Academic Year 2022-2023 (ODD Semester)

RV College of Engineering®
Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi
Approved by AICTE New Delhi

USN: 1RV21AI045

Department of Artificial Intelligence and Machine Learning

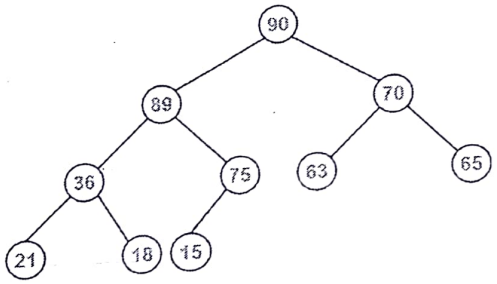
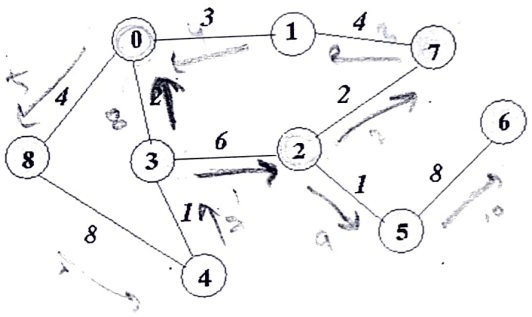
Date: 22 Feb 2023
Duration: 90 Minutes

Course Code: 21AI33
Sem: III

CIE-II

Data Structures and Data Analysis (DSDA)

Answer all the Questions

SL. No		Questions	M	BT	CO
1	a	Given the following Max Heap, write various steps in deleting the data element 89 and also show heapifcation. 	04	03	01
	b	Write a C program to create a Max Heap of integers and display the same. **(Hint: Use arrays to represent the Max Heap)**	06	03	03
2		Write a C program to create an adjacency matrix of a directed graph and display the graph using DFS. Assume maximum size of the adjancency mantrix A as A[MAXV][MAXV]. **(NOTE: Your program should accept vertices and edges as inputs.)**	10	03	03
3	a	Write the DFS traversal for the given weighted graph. Assume starting vertex as 3. 	04	02	03
	b	Given the following C function, which is written for BFS traversal of a graph, with source vertex as v. Correct the logic if there are any errors, and write the corrected version. ***Assume adj[][], visited[], front, and rear have been properly initiallised before the function was called.***	06	04	01

```
void bfs(int v)
{
  for (i = 1; i <= n; i++)
```

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		if (adj[v][i] && visited[i])
		queue[rear++] = i;
		if (front <= rear)
		{
		visited[queue[front]] = 1;
		printf("Node visited = %d\n", queue[front]);
		bfs(adj[v][i]);
		}
		}			

4	a	Give the interpretations of the following statements; 1. H is universal if, for each x, y ∈ U, the number of h ∈ H such that h(x) = h(y) is at most |H|/m. 2. Searching and Deletion might take linear time in the case of Hash by Division.	04	04	04
	b	Given the input {4371, 1323, 6173, 4199, 4344, 9679, 1989}, a fixed table size of 10, and a hash function h(x) = x mod 10, show the working of; **a. Hashing with Open addressing and b. Hashing with Quadratic probing**	06	03	02
5		Write a block diagram depicting various phases of the CRISP-DM Process and briefly explain the importance of all stages.	10	02	02

Course Outcome	
CO1	Apply the knowledge of data structures in providing solutions to some software development requirements.
CO2	Perform data analysis of some real-world scientific/business use cases and present the analysis results.
CO3	Investigate appropriate data structures and understand requirements in solving some problems of industry and society.
CO4	Use data analysis tools to illustrate the principles of data interpretation, statistical analysis, and graphical visualizations of the datasets.
CO5	Appraise data structures and analysis knowledge to build a successful career as an AIML engineer, work in teams, and communicate their ideas effectively.

M-Marks, BT-Blooms Taxonomy Levels, CO-Course Outcomes

Marks Distribution	**Particulars**	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**L1**	**L2**	**L3**	**L4**	**L5**
	Max Marks	10	16	20	04	--	--	14	26	10	--

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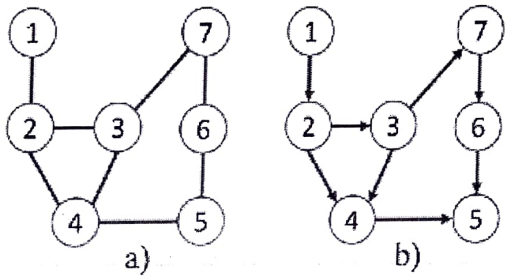
QUIZ-II

Course Code: 21AI33
Sem: III

Date: 18-Jan-2023
Duration: 20 Minutes

Data Structures and Data Analysis (DSDA)

Answer all the Questions

SL. No	Questions	M	BT	CO
1	Differentiate Data and Knowledge. Give example for each.	02	02	01
2	Write any two differences between Trees and Graphs. Give an application of a Graph.	02	01	03
3	Give Data Structure representations of the following graphs.  	02	02	01
4	How do Hash Tables are used to implement Set ADT?	02	02	01
5	Is the hash function **h(x)=x mod m** a perfect hash function? Justify.	02	02	01

Marks Distribution	Particulars	CO1	CO2	CO3	CO4	CO5	L1	L2	L3	L4	L5
	Max Marks	08	---	02	--	--	02	08	--	--	--

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Academic year 2022-2023 (ODD Sem)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Date	FEB 2023	Maximum Marks	50+10
Course Code	21CS35	Duration	20+90 Min
Sem	III Semester	CIE-II	

OPERATING SYSTEMS
(Common to AI&ML, CSE and ISE)

Sl. No.	Questions	M	BT	CO
	PART A			
1.1	Differentiate between compile time binding and runtime binding	2	2	1
1.2	What is starvation? State the solution for it.	2	1	1
1.3	A shared variable x, initialized to zero, is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, increments by one, stores it to memory, and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution?	2	4	2
1.4	List any two possible solution to deadlock in dining-philosophers problem	2	1	1
1.5	A counting semaphore was initialized to 20. Then 6 P(wait) operations and 7 V(Signal) operations were completed on this semaphore. The resulting value of the semaphore is _____	1	3	3
1.6	_____ refers to the period of time from the arrival of an interrupt at the CPU to start of the routine that services the interrupt.	1	2	1
	PART-B			
1 a.	Compare external and internal fragmentation.	5	2	1
1b.	With a neat diagram explain the process of swapping.	5	2	2
2 a.	Given memory partitions of 200 K , 600 K, 300 K, 400 K and 700 K (in order), how would each of the first-fit, best-fit and worst-fit algorithms places processes of 312 K, 517 K, 212 K and 526 K (in order)? Which algorithm makes the most efficient use of memory?	5	3	2
2b.	Explain the Peterson's solution to critical section problem	5	2	2
3 a.	Implement the semaphore and its operation to avoid busy waiting and explain	6	4	4
3b.	Write a note on Dynamic loading.	4	1	4
4	With simple procedures explain the following problems of synchronization and its solution (i) Reader-Writer problem (ii) Bounder buffer problem	10	2	4

5	Consider the following set of processes. Process / Arrival time / Burst time / Priority P_1 0 4 2 P_2 1 2 4 P_3 2 3 6 P_4 3 5 10 P_5 4 1 8 P6 5 4 12 P7 6 6 9 (i) Draw the Gantt charts to illustrate execution using RR(quantum=3) and pre-emptive priority.(higher number represents higher priority) (ii) Compute average waiting time and average turnaround time in each of the cases (iii) Compute the response time for each of the processes for pre-emptive priority scheduling. (iv) Which one of them provides minimal average waiting time and turnaround time?	10	3	1

COURSE OUTCOMES:

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the operating systems concepts to solve problems in computing domain
CO2:	Analyze data structures and algorithms used to implement OS concepts
CO3:	Design solutions using modern tools to solve applicable problems in operating systems domain
CO4:	Implement process, memory, scheduling, synchronization and other operating system techniques
CO5:	Demonstrate skills like investigation, effective communication, working in team/Individual and following ethical practices by implementing operating system concepts and applications

.BT-Blooms Taxonomy, CO-Course Outcomes, M-Marks

	L1	L2	L3	L4	L5	L6	CO1	CO2	CO3	CO4	CO5
Total Marks	08	28	16	2	-	-	22	17	1	6	-

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DEPARTMENT OF MATHEMATICS

Date	**20-02-2023**	**Maximum Marks**	**50**
Course Code	**21MA31D**	**Time**	**3:30 PM to 5:30 PM**
Semester	**III**	**Test-2**	

Mathematics for AI and ML (AIML)

Sl.No.	QUIZ	M	BT	CO
1	Let $T: R^2 \to R^2$ be a linear transformation representing reflection over the y=2x. Find matrix of transformation.	2	L2	1
2	If $v_1 = \begin{bmatrix} 1 \\ -3 \\ 2 \end{bmatrix}, v_2 = \begin{bmatrix} -3 \\ 9 \\ 6 \end{bmatrix}, v_3 = \begin{bmatrix} 5 \\ -7 \\ k \end{bmatrix}$. For what value of k the set $\{v_1, v_2, v_3\}$ is linearly dependent ?	2	L2	1
3	Consider a vector space $V = \{x \in \mathbb{R}^2 \; such \; that \; Ax = 5x\}$ .If $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ Find the basis and dimension of V .	2	L2	1
4	Orthogonal projection of y = (2 , 6) onto u = (7, 1) is ----------.	2	L1	1
5	Let $A = \begin{bmatrix} 2 & 4 & -2 & 1 \\ -2 & -5 & 7 & 3 \\ 3 & 7 & -8 & 6 \end{bmatrix}$, if column space of A is subspace of $\mathbb{R}^k$,what is k? If null space of A is subspace of $\mathbb{R}^k$,what is k?	2	L1	4
	TEST			
1	Obtain basis and dimension for row space, column space, null space and left null space for the matrix A = $\begin{bmatrix} 1 & 2 & 1 & -3 & -1 \\ 0 & -3 & -6 & 4 & 9 \\ -2 & -3 & 0 & 3 & -1 \\ 1 & 4 & 5 & -9 & -7 \end{bmatrix}$.	10	L2	4
2a	Diagonalize the matrix A= $\begin{bmatrix} 7 & 2 \\ 2 & 4 \end{bmatrix}$.	5	L2	4
2b	Show that $S = \{(1, 0, -1), (1, 2, 1), (0, -3, 2)\}$ form a basis for $\mathbb{R}^3$.	5	L2	1
3a	Compute basis and dimension of kernel, Image of $T: \mathbb{R}^3 \to \mathbb{R}^3$ defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$ .Also verify Rank-nullity theorem for linear transformation .	5	L2	4
3b	Consider a linear transformation $T: \mathbb{R}^2 \to \mathbb{R}^2$ such that T(1, 0) = (1, 1) and T(0, 1) = (-1 , 2) find an explicit formula for T (x, y) and also prove that T maps square with vertices (0, 0), (1, 0), (1, 1) , (0, 1) into a parallelogram.	5	L3	4
4	Determine QR factorization for matrix $A = \begin{bmatrix} 1 & 3 & 5 \\ -1 & -3 & 1 \\ 0 & 2 & 3 \end{bmatrix}$.	10	L2	1
5	Obtain the Singular Value Decomposition of $A = \begin{bmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{bmatrix}$.	10	L3	4

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Academic Year 2022-2023 (ODD Semester)

USN:

Department of Artificial Intelligence and Machine Learning

Course Code: 21AI34 **Date:** 23.02.2023

Sem: III Semester **Maximum Marks:** 10(QUIZ), 50 (Test)

Duration: 110 Minutes

PART-A

SL. No	Question	M	BT	CO
1	Give an example for Optical Sensors	1	1	1
2	What is the role of Analog Front End (AFE) in Sensors?	1	1	2
3	In what context the working of Memory Mapped IO is different from Port IO	1	1	2
4	Identify the CPU used by the Stereo Vision tracking Systems.	1	1	1
5	Differentiate between Ad-hoc Networks from Wireless Sensor Networks.	1	2	2
6	What do you mean by Board Support Packages (BSP)	1	1	1
7	How Smart Sensor is different from the Sensor.	1	2	2
8	What is the use of Boot Code in Embedded Systems?	1	1	1
9	What are primary design considerations for traditional Sensor Networks	1	1	2
10	Define Sampling Frequency.	1	1	1

PART-B

SL. No		Questions	M	BT	CO
1	a)	With a neat sketch discuss Stereo-Vision Tracking System	5	3	2
	b)	List and explain the hardware components used in Stereo-Vision Tracking System	5	1,2	2
2	a)	Discuss Processing Subsystem in Stereo-Vision Tracking System	5	2	2
	b)	Illustrate PCI Express Byte Lane Network Architecture.	5	3	2
3	a)	Illustrate Taxonomy of Processor-IO Interconnection Strategies.	5	3	1
	b)	Identify the difference between 1. WSN and MANET's 2. Traditional Sensor Networks and WSN	5	1	2
4	a)	Compare VME and PCI 2.x Buses	5	2	2
	b)	Discuss the Sensor Classification in CPS	5	2	2
5	a)	Discuss fundamental services and extended services of Real-Time Operating System	5	2	2

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b) Illustrate the OODA architecture by considering Autonomous Vehicles as an Example. 5 3 1

Course Outcome	
CO1	Understand and apply the knowledge of engineering specialization to address the complex engineering problems
CO2	Analyse the various Cyber-Physical components used in solving the real-world problem
CO3	Design solution for complex engineering problem using Cyber Physical Systems
CO4	Communicate effectively and collaborate in group to carryout Cyber Physical System activities
CO5	Demonstrate design skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

M-Marks, BT-Blooms Taxonomy Levels, CO-Course Outcomes

	Particulars	CO1	CO2	CO3	CO4	CO5	L1	L2	L3	L4	L5	L6
Marks Distribution	Max Marks (QUIZ)	5	5	-	-	-	8	2	-	-	-	-
	Max Marks (TEST)	5	45	-	-	-	6	24	20	-	-	-

***** ALL THE BEST *****

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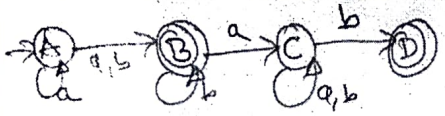
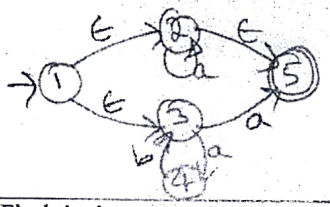
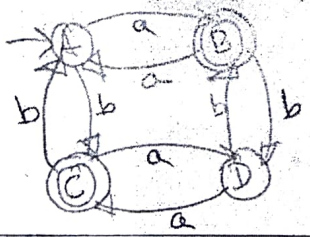
Academic year 2022-2023 (Odd Semester)

DEPARTMENT OF

CSE/ISE/AIML

Date	25th Feb 2023	Maximum Marks	60
Course Code	21CS36	Duration	110 Mins
Sem	III	CIE - II	
DISCRETE MATHEMATICLA STRUCTURES			

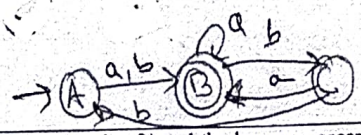
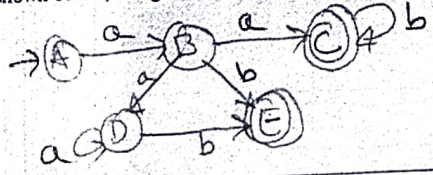
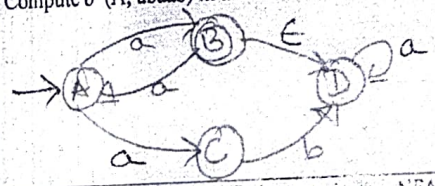
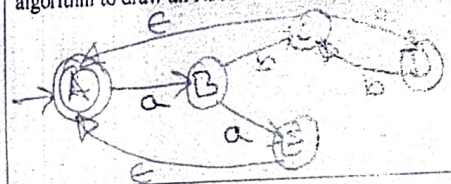
Part - A

Sl. No.	Questions	M	BT	CO
1	For the language L={ab, bc, a} over the alphabet ∑={a, b, c}, find L^3.	1	L2	CO1
2	Let L_1 and L_2 are two languages over the alphabet ∑={a, b, c} as below. Find $L_1 \cap L_2$. $L_1=\{a^n b^n c^m \mid n, m \geq 1\}$, $L_2=\{a^n b^m c^m \mid n, m \geq 1\}$.	1	L1	CO1
3	Compute δ*(A, ababa) in the NFA shown below. 	1	L2	CO2
4	Find ε-closure ({1, 2, 3}) in the NFA-ε shown below. 	1	L2	CO2
5	Find the language accepted by the automat shown below. 	1	L1	CO2
6	If the binary operation * is associative, then complete the following table	2	L3	CO2
7	If G is a group under the binary operation * then $(a*b)^{-1}$ maps to ---------- for all a, b ε G.	1	L2	CO1
8	For the following encoding function, find the minimum distance between the code words. What are the error detection and correction capabilities of these? E: $Z_2^2 \rightarrow Z_2^{10}$ E(00)=0000000000, E(01)=0000011111, E(10)=1111100000, E(11)=1111111111.	2	L2	CO3

*	a	b	c	d
a	a	b	c	d
b	b	a	c	d
c				
d	d	c	c	d

Academic year 2022-2023 (Odd Semester)

PART B

QNo.	Questions	M	BT	CO
1. a	Define DFA, the extended transition function δ* and the language accepted by DFA. Construct DFAs which generates the following languages over the alphabet ∑={0, 1}. i. Set of all strings that do not end with 01. ii. Set of all strings that do not contain the substring 00.	07	L3	CO2
1. b	Find the language of the DFA shown below and compute δ*(A, ababb) and δ*(A, bbaaba). 	03	L2	CO1
2. a	Define NFA, the extended transition function δ* and the language accepted by NFA. Construct the NFA to accept the language L={w | w ε {a, b}* and w ends with ab or ba}. Compute δ*(q_0, bbaabba) where q_0 is the start state of the NFA constructed.	06	L2	CO1
2. b	Prove that for every NFA there exists a DFA accepting the same language. For the NFA shown below, using the subset construction draw the equivalent DFA. 	04	L3	CO2
3. a	Define NFA-ε, the extended transition function δ* and the language accepted by NFA-ε. Compute δ*(A, abaab) in the NFA-ε shown below. 	04	L2	CO2
3. b	Explain the algorithm to find an equivalent NFA from the given NFA- ε. Use this algorithm to draw an NFA for the NFA- ε given below. 	06	L1	CO1
4.a	Find all the subgroups of $(Z_{18}, +)$.	06	L4	CO3
4. b	Show that (U_{14}, x) is a cyclic group and find all its generators.	04	L2	CO1
5. a	Let E:$Z_2^3 \rightarrow Z_2^9$ be the encoding function for the (9, 3) triple repetition code. i. If D: $Z_2^9 \rightarrow Z_2^3$ is the corresponding decoding function, apply D to decode received words 111101100, 000100011, 010011111. ii. Find three different words r for which D(r)=000.	04	L2	CO2
5. b	The encoding function E: $Z_2^2 \rightarrow Z_2^5$ is given by the generator matrix $G=\begin{bmatrix}1&0&1&1&0\\0&1&0&1&1\end{bmatrix}$ i. Determine all code words. What is the error detection and correction capability. ii. Find the associated parity check matrix H. iii. Use H to decode the received words 00111, 00110.	06	L4	CO3