b) Three grades of coal A, B and C contain phosphorous and ash as impurities. In a particular process, fuel up to 100 tons (maximum) is required which should contain ash not more than 3% and phosphorous not more than 0.03%. It is desired to maximize the profit while satisfying these conditions. There is an unlimited supply of each grade. The percentage of impurities and the profits of grades are given below.

Coal	Phosphorous (%)	Ash (%)	Profit (₹ per ton)
A	0.02	3.0	12.00
B	0.04	2.0	15.00
C	0.03	2.0	14.00

Find the proportions in which the three grades be used. Use simplex method.

12. (a) Solve the following transportation problem of a Dairy milk company:

		Distribution centers				Supply (10 <sup>6</sup> litres)
		D1	D2	D3	D4	
Plants	A	2	3	11	7	6
	B	1	0	6	1	1
	C	5	8	15	9	10
(10 <sup>6</sup> litres) Demand		7	5	3	2	

Or

- (b) A trip from Chandigarh to New Delhi takes six hours by bus. A typical table of the bus service in both directions is given below.

Departure from Chandigarh	Chandigarh – New Delhi Service line or route number	Arrival of New Delhi
06.00	A	12.00
07.30	B	13.30
11.30	C	17.30
19.00	D	01.00
00.30	E	06.30

Arrival at Chandigarh	New Delhi — Chandigarh Service line or route number	Departure from New Delhi
11.30	1	05.30
15.00	2	09.00
21.00	3	15.00
00.30	4	18.30
06.00	5	00.00

The cost of providing this service by the transport company depends upon the time spent by the bus crew (driver and conductor) away from their places in addition to service times. There are five crews. There is a constraint that every crew should be provided with more than 4 hours of rest before the return trip again and should not wait for more than 24 hours for the return trip. The company has residential facilities for the crew at Chandigarh as well as New Delhi. Suggest an optimal assignment of the crew.

13. (a) The optimistic, most likely and pessimistic time estimates of activities of a project are given below. Activity 40-50 must not start before 22 days, while activity 70-90 must end by 35 days. The scheduled completion time of the project is 46 days. Draw the network and determine the critical path. What is the probability of completing the project in the scheduled time?

Activity	$t_o$	$t_m$	$t_p$	Activity	$t_o$	$t_m$	$t_p$
10-20	4	8	12	50-70	3	6	9
20-30	1	4	7	50-80	4	6	8
20-40	8	12	16	60-100	4	6	8
30-50	3	5	7	70-90	4	8	12
40-50	0	0	0	80-90	2	5	8
40-60	3	6	9	90-100	4	10	16

Or

- (b) A project schedule has the following characteristics:

Activity	Time (weeks)	Activity	Time (weeks)
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

- (i) Construct the network
- (ii) Compute the earliest occurrence time and latest allowable occurrence time for each event
- (iii) Find the critical path
14. (a) (i) Classify and explain the various types of direct inventories and indirect inventories. (8)
- (ii) A company uses ₹ 10,000/- worth of an item during the year. The ordering costs are ₹ 25/- per order and carrying charges are 12.5 % of the average inventory value. Find the economic order quantity, number of orders per year, time period per order and the total cost. (8)

Or

- (b) (i) A newspaper boy buys papers for ₹ 0.50 each and sells them for ₹ 0.75 each. He cannot return unsold newspapers. Daily demand  $R$  for newspapers follows the distribution:

$R$	10	11	12	13	14	15	16
$p^R$	0.05	0.15	0.40	0.20	0.10	0.05	0.05

If each day's demand is independent of the previous day's demand, how many papers should be ordered each day? (8)

- (ii) An automobile manufacturer purchases 2,400 castings over a period of 360 days. This requirement is fixed and known. These castings are subject to quantity discounts. Ordering cost is ₹ 70,000/- per order and storage cost per day is 0.12% of the unit cost. Determine the optimal purchase quantity if the supplier has offered the following unit prices for the castings:

Unit price = ₹ 1,000/- for  $q < 1,000$

= ₹ 950/- for  $q \geq 1,000$ . (8)

15. (a) (i) Explain the structure of a queuing system. (8)

- (ii) The milk plant at a city distributes its products by trucks, loaded at the loading dock. It has its own fleet of trucks plus trucks of a private transport company. This transport company has complained that sometime its trucks have to wait in line and thus the company loses money paid for a truck and driver that is only waiting. The company has asked the milk plant management either to go in for a second loading dock or discount prices equivalent to the waiting time. The following data are available:

Average arrival rate (all trucks) = 3 per hour

Average service rate = 4 per hour

The transport company has provided 40% of the total number of trucks. Assuming that these rates are random according to Poisson distribution, determine,

- (1) the probability that the truck has to wait
- (2) the waiting time of a truck that waits
- (3) the expected waiting time of company trucks per day. (8)

Or

- (b) (i) Explain Kendall's notation for representing queuing models. (8)
- (ii) In a bank, 20 customers, on the average, are served by a cashier in an hour. If the service time has exponential distribution, what is the probability that
- (1) it will take more than 10 minutes to serve a customer?
  - (2) a customer shall be free within 4 minutes? (8)
-