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Reg. No. | | | | | | | | | | | |

Question Paper Code : 27399

5 Year M.Sc. DEGREE EXAMINATION, MAY/JUNE 2016

Fifth Semester

Computer Technology

XCS 351 / 10677 SW 501 – OPERATIONS RESEARCH

(Common to 5 Year M.Sc. Software Engineering and VII Semester 5 year M.Sc. Information Technology)

(Regulations 2003/2010)

Time : Three Hours **Maximum : 100 Marks**

Statistical Tables to be permitted.

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Write the following linear programming problem in standard form

Minimize $Z = 2x_1 + x_2 + 4x_3$

Subject to the constraints : $-2x_1 + 4x_2 \leq 4$

$x_1 + 2x_2 + x_3 \geq 5$

$2x_1 + 3x_3 \leq 2$

$x_1, x_2 \geq 0$ and x_3 unrestricted in sign

2. Write any two relationship between the optimal primal and dual solutions.

3. State the available methods to find the initial basic feasible solution to the transportation problems.

4. What is an assignment model ?

5. Define merge event and burst event.

6. Construct a network for the following data :

Activity :	A	B	C	D	E	F	G	H	I
Preceeding activity :	–	–	–	A	A	B, D	C	B	F, G

7. What are the costs that make up the total inventory carrying costs ?

8. What do we mean by lead time ?

9. What are the elements of a queuing system ?

10. The cashier in a bank serves 12 customers on the average per hour. Customers' arrival is according to Poisson process with a mean of 6 customers per hour. Find the probability that the queuing system is idle.

PART – B (5 × 16 = 80 Marks)

11. (a) A toy company manufactures two types of doll, a basic version-doll A and a deluxe version doll B. Each doll of type B takes twice as long to produce as one of type A and the company would have time to make a maximum of 2000 per day if produced only the basic version. The supply of plastic is sufficient to produce 1500 dolls per day (both A and B combined). The deluxe version requires a fancy dress of which there are 600 per day available. If the company makes profit of ₹ 3 and ₹ 5, per doll respectively, on doll A and B, how many of each should be produced per day in order to maximize profit ?

OR

(b) Use the simplex method to solve :

Maximize $Z = X_1 + 9X_2 + X_3$

Subject to $X_1 + 2X_2 + 3X_3 \leq 9$;

$3X_1 + 2X_2 + 2X_3 \leq 15$

$X_1, X_2, X_3 \geq 0$

12. (a) Obtain an optimum basic feasible solution to the following transportation problem : **(16)**

		To			**Availability**
		16	19	12	14
From		22	13	19	16
		14	28	8	12
Requirement		10	15	17	

OR

(b) (i) What is an unbalanced assignment problem ? How is it solved for optimal solution ? **(6)**

(ii) A company has 5 jobs to be done. The following data shows the return (in rupees) by assigning the i^{th} machine to the j^{th} job. Using Hungarian method, assign the 5 jobs to 5 machines so as to maximize the total expected profit. **(10)**

		Jobs				
		1	2	3	4	5
	A	62	78	50	101	82
	B	71	84	61	73	59
Machine	C	87	92	111	70	81
	D	45	64	87	77	80
	E	60	70	98	66	83

13. (a) The routes and their lengths in km between city 1 (node 1) and four other cities (node 2 to 5) are shown in figure 13 (a). Use Dijkstra's algorithm to find the shortest route between city 1 and the remaining four cities.

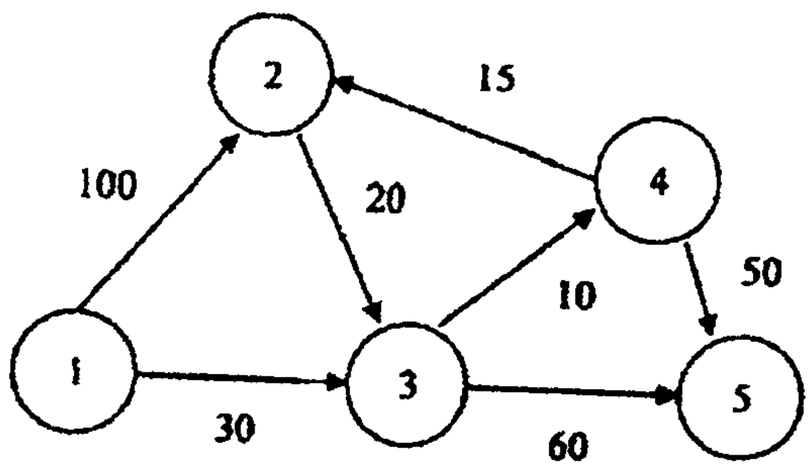

Figure 13 (a)

OR

(b) A project consists of 8 activities and their time estimates are as shown in Table Draw the network, determine critical path and calculate event slacks. Determine the probability of project completion if the scheduled completion time is 23 weeks. **(16)**

Activity		1-2	2-3	2-4	2-5	3-6	4-6	5-7	6-7
Duration	To	3	3	2	4	4	0	3	1
	Tm	3	6	4	6	6	0	4	5
	Tp	3	9	6	8	8	0	5	8

Table 13 (b)

To-Optimistic time, Tm-Most likely time and Tp-Pessimistic time.

14. (a) (i) The annual demand of an item is 3200 units. The unit cost is ₹ 6 and inventory carrying charges 25% per annum. If the cost of one procurement is ₹ 150. Determine

(1) EOQ **(2)**

(2) No. of orders per year **(2)**

(3) Time between two consecutive order **(2)**

(4) The optimal cost **(2)**

(ii) An item is produced at the rate of 50 per day. The demand occurs at the rate of 25 items per day. If the set-up cost is ₹ 100 per run and the holdings cost is ₹ 0.01 per unit of item per day. Find the economic lot size for one run assuming the shortages are not permitted. Also find the time of the cycle and minimum cost for one run. **(8)**

OR

(b) Find the optimal order quantity for a product for which the price breaks are as follows :

Quantity	**Unit Cost (₹)**
$0 \leq q_1 \leq 500$	100
$500 \leq q_2 \leq 750$	092.50
$750 \leq q_3$	087.50

The monthly demand of the product is 200 units, the holding cost is 2% of the unit cost and the ordering cost is ₹ 1,000. **(16)**

15. (a) Obtain the steady-state equations for the model (M/M/C) : (GD / ∞ / ∞) and show that

$$p_n = \begin{cases} \frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n p_0, & n = 0,1,2,..c \\ \frac{1}{C!C^{n-c}}\left(\frac{\lambda}{\mu}\right)^n p_0, & n = c+1, c+2,... \end{cases}$$

$$\text{where } p_0 = \left[\sum_{n=0}^{c-1} \frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n + \frac{1}{c!}\left(\frac{\lambda}{\mu}\right)\frac{c\mu}{c\mu - \lambda}\right]^{-1}$$

OR

(b) 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) The telephone department will install a second booth when convinced that an arrival would expect waiting for atleast 3 minutes for a phone call. By how much should the flow of arrivals increase in order to justify a second booth ?

(iii) What is the probability that it will be take him more than 10 minutes altogether to wait for the phone and complete his call ?