337556(37)

B. E. (Fifth Semester) Examination, April-May 2018

(New Scheme)

(Branch : Mech., Production & Automobile)

OPERATIONS RESEARCH

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note *: Attempt all questions. Part (a) of each question is compulsory. Attempt* ***one*** *part from (b) and (c). All question carry equal marks. Use of graph sheet is permitted.*

Unit - I

1. (a) If a negative value appears in the solution values (X_B) column of the simplex table, then :

(i) the solution is optimal

(ii) the solution is infeasible

(iii) the solution is unbounded

(iv) all of the above

(b) A firm makes two products X and Y, and has a total production capacity of 9 tonnes per day. Both X and Y require the same production capacity. The firm has a permanent contract to supply at least 2 tonnes of X and at least 3 tonnes of Y per day to another company. Each tonne of X requires 20 machine hours of produciton time and each tonne of Y requires 50 machine hours of production time. The daily maximum possible number of machine hours is 360. All of the firm's output can be sold. The profit made is ₹ 80 per tonne of X and ₹ 120 per tonne of Y. 18

(i) Formulate this problem as an LP model.

(ii) Solve it by Graphical method to determine the production schedule that yields the maximum profit.

(c) A company makes two kinds of leather belts, belt

A and belt B. Belt A is a high quality belt and belt B is of lower quality. The respective profits are ₹ 4 and ₹ 3 per belt. The production of each of type A requires twice as much time as a belt of type B, and if all belts were of type B. The company could make 1,000 belts per day. The supply of leather is sufficient for only 800 belts per day (both A and B combined). Belt A requires a fancy buckle and only 400 of these are available per day. There are only 700 buckles a day available for belt B. 18

(i) Formulate this problem as an LP model.

(ii) Solve it by Simplex method to determine daily production of each type of belt.

Unit - II

2. (a) An assignment problem is considered as a particular case of a transportation problem because : 2

(i) The number of rows equals columns

(ii) All $X_{ij} = 0$ or 1

(iii) All rim conditions are 1

(iv) All of the above

(b) Solve the following transportation problem where cell entries are unit costs : 18

	D_1	D_2	D_3	D_4	D_5	Available
O_1	68	35	4	75	15	18
O_2	57	88	91	3	8	17
O_3	91	60	75	45	60	19
O_4	52	53	24	7	82	13
O_5	51	18	82	13	7	15
Required	16	18	20	14	14	82/82

(c) An airline that operates 7 days a week has the time table shown below. Crew must have a minimum layover of 5 hours between flights. Obtain the pairing of flights that minimizes layover time away from home assuming that the crew can be based at either of the two cities. The crew will be based at the city that results in smaller layover.

	Raipur-Bhopal		Bhopal-Raipur		
Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
1	7.00 am	8.00 am	101	8.00 am	9.15 am
2	8.00 am	9.00 am	102	8.30 am	9.45 am
3	1.30 pm	2.30 pm	103	12 noon	1.45 pm
4	6.30 pm	7.30 pm	104	5.30 pm	6.45 pm

Unit - III

3. (a) Customer behaviour in which customer moves from one queue to another in a multiple channel situation, is : 2

(i) Balking

(ii) Reneging

(iii) Jockeying

(iv) Alternating

(b) A tailor specialises in ladies dresses. The number of customers approaching the tailor appear to be Poisson distributed with a mean of 6 customers per hour. The tailor attends the customers on a first-come-first-served basis and the customers wait if the need be the tailor can attend the customers at an average rate of 10 customers per hour with the service time exponentially distributed. Required : 18

(i) The utilisation parameter

(ii) The probability that the queuing system is idle.

(iii) The average time that the tailor is free on a *10-hour* working day.

(iv) What is the expected number of customers in the tailor shop?

(v) What is the expected number of customers waiting for tailor's services?

(vi) What is the average length of queues that have at least one customer?

(vii) How much time should a customer expect to spend in the queue?

(viii) What is the expected time a customer would spend in the tailor's shop?

(ix) Assuming that $n > 0$ (i.e. customers are in the system) what is the probability that the waiting time (excluding service time) of a customer in the queue shall be more than 10 minutes?

(c) The utility data for a network are given below. Determine the total, free independent and interfering floats and identify the critical path. 18

Activity	:	0–1	1–2	1–3	2–4	2–5
Duration	:	2	8	10	6	3
Activity	:	3–4	3–6	4–7	5–7	6–7
Duration	:	3	7	5	2	8

Unit - IV

4. (a) A saddle point exists when : 2

(i) maximin value = maximax value

(ii) minimax value = minimum value

(iii) minimax value = maximin value

(iv) None of the above

(b) Solve the following game by using the principle of dominance : 18

		Player B					
		I	II	III	IV	V	VI
Player A	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	–5	1	2
	4	4	3	4	–1	2	2
	5	4	3	3	–2	2	2

(c) A dentist schedules all her patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time needed to complete the work.

Category	Time required (minutes)	Prooability Category
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checkup	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival times, starting at 8 a.m.

Use the following random numbers for handling the above problem :

40, 82, 11, 34, 25, 66, 17 and 79. 18