Enrollment No: _____ Exam Seat No: _____ C. U. SHAH UNIVERSITY Winter Examination-2021

Subject Name: Operation Research

Semester: 7 Date: $20/12/2021$ Time: $02:30$ To $05:30$ Marks: 70 Instructions: (1) Use of Programmable calculator & any other electronic instrument is prohibited. (2) Instructions written on main answer book are strictly to be obeyed. (3) Draw neat diagrams and figures (if necessary) at right places. (4) Assume suitable data if needed. Qc1 Attempt the following questions: (14) (a) The Scientific method in O.R. study generally involves a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only (a) One (b) More than One (a) One (b) More than One (c) Two (d) Three (c) For maximization LPP, the simplex method is terminated when all values (a) $c_1 - z_1 \le 0$ (c) $c_1 - z_2 \ge 0$ (d) $z_1 \le 0$ (a) $c_1 - z_1 \le 0$ (b) $c_1 - z_1 \ge 0$ (d) $z_1 \le 0$ (d) $z_1 \le 0$ (e) $c_1 - z_1 \ge 0$ (d) $z_1 \ge 0$ (d) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are (a) $m + n$ (b) $m \times n$ (c) $m + n - 1$ (d) all of these (e) In transportation problem if total supply > total demand we add		Subject Code: 4TE07ORE1			Branch: B.Tech (Mechanical)				
 Instructions: Use of Programmable calculator & any other electronic instrument is prohibited. Instructions written on main answer book are strictly to be obeyed. Draw neat diagrams and figures (if necessary) at right places. Assume suitable data if needed. Q-1 Attempt the following questions: The Scientific method in O.R. study generally involves Judgment phase b) Research phase c) Action phase d) All of these Graphical method can be applied to solve a LPP when there are only		Semest	er: 7	Date: 20/12/2	2021	Time: 02:30 To	05:30	Marks: 70	
 (1) Use of Programmable calculator & any other electronic instrument is prohibited. (2) Instructions written on main answer book are strictly to be obeyed. (3) Draw neat diagrams and figures (if necessary) at right places. (4) Assume suitable data if needed. (a) The Scientific method in O.R. study generally involves a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only		Instruct	tions:						
 (2) Instructions written on main answer book are strictly to be obeyed. (3) Draw neat diagrams and figures (if necessary) at right places. (4) Assume suitable data if needed. (a) The Scientific method in O.R. study generally involves a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only		(1)	Use of P	Programmable calcu	lator & any	other electronic instr	ument is pr	ohibited.	
 (3) Draw neat diagrams and figures (if necessary) at right places. (4) Assume suitable data if needed. (14) (a) Attempt the following questions: (a) The Scientific method in O.R. study generally involves (a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only		(2)	Instructi	ons written on main	n answer boo	k are strictly to be ol	beyed.		
 (4) Assume suitable data if needed. (a) The Scientific method in O.R. study generally involves a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only		(3)	Draw ne	at diagrams and fig	ures (if nece	ssary) at right places			
 Q-1 Attempt the following questions: (14) (a) The Scientific method in O.R. study generally involves a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only		(4)	Assume	suitable data if nee	ded.				
 (a) The Scientific method in O.R. study generally involves a) Judgment phase b) Research phase c) Action phase d) All of these (b) Graphical method can be applied to solve a LPP when there are only	0-1		Attom	t the following and	stions				(14)
 (ii) a bolchmethod in our adding generally provided by a second provided by the prov	Q-1	(a)	The Scie	entific method in O	R study ger	erally involves			(17)
 (b) Graphical method can be applied to solve a LPP when there are only		(u)	a) Judgn	nent phase b) Rese	earch phase	c) Action phase d)	All of these	e	
 (a) One (b) More than One (c) Two (d) Three (c) For maximization LPP, the simplex method is terminated when all values (a) c₁-z_j ≤ 0 (b) c_j-z_j = 0 (c) c_j-z_j ≥ 0 (d) z_j ≤ 0 (d) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (c) When money value changes with time (d) When money value changes with time (f) When money value changes with time (g) Priority queue discipline may be classified as		(b)	Graphic	al method can be a	pplied to so	lve a LPP when the	re are only	- 7	
 (a) One (b) More than One (c) Two (d) Three (c) For maximization LPP, the simplex method is terminated when all values (a) c₁-z_j ≤ 0 (b) c_j-z_j = 0 (c) c_j-z_j ≥ 0 (d) z_j ≤ 0 (d) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time and time is a discrete variable (c) When money value changes with time (j) Priority queue discipline may be classified as			variable	•	II		J		
 (c) For maximization LPP, the simplex method is terminated when all values (a) c_j-z_j ≤ 0 (b) c_j-z_j = 0 (c) c_j-z_j ≥ 0 (d) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (d) When money value changes with time (d) When money value changes with time (d) When money value emains constant for some time and then goes on changing with time 			(a) One	(b) More	than One	(c) Two	(d) Three	
 (a) cj -zj ≤ 0 (b) cj -zj = 0 (c) cj -zj ≥ 0 (d) zj ≤ 0 (d) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable xij is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 		(c)	For max	imization LPP, the	simplex met	hod is terminated wh	en all valu	es	
 (d) The solution to a transportation problem with m-rows and n-columns is feasible if number of positive allocations are (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add			(a) $c_i - z_i$	≤ 0 (b) $c_i - z_i = 0$	$(c) c_i - z_i$	≥ 0 (d) $z_i \leq 0$			
 number of positive allocations are (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add		(d)	The solution	ution to a transpor	tation proble	em with m-rows an	d n-colum	ns is feasible if	
 (a) m + n (b) m × n (c) m + n - 1 (d) all of these (e) In transportation problem if total supply > total demand we add (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (e) what is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (d) When money value changes with time (d) When money value changes with time (f) When money value changes with time (g) When money value changes with time 			number	of positive allocation	ons are				
 (e) In transportation problem if total supply > total demand we add (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (d) When money value changes with time (d) When money value changes with time (d) When money value does not change with time (e) When money value remains constant for some time and then goes on changing with time (f) When discipline may be classified as 			(a) <i>m</i> +	n (b) $m \times m$	n (e	c) $m + n - 1$	(d) all of	these	
 (a) dummy row with cost 0 (b) dummy column with cost 0 (c) dummy row with cost 1 (d) dummy column with cost 1 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (d) When money value changes with time (d) When money value changes with time (d) When money value emains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 		(e)	In transp	ortation problem if to	otal supply >	total demand we add		_·	
 (c) dummy row with cost <i>l</i> (d) dummy column with cost <i>l</i> (f) In Assignment Problem the value of decision variable <i>x_{ij}</i> is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (c) When money value changes with time (d) When money value changes with time (f) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(a) dumi	my row with cost 0	(b) dumn	ny column with cost 0			
 (f) In Assignment Problem the value of decision variable x_{ij} is (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (d) When money value changes with time (d) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(c) dumr	ny row with cost 1	(d) dumn	ny column with cost 1			
 (a) no restriction (b) two or one (c) one or zero (d) none of them (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value changes with time (c) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 		(f)	In Assig	mment Problem the	value of dec	tision variable <i>x_{ij}</i> is	•		
 (g) If number of sources is not equal to number of destination in Assignment problem then it is called (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(a) no re	estriction (b) tw	o or one	(c) one or zero	(d) none	of them	
 (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 		(g)	If numb	er of sources is not	equal to num	nber of destination ir	n Assignme	ent problem then	
 (a) unbalanced (b) symmetric (c) unsymmetric (d) balanced (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			it is call	ed	. •	. •	(1) 1 1	1	
 (h) What is concerned with the prediction of replacement costs and determination of the most economic replacement policy? (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(a) unba	lanced (b) sym	metric (c) unsymmetric	(d) balan		
 (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 		(h)	What is	concerned with the	e prediction	of replacement cost	s and deter	rmination of the	
 (a) search theory (b) theory of replacement (c) probabilistic programming (d) none of these (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			most eco	bhomic replacement	t policy?	own of nonlocomont			
 (i) Which of the following replacement policies is considered to be dynamic in nature? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(a) searc	abilistic programmi	(0) the	one of these			
 (i) Which of the following replacement policies is considered to be dynamic in hattie? (a) Time is a continuous variable and the money value does not change with time (b) When money value does not change with time and time is a discrete variable (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			Which o	of the following repl	lig (u) li	one of mese	ha dynam	ic in natura?	
 (a) This is a continuous variable and the money value does not change with this (b) When money value does not change with time (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 		(1)	(a) Time	is a continuous vari	able and the	money value does n	ot change y	with time	
 (c) When money value changes with time (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(a) The (b) When	money value does	not change y	with time and time is	a discrete y	variable	
 (d) When money value remains constant for some time and then goes on changing with time (j) Priority queue discipline may be classified as 			(c) When	money value chang	not change v		a uisciele	variable	
(i) Priority queue discipline may be classified as			(d) When	money value rema	ins constant	for some time and t	hen goes o	n changing with	
(j) Priority queue discipline may be classified as			time	money value fellia	ins constant	tor some time and t	1011 2003 0		
		(i)	Priority	aueue discipline m	av be classifi	ed as			
(a) finite or infinite (b) limited and unlimited		J)	(a) finite	or infinite	(h) limited and unlimit	ed		



	(k)	 (c) pre-emptive or non-pre-emptive (d) all of the above Which of the following is not a key operating characteristic for a queuing system (a) utilization factor 	
	(1)	 (b) percent idle time (c) average time spent waiting in the system and queue (d) none of the above Which of the cost estimates and performance measures are not used for economic analysis of a queuing system (a) cost per server per unit of time (b) cost per unit of time for a customer waiting in the system 	
	(m)	 (c) the average number of customers in the system (d) average waiting time of customers in the system The objective of network analysis is to (a) minimize total project duration (b) minimize total project cost (c) minimize production delays, interruption and conflicts 	
	(n)	 (d) maximize total project duration The activity cost corresponding to the crash time is called the (a) critical time (b) normal time (c) cost slope (d) crash cost 	
Attem	pt any	four questions from Q-2 to Q-8.	
Q-2	(a) (b)	Attempt all questions Explain the phases of OR. Also state the limitation of OR. Solve the following LPP by Big-M method. Minimize cost, $Z = 3x_1 + 8x_2$ Subject to, $x_1 + x_2 = 200$ $x_1 \le 80$ $x_2 \ge 60$ $x_1, x_2 \ge 0$.	(06) (08)
Q-3	(a)	Attempt all questions Solve the following linear programming problem by simplex method: Maximize $Z = 800x_1 + 600x_2 + 300x_3$ Subjected to the constraints $10x_1 + 4x_2 + 5x_3 \le 2000$ $2x_1 + 5x_2 + 4x_3 \le 1009$	(08)
	(b)	Write the dual of the following linear programming problem: Minimize $Z = 5x_1 - 6x_2 + 4x_3$ Subjected to the constraints $3x_1 + 4x_2 + 6x_3 \ge 9$ $x_1 + 3x_2 + 2x_3 \ge 5$ $7x_1 - 2x_2 - x_3 \le 10$ $x_1 - 2x_2 + 4x_3 \ge 4$ $2x_1 + 5x_2 - 3x_3 \ge 3$ $x_1, x_2, x_3 \ge 0$	(06)

Q-4 Attempt all questions

(a) Find the initial basic feasible solution of the following transportation problem by (04)



Vogel's Approximation Method.

	W1	W2	<i>W3</i>	W4	Capacity
<i>F1</i>	19	30	50	10	7
F2	70	30	40	60	9
<i>F3</i>	40	8	70	20	18
Requirement	5	8	7	14	

(b) The captain of a cricket team has to allot five middle order batting positions to six (10) batsmen available for selection. The average runs scored by each batsmen at these positions are summarized in a table below:

Dataman	Batting Position						
Daisman	III	IV	V	VI	VII		
\boldsymbol{A}	40	40	35	25	50		
B	42	30	16	25	27		
С	50	48	40	60	50		
D	20	19	20	18	25		
\boldsymbol{E}	58	60	59	55	53		
F	45	52	38	50	49		

Using Assignment model, determine the assignment of batsmen to positions which would give maximum runs in favour of team. Which batsmen will not qualify for selection based on the solution obtained?

Q-5 Attempt all questions

(a) In the modification of a plant layout of a factory four new machines M_1 , M_2 , M_3 and M_4 (04) are to be installed in a machine shop. There are five vacant places A, B, C, D and E available. Because of limited space, machine M_2 cannot be placed at C and M_3 cannot be placed at A. the cost of locating of machine I to place j in rupees is shown below. Find optimal assignment schedule.

	A	B	С	D	E
M_1	9	11	15	10	11
M_2	12	9	-	10	9
M_3	-	11	14	11	7
M_4	14	8	12	7	8

(b) A manufacturing company has 3 plants X, Y and Z Which supply to the distributors (10) located at A, B, C, D and E. Monthly plant capacities are 80, 50 and 90 units respectively. Monthly requirements of distributors are 40, 40, 50, 40 and 80 units respectively. Unit transportation costs are given below in rupees:

Enom	То							
From	Α	В	С	D	E			
X	5	8	6	6	3			
Y	4	7	7	6	6			
Ζ	8	4	6	6	3			

Determine an optimal distribution for the company in order to minimize the total transportation cost.

Q-6 Attempt all questions

(a) The purchase price of a machine is Rs. 52000. The installation charges amount to Rs. (06) 14400 and its scrap value is only Rs. 6400. The maintenance cost in various years is



given below:

0								
Year	1	2	3	4	5	6	7	8
Maintenance Cost	1000	3000	4000	6000	8000	11600	16000	19200
		1 11			1 10			

After how many years should the machine be replaced? Assume that the machine replacement can be done only at the year ends.

(b) A project schedule has the following characteristics: (i) Construct the network. (ii) (08) Compute E and L for each event, and (iii) Find the critical path.

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

Q-7

- Attempt all questions(a) Write a short note on "ABC analysis" of inventory control technique.
- (b) Customers arrive at a one window drive-in bank according to Poisson distribution with mean 10 per hour. Service time per customer is exponential with mean 5 minutes. The space in front of the window including that for the serviced car can accommodate a maximum of 3 cars. Others can wait outside this space. (i) What is the probability that an arriving customer can drive directly to the space in front of the window? (ii) What is the probability that an arriving customer will have to wait outside the indicated space? (iii) How long is an arriving customer expected to wait before starting service?

Q-8 Attempt all questions

(a) The time estimates (in weeks) for the activities of a PERT network are given below: (07)

Activity	t_0	t_m	t_p
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

(i) Draw the project network and identify all the paths through it. (ii) Determine the expected project length. (iii) Calculate the standard deviation and variance of the project length.

(b) The following mortality rates have been observed for certain type of light bulbs:

e rono wing mortanty rates have been observed for certain type of inght bulles.							
End of month	1	2	3	4	5		
Percentage failing	10	20	50	70	100		

There are 1000 bulbs in use and it costs *Rs.* 10 to replace an individual bulb which has burnt out. If all the bulbs are replaced simultaneously, it would cost *Rs.* 5 per bulb. It is proposed to replace all the bulbs at fixed intervals whether they have fixed or not and to continue replacing fused bulbs as and when they fail. At what intervals should all the bulbs be replaced so that the proposal is economical?



(07)

(07)