U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

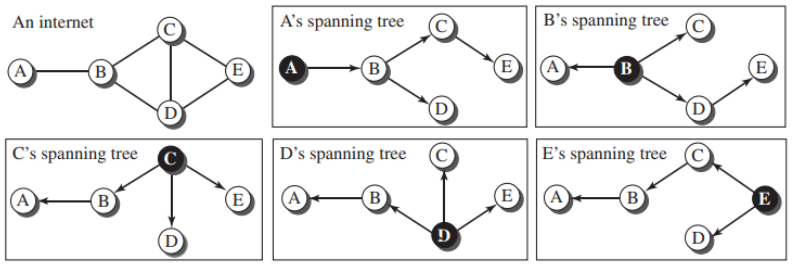
April 2024 Semester End Main Examinations

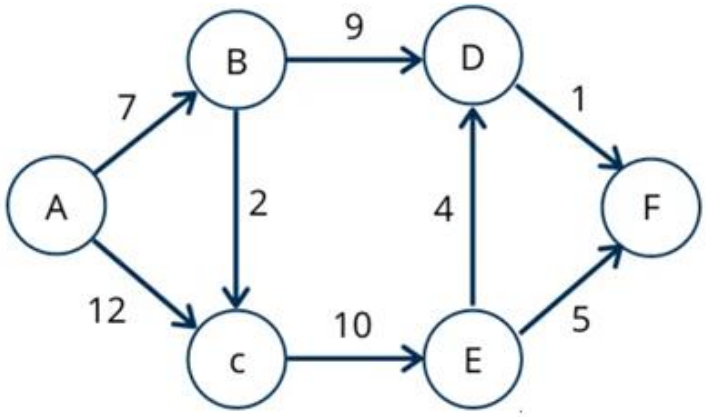
Programme: B.E. **Semester: IV**
Branch: Computer Science & Engineering **Duration: 3 hrs.**
Course Code: 22CS4PCCON **Max Marks: 100**
Course: Computer Networks

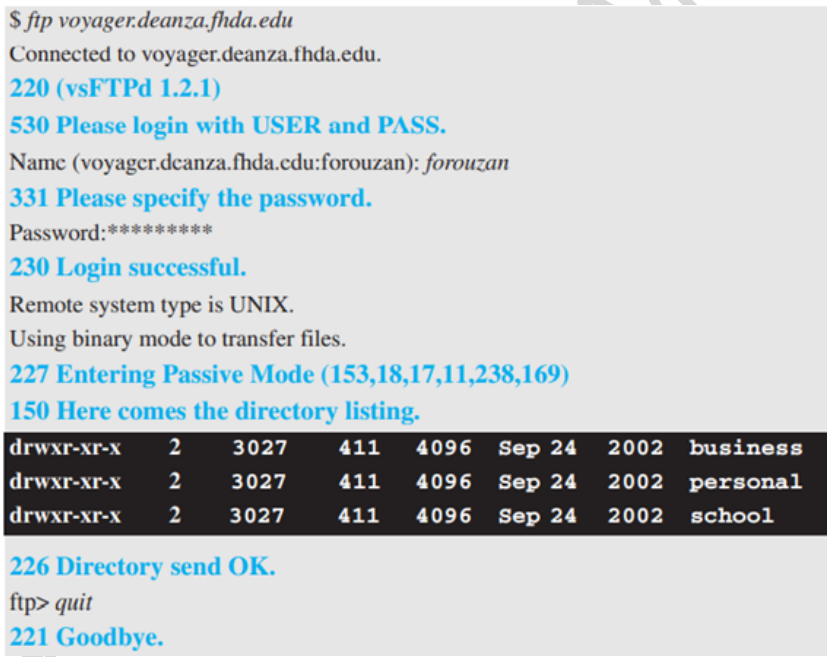
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Write the functionalities of i. Network layer ii. Transport Layer	*CO1*	*PO1*	**6**
	b)	We have four sources, each creating 250 characters per second. If the interleaved unit is a character and 1 synchronizing bit is added to each frame, find i. the data rate of each source ii. the duration of each character in each source iii. the frame rate iv. the duration of each frame v. the number of bits in each frame, and vi. the data rate of the link.	*CO2*	*PO2*	**6**
	c)	Discuss on the two D-D schemes – MLT-3, 2B1Q. Apply these two schemes to the following data streams and draw the graphs assuming the last signal level has been positive. i. 00001111 ii. 11001100 iii. 01010101	*CO1*	*PO1*	**8**
		UNIT - II			
2	a)	Demonstrate byte stuffing in a character-oriented protocol with an example.	*CO1*	*PO1*	**6**
	b)	A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is x^3+1. i) What is the actual bit string transmitted? ii) Suppose the third bit from the left is inverted during transmission (ie.10**1**11101…). How will receiver detect this error?	*CO1*	*PO1*	**6**
	c)	Consider a Walsh table with W1=[-1]. Generate the chip sequences for four stations. Apply CDMA technique assuming Station 1 transmits Bit 0, Station 2 transmits Bit 1, Stations 3 and	*CO2*	*PO2*	**8**

			4 remain silent. Assume Station 4 wants to retrieve the data sent by station 2. Analyze and represent the scenario diagrammatically and explain the same.			
			OR			
	3	a)	Explain the RTS and CTS Frame Exchange Time Line in CSMA/CA with a neat figure.	*CO1*	*PO1*	**6**
		b)	A pure ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces i) 1000 frames per second? ii) 500 frames per second? iii) c. 250 frames per second?	*CO1*	*PO1*	**6**
		c)	A sender needs to send the four data items Ox3456, OxABCC, Ox02BC, and OxEEEE. Analyze and answer the following: i. Find the checksum at the sender site. ii. Find the checksum at the receiver site if there is no error. iii. Find the checksum at the receiver site if the second data item is changed to OxABCE. iv. Find the checksum at the receiver site if the second data item is changed to OxABCE and the third data item is changed to Ox02BA.	*CO2*	*PO2*	**8**
			UNIT - III			
	4	a)	Discuss about the closed loop congestion control.	*CO1*	*PO1*	**6**
		b)	Discuss the need of Path vector routing. Consider the given figure that demonstrates path vector routing. Analyze the various spanning trees and list down the policies followed by every node. 	*CO 2*	*PO2*	**6**

		c)	Analyze the given topology. Use Dijkstra's algorithm, show the various steps involved in finding the shortest path tree. 	*CO2*	*PO2*	**8**
			OR			
	5	a)	Explain DHCP Operation with a neat figure.	*CO1*	*PO1*	**6**
		b)	A problem with distance-vector routing is that any decrease in cost (good news) propagates quickly, but any increase in cost (bad news) will propagate slowly. Analyze and justify the statement with an example.	*CO2*	*PO2*	**6**
		c)	An organization is granted a block of addresses with the beginning address 14.24.74.0/24. The organization needs to have 3 subblocks of addresses to use in its three subnets: one subblock of 10 addresses, one subblock of 60 addresses, and one subblock of 120 addresses. Analyze the given scenario and design the subblocks. Draw a figure showing the above scenario.	*CO2*	*PO2*	**8**
			UNIT - IV			
	6	a)	Discuss about the UDP user datagram and header format with neat figures.	*CO1*	*PO1*	**6**
		b)	Consider that a network uses Selective-Repeat protocol with m = 4, the sending window of size 8, the value of variables are S_f = 1062, Sn = 1067, and Rn =1064. Assume that • The network does not duplicate the packets. • packet 1065 has already been acknowledged at the sender site • Packets 1065 and 1066 are received out-of-order at the receiver site. Analyze the network above and answer the following. i. What are the sequence numbers of pending data packets (in transit, corrupted, or lost)? Explain. ii. What are the acknowledgment numbers of pending ACK packets (in transit, corrupted, or lost)? Explain.	*CO2*	*PO2*	**6**
		c)	Assuming TCP Reno is the protocol experiencing the behaviour shown below, answer the following questions. In all cases, provide a short discussion and justify your answer.	*CO2*	*PO2*	**8**

			i. Identify the intervals of time when TCP congestion avoidance is operating. ii. After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? iii. After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout? iv. What is the value of ssthresh at the 24th transmission round?			
			UNIT - V			
	7	a)	Consider web-based email and discuss about the two cases given here. Support your answers with neat figures. i. only receiver uses HTTP and ii. Both sender and receiver use HTTP with neat figures.	*CO1*	*PO1*	**6**
		b)	Analyze the following image, showing a sequence of signals. Write about the commands associated with every statement and discuss.  $ *ftp voyager.deanza.fhda.edu* Connected to voyager.deanza.fhda.edu. 220 (vsFTPd 1.2.1) 530 Please login with USER and PASS. Name (voyager.deanza.fhda.edu:forouzan): *forouzan* 331 Please specify the password. Password:********* 230 Login successful. Remote system type is UNIX. Using binary mode to transfer files. 227 Entering Passive Mode (153,18,17,11,238,169) 150 Here comes the directory listing. drwxr-xr-x 2 3027 411 4096 Sep 24 2002 business drwxr-xr-x 2 3027 411 4096 Sep 24 2002 personal drwxr-xr-x 2 3027 411 4096 Sep 24 2002 school 226 Directory send OK. ftp> *quit* 221 Goodbye.	*CO2*	*PO2*	**6**
		c)	Write about the resolution in DNS. Explain in detail the two categories of resolutions with neat figures.	*CO1*	*PO1*	**8**

******

U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Computer Science & Engineering **Duration: 3 hrs.**
Course Code: 22CS4PCOPS **Max Marks: 100**
Course: Operating Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			CO	PO	Marks
		UNIT - I			
1	a)	Define Operating Systems. Explain dual mode of operating systems with a neat diagram.	*CO1*	*PO1*	**05**
	b)	List and explain services provided by an operating system that are designed to make the usage of computer systems more convenient for both users and system.	*CO1*	*PO1*	**08**
	c)	Discuss the implementation of IPC using shared memory and message-passing approaches in detail.	*CO1*	*PO1*	**07**
		UNIT - II			
2	a)	Calculate the average waiting time and the average turnaround time by drawing the Gantt chart using FCFS, SRTF, RR(quantum=2ms), and priority algorithms. Lower priority number represents a higher priority.	*CO3*	*PO3*	**10**
	b)	List and Explain Threading issues in multithreaded programming.	*CO1*	*PO1*	**05**
	c)	Give a brief description about multithreading and explain the different multi-threading models.	*CO1*	*PO1*	**05**
		UNIT - III			
3	a)	What is a deadlock? List the necessary conditions for the deadlock to occur.	*CO1*	*PO1*	**05**
	b)	Illustrate how Reader's-writer's problem can be solved by using Semaphores.	*CO1*	*PO1*	**05**

Process	Arrival time	Burst time	Priority
P1	0	9	3
P2	1	4	2
P3	2	9	1
P4	3	5	4

<table>
<tr><td></td><td></td><td>c)</td><td>Consider the following snapshot of a system:

<table>
<tr><th>Process</th><th colspan="4">Allocation</th><th colspan="4">Max</th><th colspan="4">Available</th></tr>
<tr><td></td><th>A</th><th>B</th><th>C</th><th>D</th><th>A</th><th>B</th><th>C</th><th>D</th><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>P0</td><td>2</td><td>0</td><td>0</td><td>1</td><td>4</td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>P1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>5</td><td>2</td><td>5</td><td>2</td><td colspan="4"></td></tr>
<tr><td>P2</td><td>2</td><td>1</td><td>0</td><td>3</td><td>2</td><td>3</td><td>1</td><td>6</td><td colspan="4"></td></tr>
<tr><td>P3</td><td>1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>4</td><td>2</td><td>4</td><td colspan="4"></td></tr>
<tr><td>P4</td><td>1</td><td>4</td><td>3</td><td>2</td><td>3</td><td>6</td><td>6</td><td>5</td><td colspan="4"></td></tr>
</table>
Apply Banker’s algorithm and answer the following.
i) Is the system in safe state? If so, give the safe sequence.
ii) If process P2 requests (0,1,1,3) resources can it be granted immediately?</td><td>CO2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>a)</td><td>Explain Paging hardware with TLB.</td><td>CO1</td><td>PO1</td><td>05</td></tr>
<tr><td></td><td>b)</td><td>Consider the page reference string: 1,0,7,1,0,2,1,2,3,0,3,2,4,0,3,6,2,1 for memory with 3 frames. Apply FIFO, optimal and LRU replacement algorithms to determine the number of page faults. Which algorithm is most efficient?</td><td>CO2</td><td>PO2</td><td>09</td></tr>
<tr><td></td><td>c)</td><td>What is Thrashing? What is the cause of Thrashing? How does the system detect Thrashing? What can the system do to eliminate this problem?</td><td>CO1</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>a)</td><td>What is a Virtual Memory? Discuss the benefits of virtual memory technique.</td><td>CO1</td><td>PO1</td><td>05</td></tr>
<tr><td></td><td>b)</td><td>Given five memory partitions of 100kb,500kb,200kb,300kb, and 600kb(in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212kb,417kb,112kb, and 426kb(in order)? Which algorithm makes the most efficient use of memory?</td><td>CO2</td><td>PO2</td><td>09</td></tr>
<tr><td></td><td>c)</td><td>Discuss briefly Demand-paging in memory management scheme.</td><td>CO1</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>a)</td><td>Explain Access matrix method of system protection with domain as objects and discuss its implementation.</td><td>CO1</td><td>PO1</td><td>08</td></tr>
<tr><td></td><td>b)</td><td>A disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 53. The queue of pending requests, in FIFO order is 60, 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?</td><td>CO3</td><td>PO3</td><td>12</td></tr>
</table>

			i) FCFS ii) SSTF iii) SCAN iv) LOOK v) C-SCAN vi) C-LOOK.			
			OR			
	7	a)	List and explain various methods for Free-space management.	*CO1*	*PO1*	**08**
		b)	Explain three different allocation methods in file system implementation. Illustrate with a neat diagram.	*CO1*	*PO1*	**12**

****

U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Computer Science & Engineering **Duration: 3 hrs.**
Course Code: 22CS4PCADA **Max Marks: 100**
Course: Analysis and Design of Algorithms

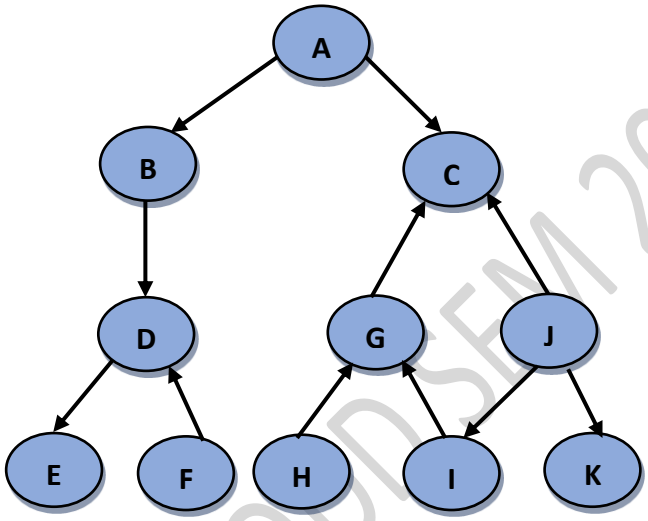
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

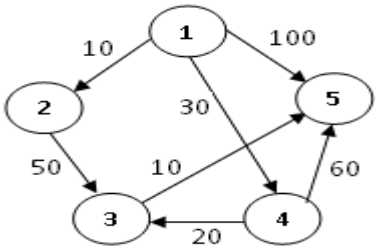
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	PO	Marks
		UNIT - I			
1	a)	Demonstrate with an example Worst case, Best case time complexity of an algorithm.	CO1	PO2	6
	b)	Several algorithms may be written for solving same problem. Justify your answer with an example. Also, specify which algorithm is better and give reason for the same.	CO2	PO1	8

	c)	Analyze the time complexity for the following codes. Show the steps clearly
		1)
		`int function(a)`
		`{`
		`int x=0;`
		`for (i=0;<n; i++)`
		`{`
		`for (j=0; j<n; j++)`
		`{`
		`if(a[i][j]==x)`
		`{`
		`return;`
		`}`
		`}`
		`}`
		`}`
		2)
		`recur_fn(int n)`
		`{`
		`if (n>1)`
		`{`
		`printf("%d", n);`
		`recur_fn(n/2);`
		`}`
		`}`
			CO1	PO2	6

		UNIT - II			
2	a)	Differentiate between different variations of Decrease and Conquer technique with an example	CO2	PO1	6
	b)	Write a program to check whether a particular given node is reachable from a given source node using DFS traversal technique. If yes, print "Node is accessible", otherwise print "Node is not accessible".	CO2	PO1	8

		c)	Apply Exhaustive Search technique to solve the following instance of Knapsack problem with number of objects N=4, weights of 4 objects= {10,20,16,24) and profits = {85,40,35,30} with the capacity of Knapsack M=50.	*CO2*	*PO1*	**6**
			OR			
	3	a)	Differentiate between DFS and BFS tree traversals.	*CO2*	*PO1*	**6**
		b)	Apply Johnson Trotter method to generate permutations for the set **{6,7,8}**	*CO2*	*PO1*	**6**
		c)	Apply DFS traversal technique to find traversal for the following graph. Show the steps with the appropriate data structure. Write the algorithm for the same. 	*CO2*	*PO1*	**8**
			UNIT - III			
	4	a)	Write an algorithm to determine number of occurrences of each element in an array using the concept of presorting and analyze its time complexity.	*CO1*	*PO2*	**6**
		b)	Apply Quick sort technique to sort the following set of integers. Also, write Quick sort algorithm to sort an array. **60, 50, 25,10,35,25,75,30,85**	*CO2*	*PO1*	**8**
		c)	Apply Divide and Conquer technique to multiply the following two long integers: **1234 and 4321**	*CO2*	*PO1*	**6**
			OR			
	5	a)	Is Merge sort better than Quick sort, in the worst case. Justify your answer by deriving the time complexities for both in worst case.	*CO1*	*PO2*	**6**
		b)	Construct a max heap and sort the following list of elements using Heap sort technique. Write an algorithm and find its time complexity **16, 10, 15, 9, 5, 12, 14**	*CO1*	*PO2*	**8**

	c)	Justify how Boyer-Moore pattern matching algorithm is better compare to Brute Force pattern matching with respect to time complexity with an example	***CO1***	***PO2***	**6**
		UNIT - IV			
6	a)	Suppose the knapsack problem is solved by Dynamic programing technique and the solution table is given below. Explain step by step process of selecting objects to get optimal solution. Consider number of objects=4, Weight={1,5,3,4} for the items with the number {1,2,3,4}, Capacity of Knapsack=8	***CO2***	***PO1***	**6**
	b)	Apply Dijkstra's algorithm to find shortest path from the vertex 1 to all other vertices for the following graph 	***CO2***	***PO1***	**8**
	c)	The characters a to h have the set of frequencies based on the first 8 Fibonacci numbers as follows: a : 1, b : 1, c : 2, d : 3, e : 5, f : 8, g : 13, h : 21 A Huffman code is used to represent the characters. What is the sequence of characters corresponding to the following code? 110111100111010	*CO2*	*PO1*	**6**
		UNIT - V			
7	a)	Show the state space tree for finding sum of subset for the set X={5,8,13} with d=13 using Backtracking technique.	***CO2***	***PO1***	**6**

	0	1	2	3	4	5	6	7	8
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1	**0**	**15**	**15**	**15**	**15**	**15**	**15**	**15**	**15**
2	**0**	**15**	**15**	**15**	**15**	**15**	**25**	**25**	**25**
3	**0**	**15**	**15**	**15**	**24**	**24**	**25**	**25**	**25**
4	**0**	**15**	**15**	**15**	**24**	**24**	**25**	**25**	**29**

		b)	Apply Branch and Bound technique to solve the following instance of knapsack for knapsack capacity M = 15. **Item No. / Profit / Weight** **1 / 10 / 2** **2 / 10 / 4** **3 / 12 / 6** **4 / 18 / 9**	***CO2***	***PO1***	**8**
		c)	Convert the below CNF into Clique graph $(x_1 \vee x_1 \vee x_2) \wedge (\overline{x_1} \vee \overline{x_2} \vee \overline{x_2}) \wedge (\overline{x_1} \vee x_2 \vee x_2)$	***CO2***	***PO1***	**6**

****

U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

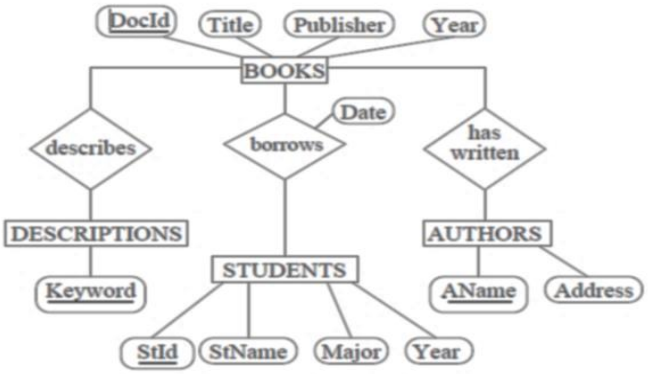
April 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 22IS4PCDBM **Max Marks: 100**
Course: Database Management System

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

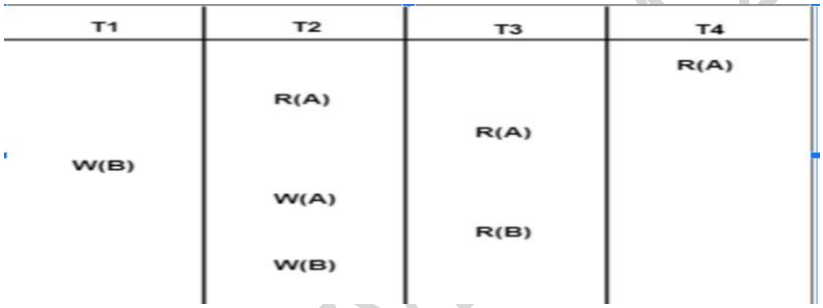
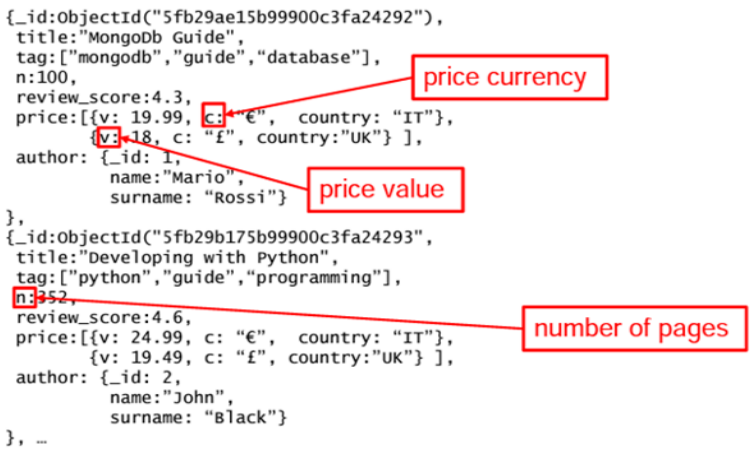
		UNIT - I	*CO*	*PO*	Marks
1	a)	Outline any two key characteristics that distinguish the database approach from the file-processing approach in data management.	*CO1*	-	**06**
	b)	Identify the architecture of DBMS that separates the user applications from the physical database and illustrate the same with a neat diagram.	*CO1*	-	**08**
	c)	Differentiate between the schema and instance in the context of a relational database. Create a simplified schema diagram and instance for an E-Commerce website of a bookstore.	CO2	PO1	**06**
		UNIT - II			
2	a)	Design an Entity–Relationship diagram representing entities, attributes, relationship, cardinality ratio and type of participation for the Movie database with the following requirements: • Each movie is identified by title and year of release. Each movie has length in minutes and classified under one genres (like action, horror etc.). • Each movie has a plot outline. • Production companies are identified by name and each has an address. • A production company produces one or more movies. • Actors are identified by id. Other details like name and date of birth of actors are also stored. • Each actor acts in one or more movies. • Each actor has a role in movie. • Directors are identified by id. Other details like name and date of birth of directors are also stored. • Each director directs one or more movies. • Each movie has one or more actors and one or more directors and is produced by a production company.	CO2	PO1, PO2	**10**

		b)	Translate the given ER diagram into relations using ER to Relational mapping conversion steps.  	CO2	PO1, PO2	**10**
			UNIT - III			
	3	a)	Consider the relation schema given below : *employee (ID, person_name, street, city)* *works (ID, company_name, salary)* *company (company_name, city)* *manages (ID, manager_id)* **Formulate the following queries in SQL:** i) Find the ID, name, and city of residence of each employee who works for First Bank Corporation. ii) Find the ID, name, and city of residence of each employee who works for First Bank Corporation and earns more than $10000. iii)Find the ID of each employee who earns more than every employee of Small Bank Corporation. iv) Find the name of each company whose employees earn a higher salary, on average, than the average salary at First Bank Corporation. v) Modify the database so that the employee whose ID is 12345 now lives in Newtown.	CO3	PO4	**10**
		b)	Provide the various database modification or update operations with appropriate syntax of Relational DataBase Management System. Also specify types of constraints that may be violated by each of these operations	CO1		**10**
			UNIT - IV			
	4	a)	For the given SQL below, represent Relational Algebraic Expression and Query Tree. SELECT DeptName FROM Department, Student WHERE Code = Major AND Year = 4	CO2	PO1	**06**

		b)	Consider two relations Works and Critical. What would be the result after applying the following operations on them? Justify your answer by clearly explaining the operations involved each algebraic expression. i) **Works ÷ Critical** ii) **(Works ÷ Critical) X Critical** **Works** enum | pnum E35 | P10 E45 | P15 E35 | P12 E52 | P15 E52 | P17 E45 | P10 E35 | P15 **Critical** pnum P15 P10	CO2	PO1	**04**
		c)	Consider Relation R(X,Y,Z) Assume it is in 1NF. Find the highest normal form of the relation given the Functional Dependencies, FD = {X->Y and Y->Z}	CO2	PO1, PO2	**10**
			OR			
	5	a)	Assume the following relations: **BookS**(DocId, Title, Publisher, Year) **Students**(StdId, StName, Major, Age) **Authors**(AName, Address) **Borrows**(DocId, StId, Date) **Has-written**(DocId, AName) **Describes**(DocId, Keyword) **Formulate the following queries in relational algebra operations**: i) List the names of all students who have borrowed a book and who are CSmajors. ii) Find the title of the oldest book. iii) List the authors of the books the student 'Smith' has borrowed. iv) Which books have both keywords 'database' and 'programming'?	CO3	PO4	**10**
		b)	Consider a relation, **Student (StudentID, ModuleID, ModuleName, StudentName, StudentAddress, TutorId, TutorName)**. The functional dependencies are given below: StudentID ->StudentName, StudentAddress, TutorId, TutorName ModuleId -> ModuleName TutorId -> TutorName Check whether the relation is in 2NF and 3NF. If not, Normalize to 3NF.	CO2	PO1. PO2	**10**

			UNIT - V			
	6	a)	Two transactions T1 and T2 are executing simultaneously in a Schedule, Identify the Problems that occurs when the transactions access the same database record in an uncontrolled manner.	CO2	PO2	**10**

		b)	Which of the following schedules is (conflict) serializable? For each serializable schedule, determine the equivalent serial schedules and provide the justification for each.
			a) r1(X); r3(X); w1(X); r2(X); w3(X);
			b) r3(X); r2(X); w3(X); r1(X); w1(X);
				CO2	PO1, PO2	**05**

		c)	State the CAP theorem in NOSQL.	CO1	-	**05**
			OR			
	7	a)	For the given transactions, check whether the given schedule S is conflict serializable or not using precedence graph algorithm. If yes, then determine all the possible serialized schedules- 	CO2	PO1, PO2	**08**
		b)	Illustrate the different states of transaction execution with a state transition diagram.	CO1	-	**06**
		c)	i) Differentiate between SQL and NOSQL databases. ii) Write the queries to execute the following operations, given the below collection of books. a) Find all the books with a number of pages greater than 250 b) Find all the books authored by Mario Rossi c) Find all the books with a price < 20 € for Italy(IT) 	CO3	PO4	**06**

*****

U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 22IS4PCOPS **Max Marks: 100**
Course: OPERATING SYSTEM

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Explain the operating system structure.	CO1	PO1	**10**
	b)	Operating system services provides several functionalities. Elaborate on the services.	CO1	PO1	**10**
		UNIT - II			
2	a)	Explicate the following Interprocess communication methods: i) Direct & Indirect communication. ii) Synchronous & Asynchronous communication. iii) Automatic or Explicit buffering communication.	CO2	PO1	**10**
	b)	Provide details on Peterson's solution and Mutex locks.	CO1	PO1	**10**
		OR			
3	a)	Outline about the Process Control Block. Explain short-term, medium term and long term schedulers.	CO1	PO1	**10**
	b)	Interpret the Classical problems of Synchronization.	CO1	PO1	**10**
		UNIT - III			
4	a)	(i) Consider the following set of processes, assumed to have arrived at time 0 in the order P_1, P_2, … , P_5, with length of the CPU burst given in milliseconds. Draw Gantt chart and determine the average waiting time using Priority scheduling. Assume lower number having higher priority.	CO2	PO2	**10**

Process	Burst Time	Priority
P_1	10	3
P_2	1	1
P_3	2	4
P_4	1	5
P_5	5	2

			(ii) Consider the following set of processes that arrive at time 0, with the length of the CPU burst given in milliseconds. Write the Gantt chart and compute the average waiting time using Round-Robin scheduling. Use time quantum of 4 milliseconds. **Process** / **Burst Time** P_1 / 24 P_2 / 3 P_3 / 3			
		b)	Consider a system with five processes P_0 through P_4 and three resource types A, B, and C. Resource type A has ten instances, resource type B has five instances, and resource type C has seven instances. Suppose that, at time T_0, the following snapshot of the system has been taken: *Allocation* / *Max* / *Available* A B C / A B C / A B C P_0 0 1 0 / 7 5 3 / 3 3 2 P_1 2 0 0 / 3 2 2 P_2 3 0 2 / 9 0 2 P_3 2 1 1 / 2 2 2 P_4 0 0 2 / 4 3 3 (i) Determine whether the system is safe or not? If safe, provide the safe sequence. (ii) Suppose process P_1 requests one additional instance of resource type A and two instances of resource type C, so $Request_1$ = (1,0,2). Can this request can be immediately granted?	CO2	PO2	**10**
			OR			
	5	a)	Many criteria have been suggested for CPU scheduling algorithms. List and explain the scheduling criteria.	CO2	PO2	**08**
		b)	Write the algorithm for deadlock detection with several instances of a resource type. Consider a system with five processes P_0 through P_4 and three resource types A, B, and C. Resource type A has seven instances, resource type B has two instances, and resource type C has six instances. Suppose that, at time T_0, we have the following resource-allocation state: *Allocation* / *Request* / *Available* A B C / A B C / A B C P_0 0 1 0 / 0 0 0 / 0 0 0 P_1 2 0 0 / 2 0 2 P_2 3 0 3 / 0 0 0 P_3 2 1 1 / 1 0 0 P_4 0 0 2 / 0 0 2 (i) Is the system in deadlock state? (ii) Suppose process P_2 makes one additional request for an instance of type C. Will it result in deadlock state?	CO2	PO2	**12**

			UNIT - IV			
	6	a)	(i) Differentiate between Demand paging and Thrashing. (ii) Illustrate copy– on–write in Demand paging.	CO1	PO1	**10**
		b)	Consider the following page reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 With three frames, how many page faults would occur for the following replacement algorithms? • FIFO algorithm • Optimal algorithm • LRU algorithm	CO2	PO2	**10**
			UNIT - V			
	7	a)	A request for cylinders in a disk queue is as follows: 33, 72, 47, 8, 99, 74, 52, 75 Initial position of disk head is at cylinder 63. Compute total head movements using FCFS and SSTF scheduling algorithms. Represent the head movements with diagrams.	CO2	PO1	**10**
		b)	Disk queue consists of the request of cylinders in the order as: 98, 183, 37, 122, 14, 124, 65, 67 Head position is initially at cylinder 53. With pictorial representation, calculate the total head movements using SCAN and LOOK algorithms.	CO2	PO1	**10**

****

U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

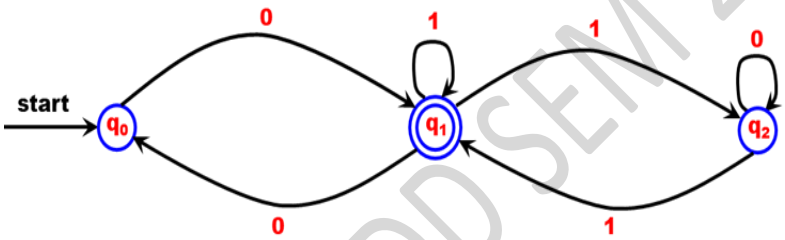
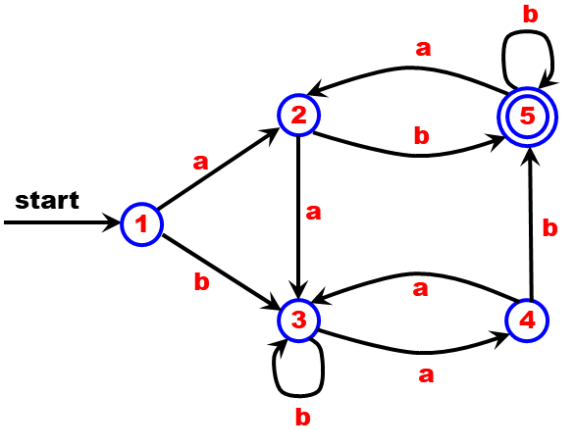
Autonomous Institute Affiliated to VTU

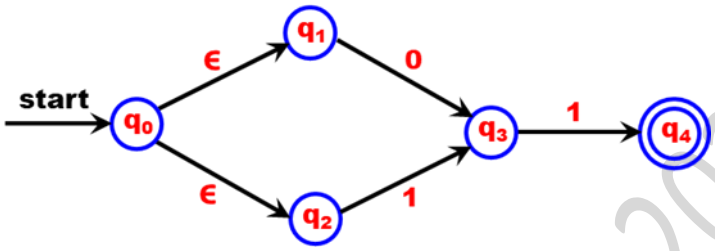
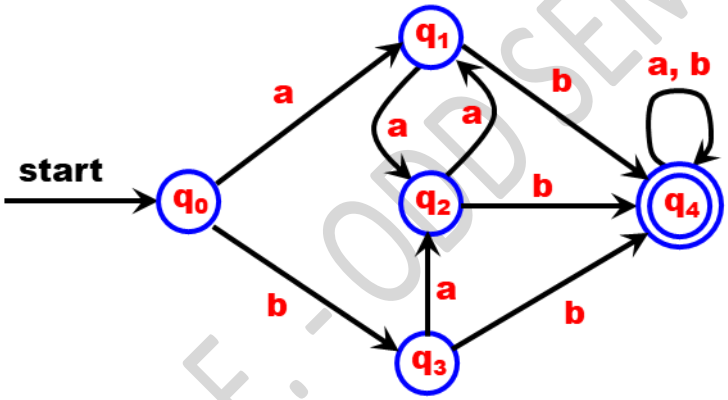
April 2024 Semester End Main Examinations

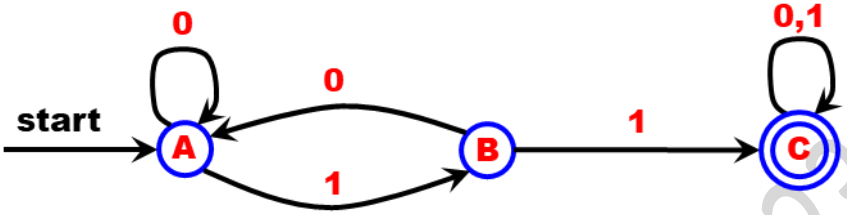
Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 22IS4PCTFC **Max Marks: 100**
Course: Theoretical Foundations of Computation

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Convert the following NFA to its equivalent DFA: 	CO1	PO1	**07**
	b)	Design DFA's for the following Languages: (i) Design a DFA to accept all the strings containing the substring 011 when $\Sigma = \{0, 1\}$ (ii) Design a DFA to accept all the strings in which the leftmost symbol differs from the rightmost symbol when $\Sigma = \{0, 1\}$	CO3	PO3	**06**
	c)	Minimize the following DFA: 	CO1	PO1	**07**

			OR			
	2	a)	Differentiate NFA and DFA. Design DFA's for the following Languages: (i) Design a DFA to accept all the strings ending with 1 and does not contain the substring 00 when Σ = {0, 1} (ii) Design a DFA to accept strings of 0's and 1's starting with at least two 0's and ending with at least two 1's when Σ = {0, 1}	CO3	PO3	**06**
		b)	Convert the following ε-NFA to its equivalent DFA: 	CO1	PO1	**07**
		c)	Minimize the following DFA: 	CO1	PO1	**07**
			UNIT - II			
	3	a)	(i) Obtain a Regular Expression to accept all the strings where the third last symbol is 1. Consider Σ = {0, 1} (ii) Obtain a Regular Expression to accept all the strings having at least one double 0 or double 1. Consider Σ = {0, 1}	CO2	PO2	**06**
		b)	State and Prove Pumping Lemma Theorem for regular languages. Also, show that the Language L = $\{ww^R \mid w \in (0 + 1)^* \}$ is not regular.	CO2	PO2	**07**
		c)	Design ε-NFA corresponding to the Regular Expression i) ((0 + 1)* + 01)* ii) 01+1*0	CO1	PO1	**07**

			OR			
	4	a)	(i) Obtain a Regular Expression to accept all the strings that either start with 01 or end with 01. Consider Σ = {a, b} (ii) Obtain a Regular Expression to accept all the strings starting with a, but not having consecutive b's. Consider Σ = {0, 1}	CO2	PO2	**06**
		b)	Show that the Language L = { $a^i b^j$ | i > j } is not Regular.	CO2	PO2	**07**
		c)	Obtain the Regular Expression for the given Finite Automata using State Elimination Method: 	CO2	PO2	**07**
			UNIT - III			
	5	a)	Design CFG's to generate the following Languages: (i) L = { w | w containing 00 or 11 when Σ = {0, 1} } (ii) L = { $a^m b^n$, n > m, n >= 1, m >= 1 }	CO3	PO3	**06**
		b)	Show that the following Grammar is Ambiguous: S → SbS | Sa | bSS | SSb | a	CO2	PO2	**06**
		c)	Simplify the following Grammar: G = (V, T, P, S) V = { S, A, B } T = { a } P = { S → AAA | B A → aA | B B → ε} S = { S }	CO1	PO1	**08**
			UNIT - IV			
	6	a)	Differentiate between Deterministic PDA and Non- deterministic PDA.	CO1	PO1	**05**
		b)	Design a PDA to accept the Language: L = { w | w ε (a + b)* where number of a's in w > number of b's in w }	CO3	PO3	**08**
		c)	Convert the following CFG to the equivalent PDA: S → aABD A → aB | b B → bA | a C → a	CO1	PO1	**07**

			UNIT - V			
	7	a)	Design a Turing Machine to accept a given string w and generates the string ww where w ϵ a^+ by final state acceptance.	CO3	PO3	**08**
		b)	Design a Turing Machine to accept the Language L = { 0^n1^n | n >= 1 } by final state acceptance.	CO3	PO3	**07**
		c)	Discuss how Turing Machines can be combined to perform complicated tasks with an example.	CO1	PO1	**05**

****

U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

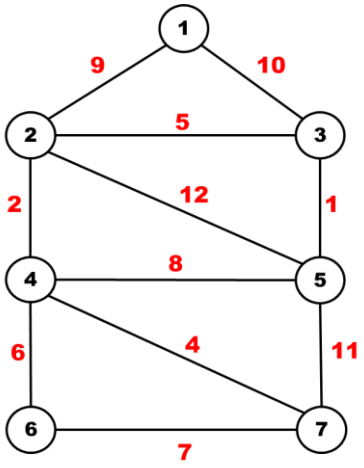
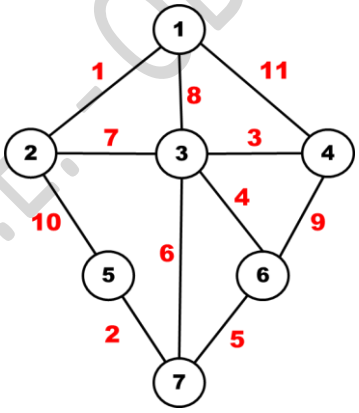
Programme: B.E. **Semester: IV**
Branch: Information Science and Engineering **Duration: 3 hrs.**
Course Code: 22IS4PCADA **Max Marks: 100**
Course: Analysis and Design of Algorithms

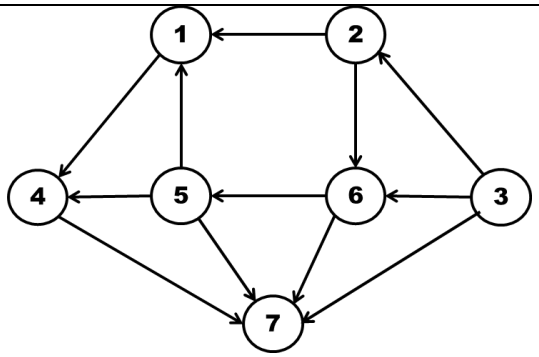
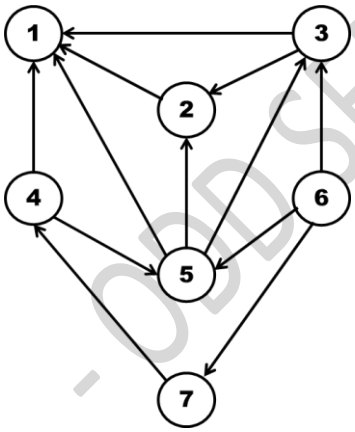
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

				CO	PO	Marks
			UNIT - I			
1	a)		Define O, θ and Ω notations with examples. Find the ascending order of the following time complexities. n^2, n log n, 2^n, n, log n, 1, n^3	**CO2**	**PO2**	**06**

	b)		Find the time complexity for the following algorithms.
			
			(i) Algorithm factorial(n)
			{
			if (n==0)
			return 1;
			else
			return n * factorial(n-1);
			}
			
			(ii) Algorithm binary(n)
			{
			if (n==1)
			return 1;
			return binary(n/2) + 1;
			}
				CO2	**PO2**	**06**

	c)		Solve the following recurrence relations: (i) x(n) = x(n-1) + 3 for n > 1, x(1) = 0 (ii) T(n) = T(n-1) + 1 + T(n-1) with T(n) = 0 when n=0, T(n) =1 when n=1	**CO2**	**PO2**	**08**
			UNIT - II			
2	a)		Sort the following array using bubble sort. Discuss why bubble sort takes more time. 64, 06, 84, 12, 26	**CO2**	**PO2**	**06**
	b)		Apply Merge sort algorithm to sort the following numbers. Show the Merge call tree for the same. 14 91 07 01 10 29 08 02	**CO1**	**PO1**	**06**

		c)	Find the MST for the following Graph using Prim's Algorithm and also write the Prim's Algorithm. 	**CO3**	**PO3**	**08**
			OR			
	3	a)	Analyse the time complexity of selection sort with a neat selection sort algorithm.	**CO2**	**PO2**	**06**
		b)	Show how the following numbers get sorted using Quick sort algorithm. 14 91 07 01 10 29 08 02	**CO1**	**PO1**	**06**
		c)	Find the MST for the following Graph using Kruskal's Algorithm and also write the Kruskal's Algorithm. 	**CO3**	**PO3**	**08**
			UNIT - III			
	4	a)	Generate all the permutations for the set {1, 2, 3, 4} using Johnson Trotter Algorithm.	**CO2**	**PO2**	**06**
		b)	Find the Topological Sequence for the following Graph using single source removal method.	**CO1**	**PO1**	**07**

						
		c)	Construct a Hash Table by Linear Probing for the following words: (Size of Hash Table is 10) WHERE, IS, NOW, THIS, AN, THAT, HOW, AND	**CO2**	**PO2**	**07**
			OR			
	5	a)	Find the BFS and DFS traversals starting from vertex 6 for the following Graph. Also, write the BFS and DFS Algorithms. 	**CO1**	**PO1**	**10**
		b)	Find the Pattern String in the Main String [Both the strings given below] using Horspool's Algorithm. Also, Write the Algorithm. Main String[] = **"WHEN WORDS FAIL MUSIC SPEAKS"** Sub String[] = **"SPEAK"**	**CO3**	**PO3**	**10**
			UNIT – IV			
	6	a)	Show how the following numbers are sorted by Heap Sort. Also, write the Heap Sort Algorithm. 84 | 23 | 68 | 09 | 96 | 66 | 05 | 25	**CO3**	**PO3**	**10**
		b)	Apply Floyd's Algorithm to find the All Pairs Shortest Path for the following digraph.	**CO1**	**PO1**	**10**

				1	2	3	4	5			
			1	0	2	∞	∞	∞			
			2	∞	0	6	∞	∞			
			3	∞	7	0	∞	∞			
			4	∞	∞	1	0	3			
			5	1	4	∞	∞	0			
			UNIT – V								
	7	a)	Write the State Space Tree to solve the following Sum of Subsets Problem. n = 4, S = [1, 3, 4, 5] and d = 8						**CO1**	**PO1**	**05**
		b)	Apply Branch and Bound Technique to Solve the following instance of the Job Assignment Problem.						**CO1**	**PO1**	**07**
					Job1	Job2	Job3	Job4			
				P1	8	1	6	7			
				P2	5	3	2	3			
				P3	4	7	5	7			
				P4	6	5	8	6			
		c)	Apply Branch and Bound Technique to Solve the following Traveling Salesman Problem.						**CO1**	**PO1**	**08**
					A	B	C	D	E		
				A	∞	3	1	5	8		
				B	3	∞	6	7	9		
				C	1	6	∞	4	2		
				D	5	7	4	∞	3		
				E	8	9	2	3	∞		

******