3.

a) i) Using pumping lemma for context free languages show that the following language is not context free. 2+4 CO2 A

$L = \{w \mid w \in a^n b^n b^n\}$

ii) Convert any one of the following CFG into an equivalent CFG in Chomsky normal form.

$R \rightarrow aRb \mid bRb \mid S$
$S \rightarrow aTa \mid bTa$
$T \rightarrow XTX \mid X \mid \varepsilon$
$X \rightarrow a \mid b$

Or

b) Prove the theorem: A language is context free iff some pushdown automata recognize it. 6 CO2 E

b) Remove null production from the following grammar: 4 CO1 N

S---->ABAC , A--→aA|Є , B-→bB|Є , C---→c

Or

Convert any one of the following context-free grammar (CFG) to an equivalent pushdown automaton

$R \rightarrow XRX \mid S$
$S \rightarrow aTa \mid bTb$
$T \rightarrow bTa \mid abTb \mid X \mid \varepsilon$
$X \rightarrow a \mid b$

4.

a) Give the implementation-level description of Turing machine that decides the following languages (any two) 6 CO3 C

i. {w | w contains three times as many 1s as 0s}
ii. $B = \{0^m 1^n 2^{m-n} \mid m, n > 0 \text{ and } m > n\}$
iii. {w | w is a string with 0s and 1s and contains 1s in a multiple of 3}
iv. $C = \{0^i 1^j 2^k \mid i+k = 2^*j \text{ and } i,j,k > 0\}$

b) Define decidable language. Find out whether the following problem is decidable or not: Is a number 'm' prime? 4 CO1 A

5.

a) Differentiate between a finite automaton and a Turing machine 2 CO4 U

b) Define the classes P, NP and NP-complete. Why NP-complete class is significant regarding the question whether P = NP? 3 CO5 U

c) Show the relationship among the following types of language in a diagram: Regular language, context free language, decidable language. 2 CO4 U

d) Can you run a nondeterministic algorithm on a deterministic machine instead of a nondeterministic one? If your answer is yes, then explain how you can do it and how the running time will be affected. If your answer is no, then explain why it will not be possible. 3 CO4 E

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE Final Exam, Autumn 2021

Course Code: CSE-2423 Course Title: **Database Management System**

Time: 2 hours 30 minutes Full Marks: **50**

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

	Course Outcomes (COs) of the Questions
CO1	**Understand** Relational Databases, Database design, Data Storage and Querying, Transaction Management.
CO2	**Apply** Relational Algebra, SQL, Query Optimization techniques, Data Integrity, Security, normalization techniques, Indexing Techniques, ACID Properties.
CO3	**Create** an enterprise data model that reflects the organization's fundamental business rules.

Letter Symbols	Bloom's Levels of the Questions					
Meaning	**R**	**U**	**Ap**	**An**	**E**	**C**
	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) Consider the following relational database:
Patient (pid, pname, Address, mobile, DOB, gender)
visit (pid, did, visit_date)
Doctor (did, dname, speciality)
drug (drid, d_name, d_type, manuf_year, unit_price)
prescribe (pid, did, drid, pdate, quantity) **CO1** **U**

Give an SQL DDL definition of this database. Identify referential-integrity constraints that should hold, and include them in the DDL definition.
Ensure the following constraints:

Pname, dname, and d_name (not null), Mobile (unique), gender ('M', or 'F'), quantity and unit_price (not negative).

OR

1. a) What is referential integrity? Explain the tests that must be made to preserve referential integrity for update operations. **CO1** **U**

1. b) Write an assertion using the schema from 1(a) that will allow only 'female' patient to visit the 'Gynecology' specialist. **CO2** **Ap**

2. a) Consider a single example from your own, identify different anomalies and functional dependencies in it and apply different normalization techniques to resolve the anomalies and functional dependencies. **CO2** **Ap**

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE Final Examination, Autumn 2021

Course Code: CSE-2425 Theory of Computing

Total marks: 50 *Time: 2 hours 30 minutes*

[Figures in the right hand margin indicate full marks
Course Outcomes and Bloom's taxonomy levels are mentioned in additional columns]

Bloom's Taxonomy Levels (Cognitive Domain)						
Letter Symbols	R	U	A	N	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Group-A

1.

a) Convert the following regular expressions to NFA. 3 CO1 A

i) a(aa)* U (bb)*

ii) a(a U b)*a U b(a U b)*b

b) What is ambiguity? Determine whether the following grammar is ambiguous. 3 CO2 N

$S \rightarrow AB$
$A \rightarrow aA$
$A \rightarrow abA$
$A \rightarrow \varepsilon$
$B \rightarrow bB$
$B \rightarrow abB$
$B \rightarrow \varepsilon$

c) Show how to derive the string **aabab** using this CFG using a left-most derivation. Draw the parse tree for the string. 5 CO2 A

Or

Show how to derive the string **abaabb** using this CFG using a right-most derivation. Draw the parse tree for the string.

2.

a) Differentiate between DFA and NFA. 5 CO1 A

Construct a DFA that recognize the following language. In all parts , the alphabet is {0,1}: *{w |w begins with a 1 and ends with 0 }*

Or

Construct a Deterministic Finite Automata , ∑ = {a,b} and L(M)= {ω| ω Starts and ends with different symbol}.

b) Define simplification of CFG with types. Write down the procedure for removal of unit production with example. 5 CO2 R

Group-B

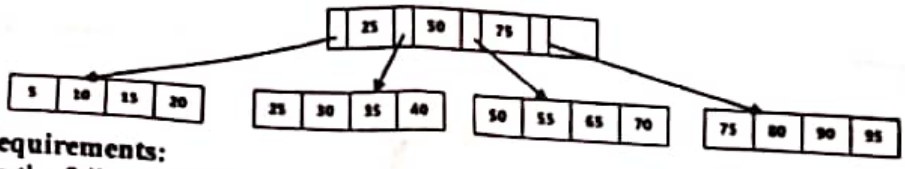
OR

2.	a)	When a relational schema will be in 1NF, 2NF, and 3NF. Illustrate with an example how you can convert a Schema ***Student*** with multi-valued attribute "email" into 1NF.	CO2	Ap	5
2.	b)	1. How does different authorization techniques could be deployed to the user and revoked? Explain with example.	CO1	U	3
		2. List out different encryption techniques obtained so far? Which one is preferable, why?			2

Part B

[Answer the questions from the followings]

3. a) Given the following B+ tree



CO2 Ap 6

Requirements:
Do the following (step by step)
Insert: 13,12,17, 60, 45

Delete: 35, 60, 75, 95,13

OR

	a)	Define **domain constraint**. Create a domain constraint *min-age* for an employee *table in* a company database that will not allow entering employees less than 18 years old.	CO2	C	6
	b)	How can Indexes help performance? Consider employees relation, if we want to retrieve all employees, whose salary is in a given range, will it be best alternative to sort the employee records by employee id. Justify your answer.	CO1	U	4
	a)	Describe multilevel indexing with a suitable example and necessary figure.	CO1	U	4

OR

	a)	How could you resolve the problem of skew? Explain with example.	CO1	U	4
	b)	How a typical lock manager works using compatibility matrix? Why must lock and unlock be atomic operations? What is starvation and how should a lock manager handle it? Explain each question with example.	CO1	U	6
	a)	What is a transaction? Explain its ACID properties with examples.	CO1	U	4
	b)	Draw the state diagram of a transaction and explain. Explain how shadow copy technique works.	CO1	An	6

Create assertion pat_test {
check (not exists (Select * from
Patient where gender = "F" and
(Select * from Doctor where speciality
= "gynecology"))

International Islamic University Chittagong
Morality Development Program (MDP)
Final Examination, Autumn-2021
4th Semester.

Course Code: MDP-2404. Course Title: Concepts on Moral Development-I

Time: 02 Hours Marks: 50

Answer any five (5) of the following questions. 10×5 50

1. Which section of the people is the worst sufferer of drug addiction? What measures can help one to get rid of or to keep him/her away from drug addiction?

2. What should be the dress code of male and female? Describe in the light Of Quran and Sunnah.

3. "Surely the believers are brothers." Explain this Quranic message with authentic references.

4. Coexistence with the people of various religious beliefs is the precondition for social security and peace. Do you agree? Explain Islamic measures to ensure peaceful coexistence.

5. Enjoining good and forbidding evil is one of the prime duties of the Muslim Ummah. Explain

6. "Gambling may ruin a family and a society"- Give reasons for or against your answer.

7. What should be the Health Policy of Islam? - Explain.

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE, Final Exam, Autumn 2021

Course Code: **ACC-2401** Course Title: **Financial and Managerial Accounting**

Time: 2 hours 30 minutes Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs) of the Questions	
CO1	Explain & Analyze the basic concept of Financial Accounting.
CO2	Explain & Analyze the basic concept of Cost Accounting.
CO3	Apply tools of Accounting
CO4	Compare different business situations.

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) The trial balance of Food Klab Restaurant at October 31, 2018 follows, along with the data for the month-end adjustments. CO3 An 10

Account Number	Account Title	Debit	Credit
11	Cash	$ 2,900	
12	Accounts receivable	13,310	
13	Prepaid rent	2,200	
14	Supplies	840	
15	Equipment	36,830	
16	Accumulated depreciation- equipment		$3,400
21	Accounts payable		3,290
22	Salary payable		
23	Unearned service revenue		5,300
31	Capital		37,290
32	Withdrawals	2,900	
41	Service revenue		12,560
51	Salary expense	2,860	
52	Rent expense		
54	Depreciation expense- equipment		
56	Supplies expense		
	Total	$ 61,840	$ 61,840

Adjusting data at October 31:

a. Unearned service revenue still unearned, $700.

d. Depreciation on equipment for the month, $250.

b. Prepaid rent still in force, $1,000.
c. Supplies used $700.
e. Accrued salary expense, $350.

Required: Enter the trial balance on a work sheet and complete the worksheet of Food klab Restaurant for the month ended October 31, 2018.

Lopez Tailoring Service
Trial Balance
April 30, 2020

CO3 An 10

Accounts Title	Debit	Credit
Cash	2,370	-
Accounts Receivable	23,540	-
Supplies	10,570	-
Prepaid Insurance	7,660	-
Equipment	63,930	-
Accumulated Depreciation- Equipment	-	21,730
Building	74,330	-
Accumulated Depreciation-Building	-	15,050
Accounts Payable	-	19,550
Interest Payable	-	-
Wage Payable	-	-
Unearned service revenue	-	8,840
N/P-Long Term	-	69,900
M. Lpoez, Capital	-	46,200
M. Lopez, Withdrawals	47,500	-
Service revenue	-	92,170
Depreciation expense-Equipment	-	-
Depreciation expense-Building	-	-
Wages expense	28,970	-
Insurance expense	-	-
Interest expense	5,890	-
Utilities expense	5,670	-
Property Tax expense	3,010	-
Supplies expense	-	-
Total	2,73,440	2,73,440

Additional data at April 30, 2020:

a. Supplies used during the year Tk.6,880.
b. Prepaid insurance expired during the year, Tk.5,370.
c. Accrued Interest expense Tk.2,280.
d. Accrued service revenue Tk.2,200.
e. Depreciation for the year: equipment Tk.6,700; building 3,210.
f. Accrued wage expense Tk.830.
g. Unearned service revenue earned during the year Tk.5,180.

Requirement: Prepare adjusting entries and an adjusted trial balance

Or,

The unadjusted trial balance of Gray Electronic Repair Services at December 31, 2017 and the data needed for the month-end adjustments follow.

Adjustment data:

a. Service revenue accrued 280.
b. Accrued utilities expense 1700.

c. Supplies on hand 500.
d. Depreciation expense 620.

Gray Electronic Repair Services
Unadjusted Trial Balance
December 31, 2017

Account Title	Debit	Credit
Cash	$7480	
Accounts Receivable	3400	
Supplies	1500	
Furniture and Fixtures	3000	
Service Equipment	16000	
Accounts Payable		$9000
Loans Payable		12000
Mr. Gray, Capital		13200
Mr. Gray, Drawing	7000	
Service Revenue		9550
Rent expense	1500	
Salaries expense	3500	
Taxes and Licenses	370	
Totals	$43750	$43750

2. a. Open T-accounts for the accounts listed in the trial balance, inserting their December 31 unadjusted balances. CO3 U 3

2. b. Journalize the adjusting entries and post them to the T-accounts. Key the journal entries and posted amounts by letter. CO3 U 4

2. c. Prepare the adjusted trial balance CO3 U 3

Part B
[Answer the questions from the followings]

3. Over the past year REVLON Clipboard manufacturing company sold 40000 clipboards, with the following operating results:

Sales (40000 clipboards)	$1500000
Less variable expenses	900000
Contribution margin	600000
Less fixed expenses	480000
Net operating income	120000

3. a) ***Required:*** Compute the CM ratio, the breakeven point in clipboards, and the degree of operating leverage at last year's level of sales. CO2 An 3

3. b) ***Required:*** Compute the breakeven point in $ amount and margin of safety. CO2 An 3

3. c) ***Required:*** Due to an increase in labor rates, the company estimates that costs will increase by $3 per clipboard next year. If this change takes place and the selling price per clipboard remains constant, what will be the new CM ratio and the new breakeven point in clipboards? CO2 An 4

4. Prepare a **Cost of Goods Sold Statement** for **Hisham & Sons Company** based on the following information: CO2 An 1(

Sales discount	$ 1800
Purchase discounts	350
Sales	2,80,000

Purchase returns and allowances	2,150
Depreciation:	
–Machinery (90% factory related)	25,000
–Building (40% factory related)	18,000
Factory insurance	5,140
Freight out	2800
Other factory expenses	1,600
production supervisor salary	5,000
land	50,000
Bond interest expense	5,000
Indirect Materials	2,350
Sales salaries	10,480
Rental Income	2,500
Freight in	1,500
Direct factory labor	85,500
Materials purchases	42,350
Supplies expense	2,000
Utility expense	3,040
Office salaries	10,600
Advertising expenses	1,200
Indirect Labor	4,350

Inventories:

	January 1, 2018	December 31, 2018
Finished goods.....	$5,000	$4,000
Work-in-process.....	6,000	3,000
Raw Materials.....	10,000	7,000

5. **ABC Door Company sells doors to home builders. The doors are sold for $50 each. Variable costs are $32 per door and fixed costs total $108,000 per year. The company is currently selling 10000 doors per year.** **CO4 R, An 10**

Required:

i. Compute BEP in sales unit and sales amount.

ii. How many units would have to be sold to earn a minimum net operating income of $20000?

iii. Prepare a contribution format income statement and compute DOL.

iv. Management is confident that the company can increase sales by 30% next year. Compute the expected percentage increase in net operating income for next year and also the expected total amount of net operating income for the next year. (Do not prepare an income statement, use the degree of operating leverage).

Or,

5 Write short notes on the following: **CO4 U 10**

Factory Overhead, Accumulated Depreciation, Unearned Revenue, Debit & Credit, and Adjustment.

International Islamic University Chittagong
Department of Computer Science & Engineering

B.Sc. in CSE Final Examination, Autumn 2021

Course Title: Mathematics-IV Course Code: MATH-2407 (New)
Course Title: Mathematics-V Course Code: MATH-3501 (Old)

Time: 2 Hours 30 Minutes **Full Marks: 50**

(i) The figures in the right-hand margin indicate full marks
(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Letter Symbols	Bloom's Levels of the Questions					
Meaning	R	U	App	An	E	C
	Remember	Understand	Apply	Analyze	Evaluate	Create

Group A
Answer the following questions

1. Define Fourier series in the interval$(-L, L)$. Sketch the following function for four cycles. CO3 App 10

$$y = f(t) = \begin{cases} 0; & -4 \le t < 0 \\ 4; & 0 \le t < 4 \end{cases}$$

Also find the Fourier series for the function

2. a) Find the Harmonic Analysis (at least 4) for the given Fourier series. CO4 An 5

$$f(t) = \frac{5}{2} - \frac{5}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}(\cos n\pi - 1)\sin\frac{n\pi t}{4}$$

Or

2. a) Plot the line (at least 6) spectrum (discrete frequency spectra) for the Fourier series CO4 An 5

$$\underbrace{f(t)}_{\text{Complex wave}} = \underbrace{\frac{5}{2}}_{\text{DC value}} + \underbrace{2\sum_{n=1}^{\infty}\frac{1}{n}\sin nt}_{\text{AC value}}$$

2. b) Find Convolution sum $x[n] * h[n]$ for the following functions CO4 An 5

$x[n] = 1 \;;\; n = 0$
$\quad\;\; -1 \;;\; n = 1$
and
$h[n] = 1 \;;\; n = 0$
$\quad\;\; = 1 \;;\; n = 1$

Where n is the time index

Or

2 b) Find convolution integral of $x_1(t) * x_2(t)$ CO4 An 5

Group B

How can you determine the presence of a negative-weight cycle in a graph using Floyd-Warshall's all-pairs shortest paths algorithm? 2 CO2 C

Show how Floyd-Warshall's all-pairs shortest paths problem exploits the optimal substructure property of shortest path. 3 CO3 An

Illustrate the operation of Dijkstra's shortest path algorithm OR Bellman-ford's shortest path algorithm using vertex 6 as the source on the graph in Figure 1. Show the d and π values after each pass. Draw the predecessor subgraph from the output of the algorithm. 5 CO1 Ap

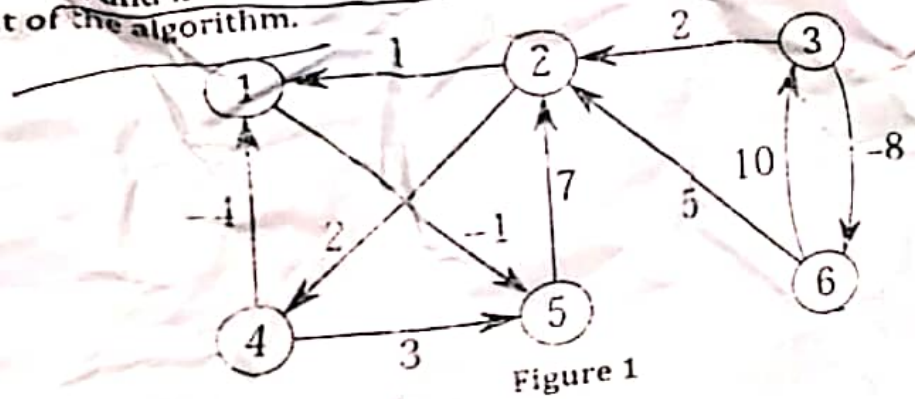


Figure 1

Given a line segment AB and a point C. How can you determine whether point C is on the line segment AB or not? 3 CO1 A

Clearly define the following term (any three). 3 CO4 U

(i) Polynomial Time Algorithm (ii) Decision Problem (iii) Optimization Problem (iv) Intractable Problem (v) Tractable Problem

In chess, a Rook attacks any opponent piece if it is placed in the same row or same column. Let N-Rook is a problem of placing N Rooks in an N×N chessboard such that no two Rooks attack each other. Show, using a tree, how backtracking algorithm searches the state space while solving 4-Rook problem. 4 CO - Ap

What is the basic principle of reducing the solution / state / search space in branch and bound technique? If required use a suitable example. 3 CO1 Ap

Define convex hull. Consider the following points and find convex hull using Graham's scan algorithm: P1(2, 2.7), P2(1.8,3.2), P3(2.6,0.8), P4(0.9,2.5), P5(0.6,0.7), P6(1.5,0.6), P7(1.5,2.5) P8(2,1.5), P9(1.0,2.0), P10(0.8 1.5). 2 CO4 3 CO1 Ap

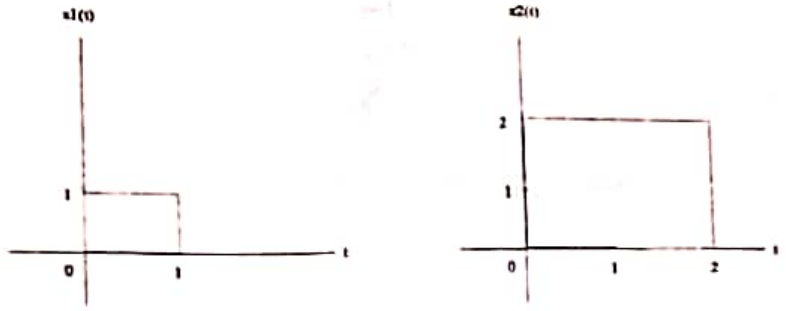
Define the following classes: NP, NP-complete

Suppose that an ant is traveling from point A(2,1) to point B(6,4) in straight line and from there it started to travel towards point C(4,6). Did the ant turn to left or right at point B? From point C it travelled toward point D(2,8). What turn did the ant make at point C, left or right? Show using the technique of cross product. (U

the technique of cross product. $(p_2 - p_0) \times (p_1 - p_0) = (x_2 - x_0)(y_1 - y_0) - (x_1 - x_0)(y_2 - y_0)$.

OR

Graham's scan solves the convex hull problem by sorting the points by polar angle counter clockwise. Suppose, you are given two points $P_1(4,5)$ and $P_2(2,3)$. which one has greater polar angle



Group B

Answer the following questions

3. a) Find the Fourier transform of the function $f(t) = \begin{cases} 1, & 0 < t < 1 \\ -1, & -1 < t < 0 \\ 0, & otherwise \end{cases}$ CO3 App 5

b) Find the inverse Laplace transform of $\frac{s-4}{s(s-1)(s-2)}$ CO3 App 5

Or

b) Find $L[u(t-3)] = \frac{e^{-3s}}{s}$ CO3 App 5

4. a) Solve the initial Value Problem (IVP) by Laplace Transformation. CO3 App 5

$$Y'' - 3Y' + 2Y = 4e^{2t}, \quad Y(0) = -3, Y'(0) = 5$$

Or

a) Solve the following Initial Value Problem (IVP) by Laplace Transform: CO3 App 5

$Y'' + Y = t, \quad Y(0) = 1 \quad Y'(0) = -2$

b) Derive unit step function. Sketch the waveforms for the following signals CO1 App 5

$x_1(t) = -u(t+3) + 2u(t+1) - 2u(t-1) + u(t-3)$

5. a) Write MATLAB code to sketch line spectrum (at least 6) for the Fourier series following CO5 App

$$\underbrace{f(t)}_{\text{Complex wave}} = \underbrace{2.5}_{\text{DC value}} + \underbrace{\left[-\frac{5}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}(\cos n\pi - 1)\sin\frac{n\pi t}{4}\right]}_{\text{AC value}}$$

b) Make a function in MATLAB environment to raise a complex wave $f(t)$ in the time interval of [-4, 20] for the following Fourier series: CO5 App

$$f(t) = \pi - \sum_{n=1}^{\infty}\frac{2}{n}\sin n\pi$$

CO3 App

If $x[n] = 1 \; ; \; n = 0$ and $h[n] = 2 \; ; \; n = 0$

$= -1 \; ; \; n = 1$ $= -2 \; ; \; n = 1$

Write MATLAB code to find the convolution sum of the above signals.

International Islamic University Chittagong
Department of Computer Science and Engineering
B.Sc. in CSE [illegible] Assessment, Autumn 2021

Course Code: CSE 2421 Course Title: Computer Algorithms

Total marks: 50 Time: [illegible] 30 minutes

[The] figures in the right-hand margin indicate full marks. Course Outcomes and Bloom's Taxonomy Levels are mentioned in additional columns.

Group A

			CO	BL
1. a)	Why do some problems which are solvable by dynamic programming also solvable by greedy algorithms and why some [illegible]? Explain.	3	CO5	[illegible]
b)	You have been asked to encode a paragraph [illegible] coding scheme. This paragraph contains the following symbols [illegible] frequency in the paragraph. (table below) [illegible] Huffman tree and utilizing that tree tell the binary encoding [illegible] letter. OR Suppose [illegible] knapsack that has a weight [illegible]. There are items [illegible] each having [illegible] $w_2, \ldots, w_n$ and some [illegible] associated with it $v_1, \ldots, v_n$. We need to [illegible] benefit such that [illegible] weight inside the knapsack is at most W. [illegible] algorithm [illegible] problem.	4	CO5	Ap
c)	Prove that the fractional knapsack problem has the greedy-choice property. OR Prove that activity selection problem has the greedy choice property.	3	CO[illegible]	[illegible]

A	B	C	D	E	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	L
3	[illegible]	26	5	3	[illegible]	12	2	[illegible]	[illegible]	9

2\. a) Show how Depth First Search (DFS) [illegible] graph and consider s as the source. Visit the nodes in [illegible] order. Also show the status of [illegible] after each step. 4 CO[illegible]

b) Draw a simple graph with at least 6 vertices such that the vertices are traversed in the same order while traversed both in BFS and DFS. 1 CO1

c) Transpose of a directed graph G is G^T where the directions of all the edges are reversed. [illegible] an efficient algorithm for [illegible] where G is represented using adjacency list.

OR

Transpose of a directed graph G is G^T where the directions of all the edges are reversed. Give an efficient algorithm for G^T [illegible] where G is represented using adjacency matrix. 3 CO2

d) How many different minimum spanning trees can be formed from a complete graph of n vertices where weights of all the edges are equal? Will the answer remain the same if weights of all the edges are different? 2 CO1