

CSE

MID SEM

6th Semester Papers

2021-22

HARCOURT BUTLER TECHNICAL UNIVERSITY, KANPUR

B. Tech. (CSE/ IT)

END SEMESTER EXAMINATION

ODD SEMESTER (V), 2021-22

ECS 351: COMPUTER NETWORKS

Time: 2:30 Hours

Max. Marks: 50

Note: 1. Attempt all questions. All questions carry marks, as shown against them.
2. Q.No.6 is from the lab component of the subject.

All the Course Outcomes (COs) are mentioned in statement form

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1. Explain the functions of the different layer of the OSI Protocol. (Understand)
 2. Design of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANS) based on available network devices. (Apply, Analyze)
 3. Develop network programming application for a given problem related to TCP/IP protocol stack. (Apply, Analyse)
 4. Understand and analyze different routing algorithms. (Understand, Analyze)
 5. Understand the use of IP addressing schemes as per IPV4 and IPV6. (Understand)
 6. Modify the existing protocols of TCP/IP protocol stack for performance improvement. (Apply, Analyze)
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Related Course Outco me (CO)	Marks
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Q. No. 1: Attempts all parts

- (a) Explain the function of Data link layer, Network layer, Transport and Application layer of OSI model given by IEEE. 01 04
- (b) What is the number of cable required for n devices connected in mesh, ring, bus and star topology? 02 04

Q. No.2: Attempts all parts

- (a) Explain ALOHA and Pure ALOHA in detail. Why is the channel throughput doubled in slotted ALOHA compared to pure ALOHA? 02 04
- (b) Calculate the ring latency of 20 stations separated by 100 meters and operate at a speed of 4 Mbps. Assume the delay introduced by each station to be 2.5 bit. 01 02
- (c) If 7- bit Hamming codeword received by a receiver is 1011011. Assuming the even parity state whether the received codeword is correct or wrong. If wrong, locate the bit in error. 01 02

(OR)

The codeword is received as 1001110. Check whether there are errors in the received code, if the divisor is 1011.

Q. No. 3:	Attempts all parts			
(a)	Discuss the Distance vector routing algorithm with an example and explain the count to infinity problem in detail.	04	04	
(b)	Explain the following terms with example (a) Multicast addressing (b) Unicast addressing. A class B network on the internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts per subnet?	05	02	
(c)	What are the main causes of congestion? Discuss Leaky bucket and Token bucket algorithm with suitable diagram.	05	02	
Q. No. 4:	Attempts all parts			
(a)	Explain key QoS (Quality of Services) primitives looked at transport layer and Discuss three way handshake techniques in detail.	05	04	
(b)	Compare and contrast UDP (User Datagram Protocol) and TCP (Transmission Control Protocol).	05	02	
(c)	What do you mean by term cryptography? Distinguish between symmetric and asymmetric key cryptography.	06	02	
	(OR).			
	Discuss the RPC (Remote Procedure Call) design and implementation issues in brief.			
Q. No. 5:	Attempts all parts			
(a)	What is domain name system? How does it work? Explain typical resolution process in DNS in detail.	06	04	
(b)	Elaborate about TELNET and its working procedure.	04	02	
(C)	State and explain various application of Internet.	03	02	
	(OR)			
	What do you mean by ATM? Explain ATM virtual circuit with help of suitable diagram.			
Q. No. 6:	Attempts all parts			
(a)	Discuss cyclic redundancy code (CRC) and write a program in C for it.	03	05	
(b)	Discuss RSA algorithm to encrypt a text data and Decrypt the same and write a program in C for it.	03	05	

HARCOURT BUTLER TECHNICAL UNIVERSITY, KANPUR

End Semester Examination

Odd Semester/ Carry-Over Examination (III/B.Tech), 2021-22

ECS-353/ ECS-303 : DATABASE MANAGEMENT SYSTEM

Time: 2:30 Hours

Max. Marks: 50

Note: 1. Attempt all questions. 2. All questions carry marks, as shown against them.

Course Outcomes

1. Understand and Develop Entity Relationship (ER) and Relational Models for a given application. (Understand, Apply)
2. Develop and manipulate relational database using Structured Query Language and relational languages. (Apply)
3. Develop a normalized database for a given application by incorporating various constraints like integrity and value constraints. (Apply)
4. Understand and apply transaction processing concepts and convert schedules to serializable schedules. (Understand, Apply)
5. Illustrate different concurrency control mechanisms to preserve data consistency in a multi-user environment. (Apply)

Q. No. 1: Attempt both questions.

Related CO **Marks**

- (a) Define candidate key, super key and foreign key with the help of an example. Also explain the role of DBA. CO 1 (04)
- (b) Explain disadvantages of conventional file-based system compared to Database management system. CO1 (04)

Q. No. 2: Attempt both questions.

- (a) Design an E-R diagram for keeping track of the exploits of your favorite sports team. You should store the matches played, the scores in each match, the players in each match and individual player statistics for each match. Summary statistics should be modeled as derived attributes. Also convert the entities into tables. CO1 (04)

OR

- What do you understand by generalization and aggregation? Describe in detail the various constraints imposed on generalizations and specializations. CO2 (04)
- (b) Write SQL statements for:
i. Creating a table Employee with following information: Name of table: **Employee**, columns and data types: employee id (6), name varchar (20), department varchar (20);
ii. Inserting data into the Employee table
iii. Altering table by adding new column emp class varchar (20)
iv. Deleting a row from the table
v. Alter table by changing the data type of employee id to number (8). CO2 (04)

Q. No. 3: Attempt both questions.

- (a) Find the Minimal cover for a relation R(A, B, C, D, E, F) the set of FDS given as follows :
 $F = \{ AB \rightarrow C, C \rightarrow A, BC \rightarrow D, ACD \rightarrow B, BE \rightarrow C, CE \rightarrow FA, CF \rightarrow BD, D \rightarrow E \}$

CO3 (04)

OR

What is normalization? Define all the normal forms.

CO3 (04)

- (b) Consider the universal relational schema R (A, B,C,D ,E, F, G, H,I, J) and a set of following functional dependencies

CO 3 (04)

$$F = \{ AB \rightarrow C, A \rightarrow DE, B \rightarrow F, F \rightarrow GH, D \rightarrow IJ \}$$

Determine the candidate keys for R? Decompose R into Highest Normal Form.

Q. No. 4: Attempt both questions.

- (a) Differentiate between Conflict Serializability and View Serializability?
Find whether following schedules are conflict Serializable or not. Also state the topological sorting.
i) r1(x); r3(x); w1(x); r2(x); w3(x)
ii) r1(x); r2(y); r3(y); w2(y); w1(x); w3(x); r2(x); w2(x)

CO 4 (04)

- (b) What are deadlocks? Also discuss about the deadlock prevention schemes in detail.

CO 4 (04)

Q.No. 5: Attempt both questions.

- (a) How can a timestamp be implemented in a database? Discuss the Time stamping protocols for concurrency control.

CO 5 (04)

- (b) What are transactions? List and discuss ACID properties of transaction.

CO 5 (04)

Q. No. 6: Attempt both questions.

Consider following schema and write SQL for given statements.

CO2 (10)

Client_master (clientno, name, address, city, pincode, state, baldue)
Product_master (productno, name, profitpercent, unitmeasure, sellprice, costprice)
Salesman_master (Salesmanno, name, address, city, pincode, state, salary, tgtotget, remarks)

- 1) Find out the names of all clients.
- 2) List all the clients who are located in Mumbai.
- 3) Delete all salesmen from salesman_master whose salaries are equal to Rs.3500.
- 4) Destroy the table client_master along with data.
- 5) List the name of all clients having 'a' as the second letter in their names.

Date of showing evaluated answer books: 23.04.2022

No. of Printed Pages: 02

Subject Code: ECS-355/ECS-301

III B. Tech. CSE/IT ODD SEMESTER/CARRYOVER EXAMINATION DESIGN AND ANALYSIS OF ALGORITHMS

Course Outcomes

1. Understand and apply mathematical preliminaries to the analysis and design stages of different types of algorithms. (Understand, Apply)
2. Analyze worst-case time complexity of various algorithms using asymptotic methods. (Analyze)
3. Understand and apply the divide-and-conquer paradigm and synthesize divide-and-conquer algorithms on problems of Sorting, Searching, finding MST etc. (Understand, Apply)
4. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms. (Apply, Analyze)
5. Apply the dynamic-programming paradigm to model engineering problems using graph and write the corresponding algorithm to solve the problems. (Apply)
6. Explain the ways to analyze randomized and approximation algorithms (Apply, Analyze)

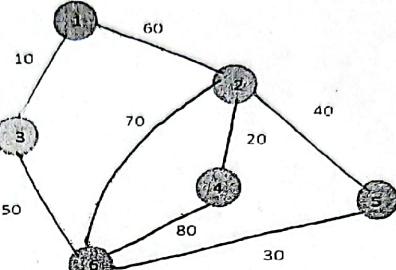
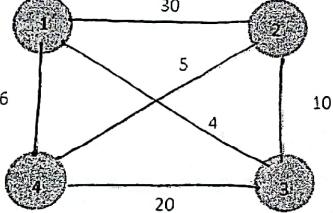
Time: 2:30 Hrs.

Max. Marks: 50

Note: 1. Attempt all questions.

2. All questions carry marks as shown against them.

Q. No.	Questions	Marks	CO	BL
1.	Attempt any four subparts of this question. (a) Define Best case, Worst case and Average case time complexities alongwith the corresponding notations used to represent them. (b) Write Divide and Conquer based Quick Sort algorithm and perform its time complexity analysis. (c) State the Master Theorem. What is the smallest value of n such that an algorithm having running time as $100n^2$ runs faster than an algorithm whose running time is 2^n on the same machine?	08 03 03	1 1 L1 L3	
2.	Attempt ALL subparts of this question (a) Explain the advantages of using height Balanced Trees. Discuss the AVL Rotations used for height balancing. Find the minimum and maximum height of any AVL-tree with 7 nodes? Assume that the height of a tree with a single node is 0. (b) A 2-3-4 tree is defined as a B-Tree with minimum degree t=2. Create a 2-3-4 tree by successively inserting the elements (in the given order) 42, 56, 24, 89, 1, 5, 87, 8, 61, 6, 78, 7, 12, 34. (c) Define Heaps in general and Fibonacci Heaps in particular. OR Discuss Amortized Analysis.	08 04 02 02 02	2 2 L2 L3 L1	
3.	Attempt ALL subparts of the following: (a) Formulate Fractional Knapsack Problem and write a Greedy Algorithm for solution to this problem. Find the optimal solution for the following fractional Knapsack problem. n=4, m = 60, W={40, 10, 20, 24} and P={280, 100, 120, 120}	08 04	2 2	L3

	(b)	Discuss the Dynamic Programming approach of designing an algorithm. Explain it by taking a suitable example. OR Discuss the Graph Coloring Problem and its solution using Branch and Bound Technique.	04	2	L2
4.	(a)	Attempt ALL subparts of this question. Explain Prim's algorithm for finding minimum spanning tree. Obtain a minimum cost spanning tree for the graph shown below.	08	04	4
					L2
	(b)	Using Dynamic Programming solve Travelling Salesman Problem presented as a following graph.	04	4	L1
					
		OR Apply backtracking to the problem of finding a Hamiltonian circuit in the above graph. Ignore the weight values of the links.			
5.		Define any FOUR subparts of the following (i) Class P and Class NP (ii) NP-complete problem (iii) NP-hard problem (iv) Randomized Algorithms (v) Approximation Algorithms	08	5	L1
6.	(a)	Attempt ALL subparts of this question Write a program in C/C++ to find K^{th} smallest number from a given list of 'N' integer numbers.	10	05	L2
	(b)	Discuss Binary Search Technique and write a program in C/C++ to search a given number 'K' in a given list of 'N' integer numbers. Assume that the given list is sorted in ascending order.	05	6	L2

Date of showing evaluated answer books : 11.04.2022

No. of Printed Pages: 02

Roll No.

HARCOURT BUTLER TECHNICAL UNIVERSITY, KANPUR

3rd B.Tech (CSE/IT)

End Semester/Carry Over Examination

ODD SEMESTER (V), 2021-22

ECS 357/ECS 305: THEORY OF AUTOMATA & FORMAL LANGUAGES

Time: 2:30 Hours

Max. Marks: 50

Note: Attempt all questions. All questions carry marks, as shown against them.

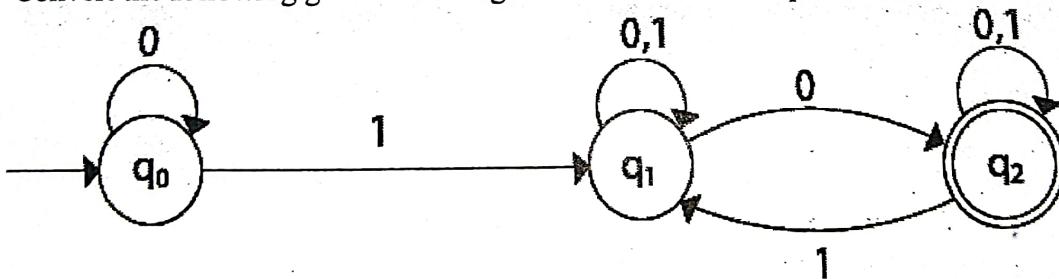
Please mention all the Course Outcomes (CO) in statement form

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1. Describe the capabilities and limitations of the abstract machines including finite automata, pushdown automata, and Turing machines and their associated languages.
 2. Construct finite automata, pushdown automata, Turing machines for the given grammar and vice-versa.
 3. Show that a language is not regular / not context-free using pumping lemma.
 4. Outline the characteristics of P, NP and NP Complete problems in the context of Turing machines.

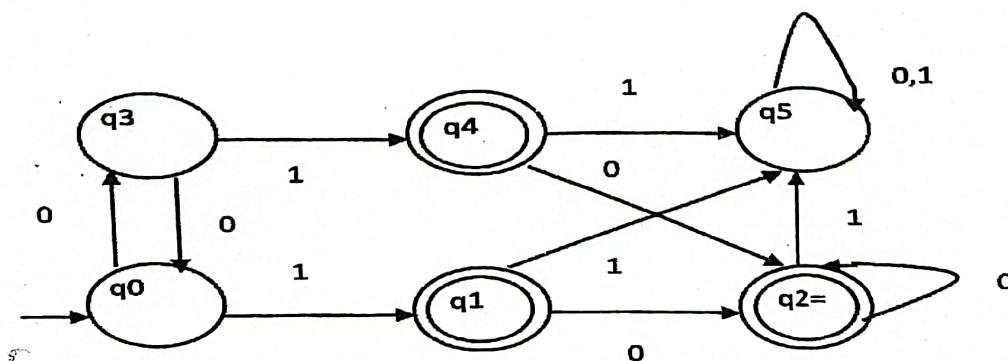
Related Course Outcome (CO)	Marks
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Q No.1: Attempt all the Questions.

- (a) Design a DFA that accepts the strings which contains the substring 0101 ($\Sigma = \{0,1\}$). 01 2.5
- (b) Convert the following given state diagram of NFA into an equivalent DFA. 02 2.5



- (c) Draw the minimum state FA for the following state diagram. 02 2.5



(d) Prove that NDFA = DFA. 02 2.5

QNo.2: Attempt all the Questions.

(a) Design a Moore machine to find the complement of binary string. 02 05
OR

L_1 and L_2 are regular languages then prove that these languages are closed under union and concatenation.

(b) State and proof pumping lemma for regular sets. 03 05
OR

Prove that language $L = \{a^p \mid p \text{ is prime}\}$ is not regular.

Q No.3: Attempt all the Questions.

(a) Construct a FA for regular expression $10 + (0+1)0^*1$. 03 2.5

(b) Describe the definition of PDA, how it is more powerful than DFA? 03 2.5

(c) Construct a PDA for the language
 $L = \{a^m b^n c^n d^m \mid m, n > 0\}$ 02 2.5

OR

$L = \{wcw^R \mid w \in \{0,1\}^*\}$

(d) Verify that the family of CFL is not closed under intersection. 02 2.5

Q No.4: Attempt all the Questions.

(a) Describe turing machine with suitable example. 01 2.5

(b) Design a turing machine for $L = \{a^n b^n c^n \mid n \geq 1\}$. 02 2.5

(c) Prove that complement of recursive language is recursive. 03 2.5

OR

The union of two recursive languages is recursive.

(d) Define Post correspondence problem with example. 01 2.5

Q No.5: Attempt all the Questions.

(a) Consider the following grammar 03 05

$L_1 = \{a^n b^{2n} c^m \mid n, m \geq 0\}$

$L_2 = \{a^n b^m c^{2m} \mid n, m \geq 0\}$

(i) Show that L_1 and L_2 are CFL by generating CFG.

(ii) Is $L_1 \cap L_2$ a CFL

(b) Convert the following grammar into Greibach normal form. 03 05

$S \rightarrow AB \mid BC$

$A \rightarrow aB \mid bA \mid a$

$B \rightarrow bB \mid cC \mid b$

$C \rightarrow c$

No. of Printed Pages: 01

Roll No.

HARCOURT BUTLER TECHNICAL UNIVERSITY, KANPUR

B-TECH

End Semester Examination
Odd Semester (V Semester), 2021-22
ECS-359: Data Science

Max. Marks: 50

Time: 2:30 Hours

Note: 1. Attempt all questions. All questions carry marks, as shown against them.

Course Outcomes (CO):

1. This course creates relevant programming abilities in the student.
2. This course creates demonstrate proficiency with statistical analysis of data.
3. This course develops the ability to build and assess data-based models.
4. This course executes statistical analyses with professional statistical software.
5. This course demonstrates skill in data management.
6. Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

Related Course Outcome (CO)	Marks
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Q. No. 1: Attempt both questions.

- (a) What is data science? Discuss data analytics and its types. CO1 (05)
(b) Discuss Machine Learning and its types with their advantages & disadvantages. CO1 (05)

Q. No. 2: Attempt both questions.

- (a) Explain Levels of measurement in data analysis and its types. CO5 (05)
(b) What is data categorization and indexing? CO2 (05)

OR

Explain Chi-Square test and t-test with an example.

Q. No. 3: Attempt both questions.

- (a) Define data modelling. What are the uses of data modelling tools? CO3 (05)
OR
Explain different type of modelling techniques in data modelling.
(b) What is Support Vector Machine (SVM)? What do you understand by Kernels in SVM. CO3 (05)

Q. No. 4: Attempt both questions.

- (a) What is data manipulation and visualization? CO1 (05)
(b) What are data frames and how can we use pandas in that, give suitable example. CO1 (05)

Q. No. 5: Attempt both questions.

- (a) How analytics can predict bank loan default and fraudulent activity in Banking sector? CO4 (05)
(b) Explain the role of analytics in the telecommunications industry. How they can predict customer Churn- Network analysis and optimize fraud detection. CO6 (05)

HAROURT BUTLER TECHNICAL UNIVERSITY
End-Semester Examination
Odd Semester (V/B. Tech.), 2021-22
(IT,CS, ME, EE, ET, CE)
BMA-341/351: Operations Research

Max. Marks: 50

Time: 2.30 Hrs.

INSTRUCTIONS:

- i) Answer all the questions. ii) All questions carry marks, as shown against them.
- iii) Mathematical symbols have their usual meanings.

Course outcomes (CO):

1. Understand and solve linear programming problems.
2. Formulate and solve Transportations models, Assignment models and integer linear programming problems.
3. Formulate and solve sequencing and scheduling models.
4. Formulate and solve Replacement and inventory models.
5. Learn and use Dynamic programming and Genetic Algorithms

1. (a) Two products P_1 and P_2 are to be manufactured by a firm. Profits on P_1 and P_2 are Rs.30 and 20 respectively. The products are to be processed on two machines, i.e., first on milling machine and other on surface grinder. The capacities and the time required to produce a unit are as follows: CO1 5

	P_1	P_2	capacity
Milling machine	3 hours	1 hour	1500 man hrs./month
Surface grinder	1 hour	1 hour	1000 man hrs./month

Use simplex method to find the no. of products of type P_1 and P_2 to get maximum profit.

- (b) Solve the following Linear programming problem by graphical method: 2.5

$$\begin{aligned} \text{Min. } Z &= 3x_1 + 5x_2 \\ \text{subject to } & -3x_1 + 4x_2 \leq 12 \\ & 2x_1 - x_2 \geq -2 \\ & 2x_1 + 3x_2 \geq 12 \\ & x_1 \leq 4 \\ & x_2 \geq 2 \\ \text{and } & x_1, x_2 \geq 0 \end{aligned}$$

- (c) Explain the duality theory of the Linear Programming and find the dual of the following LPP: 2.5

$$\begin{aligned} \text{Min. } Z &= x_1 + x_2 + x_3 \\ \text{subject to } & x_1 - 3x_2 + 4x_3 = 5 \\ & x_1 - 2x_2 \leq 3 \\ & 2x_2 - x_3 \geq 4 \\ \text{and } & x_1, x_2 \geq 0 \text{ and } x_3 \text{ is unrestricted} \end{aligned}$$

OR

Describe the computational procedure of Two phase method.

2. (a) State the transportation problem in general terms and find the initial basic feasible CO2
solution of the following T.P by using Lowest Cost Entry Method then check the
optimality of the solution by MODI method. 5

Market

Origins					Capacity
	M ₁	M ₂	M ₃	M ₄	
O ₁	8	10	7	6	50
O ₂	12	9	4	7	40
O ₃	9	11	10	8	30

Requirement	25	32	40	23	

- (b) There are five machines and five operators. Assign one operator to one machine so that overall payment is minimum and find the total minimum cost. 2.5

Jobs → Machines ↓	J ₁	J ₂	J ₃	J ₄	J ₅
M ₁	1	3	2	3	6
M ₂	2	4	3	1	5
M ₃	5	6	3	4	6
M ₄	3	1	4	2	2
M ₅	1	5	6	5	4

- (c) Explain all integer programming problem. Describe Gomory's Cutting Plane method to solve the IPP by a suitable example. 2.5

OR

Describe the Branch-and-Bound technique to solve the integer programming problem with suitable example.

3. (a) What is CPM? What are the essential steps in CPM for project planning? A project CO3 consists of nine activities with the following relevant information:

5

Activity	Estimated duration (days)		
	Optimistic	Most likely	Pessimistic
1-2	2	5	14
1-6	2	5	8
2-3	5	11	29
2-4	1	4	7
3-5	5	11	17
4-5	2	5	14
6-7	3	9	27
5-8	2	2	8
7-8	7	13	31

- (i) Draw the PERT network and calculate the expected project completion time
- (ii) Find the expected time for each activity and critical path.
- (iii) Calculate EST, LST, EFT, LFT and floats.

- (b) What is a sequencing problem? Describe the Johnson's algorithm to solve the problem of processing n jobs through two machines. Determine the optimal sequence of jobs that minimizes the total elapsed time and the total elapsed time based on the following information:

5

Job → Machines	1	2	3	4	5	6	7
M ₁	3	8	7	4	9	8	7
M ₂	4	3	2	5	1	4	3
M ₃	6	7	5	11	5	6	12

4. (a) Find the best replacement policy of a machine when its maintenance cost is given by CO4 a function increasing with time and money value is constant. The cost of a machine is Rs.6100, its scrap value is only Rs. 100. The maintenance cost is given as follows:

5

Years	1	2	3	4	5	6	7	8
Maintenance cost	100	250	400	600	900	1250	1600	2000

Determine the optimum period for replacement of the machine.

- (b) Derive the formula for economic order quantity when stock replenishment is not instantaneous (gradual replenishment or finite replenishment). 2.5
- (c) ABC manufacturing company needs ball bearings of worth Rs. 28,800 per year. The cost of placing an order is Rs. 48 and inventory carrying cost as a percentage of average inventory investment is 12%. 2.5
- (i) Determine the value of each assignment.
 - (ii) No. of orders per year.

OR

- Derive the EOQ formula for the inventory model with infinite rate of replenishment and without shortage.
5. (a) Use the principle of optimality to find the maximum value of $Z = b_1 x_1 + b_2 x_2 + \dots + b_n x_n$ when $x_1 + x_2 + x_3 + \dots + x_n = C$ and $x_1, x_2, x_3, \dots, x_n \geq 0$ CO5 5
- (b) Explain dynamic programming problem and describe the basic features and characteristics of dynamic programming problems. 5