Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Computer Science & Engineering)

CS-4401 / CS-4304 OPERATING SYSTEM

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What is Operating system, what are goals of operating system? ***07***

(b) What is meant by system call? How it can be used? How does an application program use these during call during execution? ***07***

2(a) What is PCB, draw the block diagram of process transition states? ***07***

(b) With reference to following set of process, determine average waiting time and average turnaround time. Using following scheduling algorithm : ***07***

Process	Arrival Time	CPU Burst	Priority
P1	0	24	5
P2	3	7	3
P3	5	6	2
P4	10	10	1

3(a) What are threads, what are resources are used threads are created? ***07***

(b) Write CPU scheduling criteria. ***07***

4(a) Write key concept of multiprocessing, including synchronization, communication and context switching. ***07***

(b) What are cause of thrashing, how does system detect threshing? ***07***

5(a) What do mean by deadlock prevention? A computer has six tap derive with process competing for them. Each process need two tap derives for which value of n the system is deadlock free. ***07***

(b) Explain concept of virtual memory in operating system. Discuss advantage and disadvantage of non–contiguous storage allocation. ***07***

6(a) How many page faults does LRU, FIFO and Optimal page replacement algorithm produce 7, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 assume frame size is 3? ***07***

(b) Explain concept of ‘wait’ and ‘signal’ operation on semaphore should be executed automatically. ***07***

7(a) What is file, write its attributes and operation? ***07***

(b) Explain paging and segmentation how they are helpful in removing fragmentation? ***07***

8 Write Short note on : (i) Shell Programming (ii) Multitasking OS (iii) Batch Processing (iv) Multiprogramming OS ***14***

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B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Computer Science & Engineering)

CS-4402 / CS-4301 ANALYSIS AND DESIGN OF ALGORITHM

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What do you understand by performance analysis of an algorithm? What are the different methods of algorithm's performance analysis? Find the cost in terms of time of the following code :

```
i=0; sum = 0;
while (i <= n1) {
j = 1;  i = i+1;
while (j <= n2) {
sum = sum + i;
j = j + 1;  } }
```

(b) List the various growth rate functions and draw their growth rate graph. Give one example of algorithm for three functions.

2(a) Describe Ω-notation, O-notation and θ-notation. Which notation is used to represent Worst case, Average case and Best case efficiency?

(b) Explain the Divide and Conquer technique of algorithm design. Write binary search algorithm based on this technique and analyze its time complexity.

3(a) What is Greedy approach of algorithm design? Define feasible solution, optimal solution and principal of optimality.

(b) State the Job Sequencing Problem. Find an optimal sequence to the n=5 Jobs where profits (P1,P2,P3,P4,P5) = (20,15,10,5,1) and deadlines (d1,d2,d3,d4,d5) = (2,2,1,3,3).

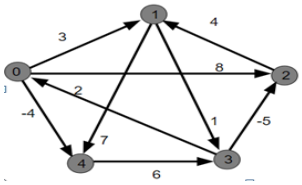
4(a) What is Huffman code? Write the optimal prefix code and draw optimal binary merge tree for the following symbols and their frequencies :

Symbols	:	A,	B,	C,	D,	E,	F, G
Frequency	:	20,	3,	15,	8,	11,	5, 9

(b) Write the concept of Dynamic Programming. Define Overlapping sub problems and Optimal substructure with example.

5(a) What are different types of Dynamic Programming? Write a program to find the n^{th} Fibonacci number using dynamic programming (bottom-up approach).

(b) Prepare the Floyd Warshall's solution matrix of the following graph :

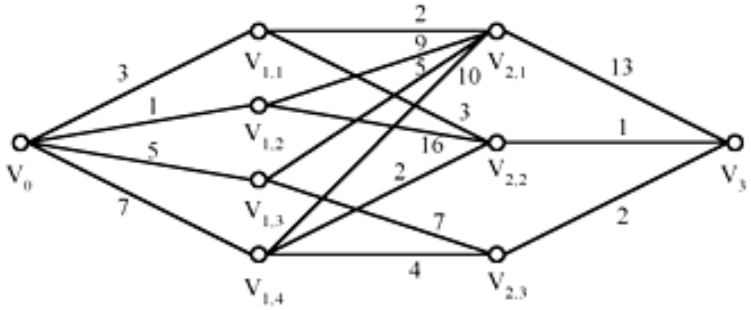


P.T.O.

6(a) What is the core idea behind the backtracking algorithm and how does it differ from a brute-force approach? Explain with an example.

(b) Write the concept of Branch and Bound technique. Distinguish between Branch and Bound and Backtracking techniques.

7(a) Apply Branch and Bound to find minimum cost path from vertex V_0 to V_3 using LC and DFS traversals on following graph :



(b) Distinguish between P-class problems and NP-class problems with suitable example.

8 Write short notes on **any four** of the following:

i) Merge sort
ii) Prim's Algorithm
iii) Hamiltonian Circuit and Path
iv) NP-Hard and NP-Complete problems
v) Hash function
vi) Hashing collision resolution techniques

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Computer Science & Engineering)

CS-4403 / CS-4302 COMPUTER ORGANIZATION AND ARCHITECTURE

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Give a historical perspective of computers in terms of generations and evolution of performance. ***07***

(b) Define the following : ***07***

(i) Desktop Computer (ii) Server (iii) Data Center (iv) Super Computer
(v) Embedded Computer (vi) Petabyte (vii) Systolic Array

2(a) Design a firmware architecture for a digital component that has four states, three inputs (J, K and Clock) and two outputs (ZERO and ONE). ***07***

(b) Draw and explain the single-bus organization of the data path inside a processor. ***07***

3(a) When a device interrupt occurs, how does the processor determine which device issued the interrupt? ***07***

(b) What is the difference between programmed-driven I/O and interrupt-driven I/O? Give one advantage and one disadvantage of each. ***07***

4(a) How flash memory is different from EEPROM and flash drives are different from hard disk drives? ***07***

(b) Consider a computer that has a cache that holds 8-word blocks and a typical DRAM main memory. 17 cycles are needed to load a block into the cache. Assume that 30 percent of the instruction in a typical program performs a read or a write operation. Assume that the hit rate in the cache is 0.95 for instructions and 0.9 for data. 1 clock cycle is needed to access information in the cache. Let us further assume that the miss penalty is the same for both read and write accesses. ***07***

How effective this cache is compared to an ideal cache?

5(a) Describe the classification of pipeline processors. ***07***

(b) Give the principle of linear pipelining with the basic structure of a linear pipeline processor and the space-time diagram. ***07***

6(a) The diagram shown below is a reservation table for a unifunctional pipeline system. Identify a collision vector : ***07***

	t_0	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8
1	X								X
2		X	X					X	
3				X					
4					X	X			
5							X	X	

P.T.O.

6(b) Draw a state diagram for the pipeline system shown in Q.6(a). Also, find out the minimum average latency for the given pipeline system. ***07***

7(a) List three broad classifications of external or peripheral, devices. ***07***

(b) Write the following rules for arithmetic operations on floating-point numbers: ***07***

(i) Add/Subtract Rule
(ii) Multiply Rule
(iii) Divide Rule

8(a) Explain caches on the processor chip. ***07***

(b) For a given CPU, the first machine cycle M1 always consists of 4 states, and the remaining machine cycles consist either of 3 or 4 states. An instruction cycle consists of a minimum of 2 and a maximum of 5 machine cycles. If the CPU's clock rate is 50 MHz and every memory access introduces one wait state. Then calculate : ***07***

(i) The shortest instruction execution time
(ii) The longest instruction execution time

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B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Computer Science & Engineering)

CS-4404 / CS-4303 DATABASE MANAGEMENT SYSTEM

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Explain disadvantages of conventional file based system compared to database management system. ***07***

(b) Define database management system. What are the major components of this system? Explain each component. ***07***

2(a) Define entity and relationship diagram. Draw an ER diagram for library management system. Assume relevant entities and attributes for given system. ***07***

(b) Determine following terms : Levels of data abstraction, Instances, Schema, Physical data independence and Logical data independence? ***07***

3(a) Write an example and explain clearly JOIN and UNION operations in relational algebra. Bring out the difference between natural JOIN and OUTER JOIN. ***07***

(b) How do the relations tables in SQL differ from the relations defined formally? Discuss the other differences in terminology. Why does SQL allow duplicate couples in a table or in a query result? ***07***

4(a) Define normalization and why it is done? Explain 1NF, 2NF, 3NF, BCNF and 4NF with example? ***07***

(b) Illustrate query optimization process with various query optimization techniques with example. ***07***

5(a) Evaluate transaction? Discuss ACID properties of a transaction with relevant example. ***07***

(b) Recall DBMS component is responsible for concurrency control how is this feature used to resolve conflicts? ***07***

6(a) What is Functional dependency? Explain the types of functional dependency. Find the candidate keys in the given functional dependency : ***07***

R (ABCDE), FD = { A → B, BC → D, E → C, D → A }

(b) Write SQL statement for the following Student (Enr_no, Name, Course_ID, Email_ID, Cell No.) Course (Course_ID, Course_nm, Duration) ***07***

(i) Add a column city in student table
(ii) Find out list of students who have enrolled in “computer” course
(iii) List name of all course with their duration
(iv) List name of all students starting with “a”
(v) List Email ID and cell no. of all computer science engineering students.

P.T.O.

7(a) Distinguish the following : ***07***

(i) Lossless and Lossy decomposition
(ii) View Serializability and Conflict Serializability

(b) Explain the following keys with suitable data base example : ***07***

(i) Primary key (ii) Foreign key (iii) Candidate Key (iv) Alternate key
(v) Super key (vi) Composite key (vii) Unique key

8 Explain following **any two** : ***2*7***

(i) Multi Valued Dependency
(ii) Two Phase Locking Protocol
(iii) The two-tier and three-tier client server architecture

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech FOURTH SEMESTER EXAMINATION JUNE-2025

(Branch : Computer Science & Engineering)

CS-4405 PYTHON PROGRAMMING FOR DATA ANALYSIS

Time : Three Hours ***Maximum Marks : 70***

Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Python is often described as a beginner-friendly language. Explain its unique features and how they contribute to its wide adoption.

(b) Write a Python program that demonstrates the use of lists, tuples and dictionaries in a meaningful way. Include at least one conditional and one loop construct.

2(a) Discuss the role of NumPy in scientific computing. Write Python code to create a NumPy array and demonstrate array transposition and a universal function.

(b) Differentiate between Python built-in functions and user-defined functions with examples. Why are user-defined functions important in modular programming?

3(a) What is a Pandas Series? Compare it with a Python list and NumPy array in terms of structure and functionality, with examples.

(b) Take any Data Frame, demonstrate how to reindex it, drop entries and perform sorting and ranking? Include explanation for each operation.

4(a) Define data analysis and discuss its significance in modern decision-making. Describe three common techniques used in data analysis.

(b) What is data cleaning? Write Python code using Pandas to handle missing values and normalize numeric data.

5(a) List three Python libraries commonly used for supervised and unsupervised machine learning. For each, mention one key feature or use-case.

(b) Using Matplotlib, write Python code to plot a line graph with labels, title, and legend. Explain how visualization aids in data analysis.

6(a) Explain the difference between mutable and immutable data types in Python. Give two examples of each and discuss why this distinction matters.

(b) Write a Python program that defines a function to compute the factorial of a number using recursion. How does recursion differ from iteration?

7(a) Take any dataset with missing and duplicate entries, write Pandas code to clean the data. Explain how data alignment works in Pandas during arithmetic operations.

(b) What is data reduction in data analysis? Describe any two techniques used for data reduction and mention their advantages.

8(a) Explain the difference between a Python module and a package. Give examples of data analysis packages and describe how to import and use them.

(b) Using Pandas and Matplotlib together, write a script that reads a CSV file, summarizes its content, and visualizes a bar chart of one of its numeric columns.

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