

# Aliah University

**Odd(Autumn) Semester Examination – 2024-25**  
**(For 3<sup>rd</sup> year 5th Semester B.Tech)**

**Paper Name:** Database Management Systems  
**Paper Code:** CSEUGPC11

**Full Marks: 80**  
**Time: 3 Hrs**

**Group A (Answer all the questions )**

**5X2=10**

1. Why do we need normalization? [CO4 BL2]
2. Define participation constraints. [CO3 BL2]
3. Differentiate Schema and Instance. [CO1 BL2]
4. What are ACID properties? [CO5 BL2]
5. What is a trigger? [CO1 BL2]

(Q)

**Group B(Answer any 5 questions)**

**5X6=30**

1. i) What is data independence? ii) Differentiate between physical and logical data independence.  
[CO1 BL2]
2. Explain about the following clauses with example queries. (i) Group by (ii) Order by (iii) Aggregation functions. [CO2 BL2]
3. i) What is a weak entity type? ii) How to model it? iii) Explain with suitable example. [CO1 BL2]
4. Draw an ER diagram for Hospital management system. [CO3 BL2]
5. i) What is DML? ii) Explain DML operations with examples. [CO2 BL2]
6. Distinguish between:  
i) Primary and Secondary indexing. ii) Primary key and Candidate Key. [CO7 BL2]

(W)

**Group C( Answer any 4 questions)**

**4X10 =40**

1. i) Draw and explain three-tier schema architecture of database system. ii) What is a foreign key constraint? iii) What is referential integrity? iv) Explain domain constraints and key constraints.  
[3+2+2+3] [CO3 BL2]
2. i) Explain insertion, deletion and update anomalies. ii) Differentiate full functional dependency and partial functional dependency. iii) By means of an example show how BCNF is stronger than 3NF.  
iv) Given a relation R(A, B, C, D) and Functional Dependency set FD = { AB → CD, B → C }, determine whether the given R is in 2NF? If not convert it into 2 NF.  
[3+2+2+3] [CO4 BL3]

(C)

(C)

3. Consider the SAILOR DATABASE

[5X2=10]

Sailors (sid:string, sname:string, rating:integer, age:real)

Boats (bid:integer, bname:string, color:string)

Reserves (sid:integer, bid:integer, day:date)

Based on the above schema, answer the following queries in relational algebra.

- (i) Find the colors of boats reserved by 'Lubber'.
- (ii) Find the names of sailors who have reserved at least one boat
- (iii) Find the names of sailors who have reserved a red or green boat
- (iv) Find the names of the sailors who have reserved both a Red boat and a Green boat.
- (v) Find names of sailors who have reserved all boats. [CO2 BL3]

4. i) Differentiate between serial schedule and serializable schedule. ii) Explain the problems that would arise when concurrency control is not provided by the database system. iii) Discuss about conflict serializability with an example. [CO5 BL2] [2+4+4]

5. Write short notes on: [CO1 BL2]

[2.5X4=10]

- i) Recoverable Schedule
- ii) Data redundancy and concurrency
- iii) Multilevel indexing
- iv) Lossless join

Section – A

Answer any five of the following       $5 \times 2 = 10$

Shahzay  
47

1. Describe the characteristics of an algorithm.
2. What is the time complexity of searching an element in a binary search tree in the best and worst cases?
3. What is recursion, and how does it work?
4. How can you compute the maximum number of nodes at height 'h,' provided there are 'n' nodes in a binary tree?
5. What are the conditions required for applying the greedy method?
6. How are subsequences different from substrings?
7. What are the advantages of using the Bellman-Ford algorithm for shortest-path problems?

10

Section – B

Answer any five of the following       $5 \times 6 = 30$

1. State the Big-Theta, Big-Oh notations. Explain their graphical interpretations.
2. Explain the Greedy knapsack algorithm.
3. Find the longest common subsequence between X = {AGGTAB} and Y = {GXTXAYB} using the dynamic programming paradigm.
4. You have an array of size 10 in which 8 numbers are arranged into a min-heap. How do you add a new number to the heap? Write the pseudo-code for the above problem.
5. From the recurrence relation, obtain the time complexity of the quick sort algorithm through the recursion tree method.
6. You are given 6 jobs with deadlines and profits. Each job takes 1 unit of time to complete. Find the sequence of jobs to maximize the profit. Jobs = [{Job1, 2, 100}, {Job2, 1, 50}, {Job3, 3, 20}, {Job4, 2, 40}, {Job5, 1, 10}, {Job6, 3, 30}].
7. Solve the recurrence relation using the recursion tree method:  $T(n) = 2T(n/3) + n$ .

Section – C

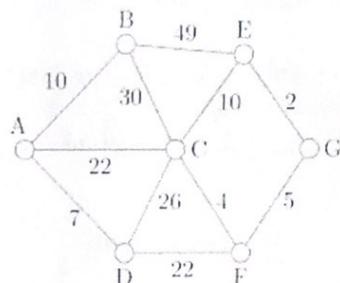
Answer any four of the following       $4 \times 10 = 40$

1. What is the main idea behind the "divide and conquer" strategy? Compare and contrast dynamic programming and greedy methods. Describe the dynamic programming algorithm to solve the 0/1 knapsack problem. [2 + 2 + 6]

2. A recursive function computes the  $n$ th Fibonacci number. Analyze its space complexity. The matrices  $M_1, M_2, M_3, M_4$  have the following dimensions  $20 \times 4, 4 \times 15, 15 \times 12$ , and  $12 \times 6$ , respectively. Explain the dynamic programming approach to find an optimal parenthesization of the above matrix chain product. [4 + 6]

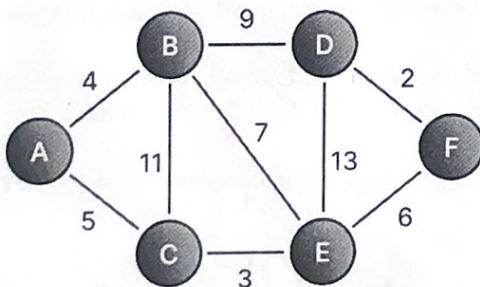
3. Find the percentage of improvement on variable length code over fixed length coding through Huffman encoding when the frequencies of characters p to u are as follows: p: 16, q: 10, r: 2, s: 12, t: 22, u: 14. Given the array: [9, 5, 6, 2, 3, 4, 8], perform the **heapify** operation to convert this array into a max-heap. Show all the intermediate steps. What will be the result of performing a **delete-max** operation on this max-heap? [5 + 3 + 2]

4. What is a spanning tree? How many spanning trees are possible from a graph with six nodes? What is a minimum cost spanning tree? Using Prim's algorithm, show the step-by-step procedure to find a minimum spanning tree of the given graph. [2 + 1 + 1 + 6]



5. State the 0/1 Knapsack problem. Consider the instance of the 0/1 knapsack problem below, with P depicting the profit value and W depicting the weight of each item, whereas M denotes the total weight-carrying capacity of the knapsack. Find optimal answers using dynamic programming techniques. P: [35 40 55 60] W = [20 30 42 50] M: 95. If the fractional part of items is allowed to pick then what will be the optimal solution? 40 100 [2 + 5 + 3]

6. a) Find the shortest paths from node 'B' to all vertices using the Dijkstra algorithm for the following graph.



- b) State the master theorem. Use the master method to find the tight asymptotic bounds for the following recurrences:

i.  $T(n) = 5T(n/5) + n \log n$   $(n(\log n)^2)$

ii.  $T(n) = 2T(n/2) + n^3$   $n^3$

[6 + 2 + 2]

Aliah University  
 Odd-Semester Examination (Autumn Semester) – 2024-25  
 (3<sup>rd</sup> Year, 5<sup>th</sup> SEM CSE)

Paper Name: Operating Systems  
 Paper Code: CSEUGPC10

Full Marks: 80  
 Time: 3 Hrs

*(General Instructions: Answers should be brief and to the point. Mention the Section name before answering it and each Section should be start from a new page and club together)*

Section - A

Answer all the questions:

(10X1=10)

Sl. No.	Questions	Marks
1.	What is the kernel in an operating system?	1
2.	What is a Process?	1
3.	What is fragmentation?	1
4.	What is bootstrapping in an operating system?	1
5.	Virtual memory is: a) Larger than physical memory b) Faster than RAM c) Only available in UNIX OS d) None of the above	1
6.	Which of the following scheduling algorithms could result in starvation? a) First-Come, First-Served (FCFS) b) Shortest Job Next (SJN) c) Round Robin (RR) d) All the above	1
7.	Which page replacement algorithm suffers from Belady's anomaly? a) FIFO b) LRU c) Optimal d) Option (b) and (c)	1
8.	Which of the following is not a type of operating system? a) Batch b) Network c) Distributed d) Compiler-based	1
9.	In multiprogramming, the number of processes in memory is called: a) Degree of multiprogramming b) Process load c) Multitasking count d) Process density	1
10.	What is the difference between user mode and kernel mode?	1

Section - B

(Answer any five questions)

(6X5=30)

Sl. No.	Questions	Marks
11. a)	Define Operating System. List out the objectives of an operating system.	3+3
b)	Differentiate between a single-user and multi-user operating system.	
12. a)	Describe context switching and its significance in an operating system.	3
b)	Describe different attributes of the process.	3
13. a)	What is Critical Section Problem? Define Busy Waiting. How to overcome busy waiting using Semaphore operations.	2+2+2
b)		
14. a)	Consider the following table and find out i) average waiting time ii) turnaround time for preemptive-SJF CPU scheduling algorithms.	4 +2
	Process      Arrival Time      Burst Time	
	P1            0                9	
	P2            1                5	
	P3            2                3	
	P4            3                4	
b)	Define waiting time turnaround time.	
15. a)	Write the difference between internal and external fragmentation.	2+4
b)	Given the following free memory blocks and process memory	

	<p>requirements: <b>Memory Blocks</b> (in KB): 100 KB, 500 KB, 200 KB, 300 KB, 600 KB  <b>Process Requirements</b> (in KB): 212 KB, 417 KB, 112 KB, 426 KB          Allocate memory using <b>Best-Fit</b> and <b>Worst-Fit</b> algorithms and calculate the memory left in each block.</p>	
16. a) b)	<p>Explain about resource allocation graph (RAG).          Given: <b>Logical Address Space</b> = 16 KB, <b>Physical Address Space</b> = 64 KB, <b>Page Size</b> = 1 KB, <b>Frame Size</b> = 1 KB. Find out number of bits in logical address and in physical address.</p>	3+3
17. a)  b)	<p>In a system with paging, the following parameters are provided:  <b>Memory access time (Tm)</b>: 100 ns  <b>Page table access time (Tp)</b>: 20 ns          The system uses a <b>TLB (Translation Lookaside Buffer)</b> with a hit ratio of 80%.          Find the <b>Effective Memory Access Time (EMAT)</b> for the given system.          What is virtual memory?</p>	5+1

**Section - C**  
**(Answer any four questions)**

(10X4=40)

Sl No.	Questions	Marks																																																																																										
18. a) b) c)	<p>What is paging? Explain the paging methods with a suitable diagram.          What are advantages of TLB with paging over paging technique?          What is demand paging?</p>	7+2+1																																																																																										
19. a) b)	<p>Define the term deadlock.          Explain various necessary conditions for a deadlock to occur. Explain in brief about deadlock prevention.</p>	2+5+3																																																																																										
20.	<p>What is the need of Page replacement? Consider the following reference string 4, 0, 1, 2, 7, 4, 0, 1, 3, 0, 4, 0, 1, 2, 7, 3, 2, 4, 0, 1, 2, 7          Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with <b>four</b> free frames which are empty initially. Which algorithm gives the minimum number of page faults?</p>	10																																																																																										
21. a)	<p>Consider the following snapshot of a system:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Process</th> <th colspan="4">Allocation</th> <th colspan="4">Max</th> <th colspan="4">Available</th> </tr> <tr> <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> </thead> <tbody> <tr> <td>P0</td> <td>0</td> <td>0</td> <td>1</td> <td>2</td> <td>0</td> <td>0</td> <td>1</td> <td>2</td> <td>1</td> <td>5</td> <td>2</td> <td>0</td> </tr> <tr> <td>P1</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>7</td> <td>5</td> <td>0</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P2</td> <td>1</td> <td>3</td> <td>5</td> <td>4</td> <td>2</td> <td>3</td> <td>5</td> <td>6</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P3</td> <td>0</td> <td>6</td> <td>3</td> <td>2</td> <td>0</td> <td>6</td> <td>5</td> <td>2</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>P4</td> <td>0</td> <td>0</td> <td>1</td> <td>4</td> <td>0</td> <td>6</td> <td>5</td> <td>6</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>i) What is the content of the matrix Need?          ii) If a request from process P1 arrives for (0,4,2,0), can the request be granted immediately?</p> <p>b) Differentiate SCAN and C-SCAN scheduling algorithm.</p>	Process	Allocation				Max				Available				A	B	C	D	A	B	C	D	A	B	C	D	P0	0	0	1	2	0	0	1	2	1	5	2	0	P1	1	0	0	0	1	7	5	0					P2	1	3	5	4	2	3	5	6					P3	0	6	3	2	0	6	5	2					P4	0	0	1	4	0	6	5	6					8+2
Process	Allocation				Max				Available																																																																																			
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P0	0	0	1	2	0	0	1	2	1	5	2	0																																																																																
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P4	0	0	1	4	0	6	5	6																																																																																				
22. a) b)	<p>Explain Peterson's solution for 2-process critical-section problem.          Explain wait() and signal() operations.</p>	7+3																																																																																										
23.	<p>A disk queue has the following requests to read tracks – 87, 170, 40, 150, 36, 72, 66, 15          If the disk head is initially at cylinder 60, then what is the total number of head movements needed to satisfy these requests for the i) FCFS and ii) SSTF disk- scheduling algorithms?</p>	5+5																																																																																										

**B.Tech. Examination-2024**  
**Electronics and Communication Engineering**  
**(Odd Semester Regular & Supplementary Examination)**  
**Microprocessor and Its Application (ECEUGOE04)**

**F M: 80****Time: 3.00 Hrs****Q. No.****Questions****M**

- |     |                                                                                                                                                                                                                                                                                                                                                     |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1.  | Answer any five questions from question No. 1                                                                                                                                                                                                                                                                                                       | 2  |
| (a) | What is microprocessor?                                                                                                                                                                                                                                                                                                                             | 2  |
| (b) | What is the function of ALE pin of 8085 microprocessor?                                                                                                                                                                                                                                                                                             | 2  |
| (c) | Explain the function of DAA instruction.                                                                                                                                                                                                                                                                                                            | 2  |
| (d) | Difference between CALL 0000 and RST 0 instruction of 8085 microprocessor.                                                                                                                                                                                                                                                                          | 2  |
| (e) | Write a program to set all flags of 8085 microprocessor.                                                                                                                                                                                                                                                                                            | 2  |
| (f) | Write a control word for mode 0 to configure port A and port CU as output port and port B & port CL as input port.                                                                                                                                                                                                                                  | 2  |
| (g) | Calculate the vector location of TRAP interrupt of 8085 microprocessor.                                                                                                                                                                                                                                                                             | 2  |
| 2.  | (a) Draw and explain the hardware model of 8085 microprocessor.<br>(b) Explain the function of demultiplexing circuit of 8085 microprocessors.                                                                                                                                                                                                      | 5  |
| 3.  | (a) Draw the timing diagram of SUB B (Opcode: 90) instruction stored from memory location 9000H.                                                                                                                                                                                                                                                    | 5  |
| 4.  | (a) Write a program to generate a 1msec time delay considering the operating frequency of 8085 is 4MHz.<br>(b) What do you mean by hardware and software interrupts of 8085? Write a program to enable RST 7.5, RST 6.5 and disable RST 5.5.                                                                                                        | 5  |
| 5.  | (a) Differentiate between memory mapped I/O and peripheral mapped I/O or I/O mapped I/O.<br>(b) Explain the flag structure of 8085 microprocessor with suitable example.                                                                                                                                                                            | 5  |
| 6.  | (a) Write down the function of the following instructions<br>a) SHLD      b) LDAX      c) INX      d) LDA      e) INR<br>Write a program to subtract a BCD number stored in memory location 9000 <sub>H</sub> from another BCD number stored in 9100 <sub>H</sub> . Store the difference in 8500 <sub>H</sub> and the borrow in 8501 <sub>H</sub> . | 10 |
| 7.  | (a) Explain the function of SP, PC register and control signals of 8085 microprocessor.                                                                                                                                                                                                                                                             | 5  |
| 8.  | (a) Interface the 2KB RAM, and 1KB EPROM memory devices in 8085 microprocessor in absolute decoding method.<br>(b) Draw and explain the Direct memory access (DMA) operation.                                                                                                                                                                       | 5  |
| 9.  | (a) Design a seven-segment common anode LED output port with the device address F5H and 8bit input port containing 8 number of switches with the device address F8. Write program to access the switches and display its value to LED.                                                                                                              | 5  |
| 10. | (a) Draw and explain the control word format of 8255.<br>(b) Explain the different modes of 8253 with proper diagram.                                                                                                                                                                                                                               | 5  |
| 11. | (a) Draw the architecture of 8086 microprocessor. What are the main functions of BIU and EU of 8086 microprocessor.<br>(b) How pipelining achieved in 8086 microprocessor.<br>(c) Write down the differences between 8086 microprocessor and 8088 microprocessor.<br>(d) Explain how 20-bit physical address is generated in 8086 microprocessor?   | 5  |

# Aliah University

Odd (Autumn)-Semester Examination - 2024

(For 5th Semester BTech(CSE) Programme)

Paper Name: Formal Languages and Automata Theory

Full Marks: 80

Paper Code: CSEUGPC13

Time: 3 Hrs

Group - A

(5X2=10)

1. Give a one-sentence answer – Apply, CO1-CO5

- a) What type of language does a regular expression represent?
- b) What do you mean by CSL and LBA?
- c) What type of language is generated by a Type 2 grammar, and what type is generated by a Type 1 grammar?
- d) What do you mean by Turing machines?

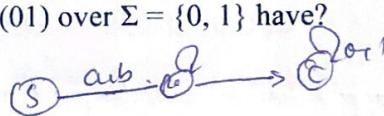
- e) How many states does a DFA for the language  $L: (0+1)^*1(01)$  over  $\Sigma = \{0, 1\}$  have?



Group - B

(Answer any six questions)

(6X5=30)



2. What is a Regular Grammar? How is it equivalent to Finite Automata? Provide an example to demonstrate. Understand, CO1

3. Minimize the DFA for the language  $L = \text{All strings over } \Sigma = \{a, b\} \text{ where each string ends with "ab"}$ . Apply, CO2

4. Draw a DFA over  $\Sigma = \{0,1\}$  where each string is divisible by 3. Apply, CO2

5. Draw a DFA over  $\Sigma = \{0,1\}$  which will accept all strings having even number of 0 and 1. Apply, CO2

6. Construct a Pushdown Automata (PDA) for the language  $L = \{0^n 1^n \mid n \geq 0\}$ . Apply, CO3

7. Convert the following grammar to Chomsky Normal Form (CNF): Apply, CO3

$S \rightarrow AB \mid \epsilon,$

$A \rightarrow aA \mid a$

$B \rightarrow bB \mid b$

(Q1) → (Q2)

8. Given the NFA with states  $\{q_0, q_1\}$ , alphabet  $\{a, b\}$ , and transitions  $\delta(q_0, a) = \{q_0, q_1\}$ ,  $\delta(q_0, b) = \{q_0\}$ ,  $\delta(q_1, a) = \{q_1\}$ ,  $\delta(q_1, b) = \emptyset$ . Convert this NFA to a DFA. **Apply, CO2**

**Group - C**

(Answer any four questions)

(10X4=40)

9. Answer the following-

- a) Convert the following  $\epsilon$ -NFA into an equivalent DFA:

States:  $\{q_0, q_1, q_2\}$ , Start:  $q_0$ , Final:  $\{q_2\}$

Transitions:  $q_0 \rightarrow \epsilon q_1$ ,  $q_1 \rightarrow 0 q_1$ ,  $q_1 \rightarrow 1 q_2$ .

- b) Simplify the following Context-Free Grammar:

$$S \rightarrow AB \mid AC$$

$$A \rightarrow aA \mid a$$

$$B \rightarrow bB \mid b$$

$$C \rightarrow cC \mid c$$

5+5

**Apply, CO2**

$$\begin{aligned} A &\rightarrow aA \mid a \\ aA &\mid AA \\ bB &\mid b \end{aligned}$$

10. Discuss the Chomsky Normal Form (CNF) for context-free grammars. Convert the given CFG to CNF:  $S \rightarrow AB \mid a$ ,  $A \rightarrow aA \mid \epsilon$ ,  $B \rightarrow bB \mid \epsilon$ . **5+5 Apply, CO3**

11. Define leftmost and rightmost derivations in context-free grammars. Show both derivations for the string "aabb" using the CFG:  $S \rightarrow aSb \mid \epsilon$  **4+6 Apply, CO3**

12. Write short notes on the following:

**5+5 Understand, CO1**

- a) Chomsky Hierarchy of Languages

- b) Closure Properties of Regular Languages

13. Construct an NFA for the regular expression  $(a|b)abb$  and then convert it to an equivalent DFA. Provide the state transition diagrams for both. Construct CFG which will generate all palindromes of odd length. **5+5 Apply, CO2**