

B.Tech. Examination-2023-24**Department of Electronics and Communication Engineering
(Odd Semester Regular & Supplementary)****Course Title: Microprocessor and Its Application****Course Code: ECEUGOE04****Full Marks: 80****Time: 3.00 Hrs**

- *Answer all parts of a question in same place.*
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meaning*

Answer any Eight (8) Questions

1. (a) Write down the differences between microprocessor and microcontroller. 4
- (b) Why the lower byte addresses bus (A0-A7) and data bus (D0-D7) are multiplexed? What is the function of ALE pin of 8085 microprocessor and explain with the help of proper diagram. 6
2. (a) Draw the timing diagram of MOV A, M (Opcode: 7E) instruction stored from memory location 8000H. 5
- (b) Write a program to generate a 10msec time delay considering the operating frequency of 8085 is 4MHz. 5
3. (a) What do you mean by maskable and non maskable interrupts of 8085? Write a program to enable all interrupt except RST 5.5 7
- (b) Write a program to exchange the contents of DE register pair with the HL register pair using PUSH and POP instruction. 3
4. (a) Explain the flag structure of 8085 microprocessor with suitable example. 6
- (b) Write down the function of the following instructions 4
- a) ADI b) LHLD c) CMP d) XCHG
5. Write an 8085 assembly language program to transfer the six 8-bit data is stored from memory location C070H to new memory locations starting from C050H. 10
6. (a) Explain the function of HOLD, RESET OUT, READY signal and PC register of 8085 microprocessor. 4
- (b) Draw and explain the Direct Memory Access (DMA) operation. 6
7. (a) Interface the 8KB RAM, and 4KB EPROM memory devices in 8085 microprocessor in absolute decoding method. 5
- (b) Design a seven-segment LED output port with the device address F5H, using a 3-to-8 decoder, a 4-input NAND gate, a NOR gate and a common anode seven segment LED. 5
8. (a) Draw and explain the functional block diagram of 8255. 5
- (b) Explain the BSR mode of 8255. Write a control word for PC7 set and PC5 reset. 5
9. (a) Discuss the different bits of the control word of 5255. 5
- (b) 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. 5

- ... questions
10. (a) Draw and discuss the architecture of 8086 microprocessor. 6
(b) How do pipelining achieved in 8086 microprocessor. 4
11. (a) Explain the process of segmentation of memory in 8086 microprocessor. What are its advantages? 5
(b) Draw and explain the flag register of 8086 microprocessor. 5
12. (a) Write down the differences between 8086 microprocessor and 8088 microprocessor. 4
(b) Write an 8085 assembly language program to compare two strings. Assume that the first byte of both strings contain the number of bytes in that string. The starting address of the two strings is 9000H and 9100H respectively. If both strings are found equal place 11H in memory location 9500H else place 22H. 6

-End-

Aliah University

Odd (Autumn)-Semester Examination – 2023 -24

(For 5th Semester B.Tech(CSE) Programme)

Paper Name: Operating System

Full Marks: 80

Paper Code: CSEUGPC10

Time: 3 Hrs

Group – A

(5X2=10)

1. Answer all questions –

- a) What is Kernel?
- b) What is a process control block (PCB)?
- c) What is race condition?
- d) State necessary conditions for a deadlock situation to arise.
- e) What is internal and external fragmentation?

Group – B (Answer any 6 questions)

(6X5=30)

- 2. What is a process? Draw and explain the process state diagram. 1 + 4
- 3. Explain the difference between long term, short term and medium term schedulers. 5
- 4. What is the critical section? What requirement should be satisfied for a solution to the critical section problem? 1 + 4
- 5. Discuss the Deadlock detection algorithm with an example. 5
- 6. What is paging? Discuss basic paging techniques in detail. 1 + 4
- 7. Memory partitions of 100kb, 500kb, 200kb, 300kb, 600 kb are available. What will be the performance of best, worst and first fit algorithm, assuming the processes are coming in the following order - 212,417,112,426 ? 5
- 8. What is demand paging? Explain it with the address translation mechanism used. What are its specific advantages? 1 + 3 + 1
- 9. Explain various file allocation methods. 5

Group – C (Answer any 4 questions)

(10X4=40)

- 10. Explain in detail various types of operating systems. 10
- 11. Consider the following set of process with the length of CPU burst time given in milliseconds: 10

Process	Arrival Time	Burst Time	Priority
P1	3	3	1
P2	4	4	2
P3	1	5	4
P4	5	3	2
P5	2	2	3

Draw the four Gantt charts illustrating the execution of these processes using FCFS, SJF, Shortest-remaining-time-first, Preemptive priority, Round Robin (quantum = 2) scheduling and calculate waiting and turnaround time for each process for each algorithm.

- 12. What are semaphores? Explain two primitive semaphore operations. State dining philosopher's problem and give a solution using semaphores. 1 + 2 + 7

13. Consider the following snapshot of a system

Process	Allocation A B C D	Max A B C D	Available A B C D
P1	2 0 0 1	4 2 1 2	3 3 2 1
P2	3 1 2 1	5 2 5 2	
P3	2 1 0 3	2 3 1 6	
P4	1 3 1 2	1 4 2 4	
P5	1 4 3 2	3 6 6 5	

Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.
If a request from process P_2 arrives for $(1, 1, 0, 0)$, can the request be granted immediately? $5 + 5$

14. What is the page fault? For the page reference string $7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1$, find out the number of page faults using FCFS, Optimal and LRU page replacement policies. $f_n = 4$ $1 + 9$

15. Illustrate the disk scheduling algorithms FCFS, SSTF, SCAN, C-SCAN, and C - LOOK with a request queue (0-199) and the current head pointer is at 100. 10

98, 183, 37, 122, 14, 124, 65, 67

Aliah University**End-Semester Examination (Autumn Semester) - 2023****5th Semester B.Tech (CSE))****Paper Name: Database Management System****Full Marks: 80****Paper Code: CSEUGPC11****Time: 3 hrs****Group-A****[1x5]**

Select the best alternative for the following

A \cap B is same as: i) (A-B)-B ii) (A \cup B)-A iii) A-(A-B) iv) A \cup (B-A)

b) Grant statement is an example of: i) DDL ii) DML iii) DCL iv) DQL

c) Rollback ensures: i) Atomicity ii) Durability iii) Consistency iv) Isolation

d) Which of the following is not an aggregate function in SQL: i) SUM ii) MAX iii) COUNT iv) MEAN

e) After successful execution of the last instruction of the transaction, the state is

i) Partially committed ii) Committed iii) Ready to abort iv) Aborted

Group- B**Answer any three****[5x3]**

1. What are Armstrong's axioms? Prove the sixth inference rule.

2. Explain the ACID properties of a Transaction.

3. What is cascading rollback? What is an irrecoverable schedule?

4. Explain with examples - 2NF and 3NF.

Group-C**Answer any four****[15x4]**6. Considering the tables EMP(empid, name, sal, did) and DEPT(did, dname, dloc), write relational algebra and SQL for each of the query- [(2.5x2)x3]

a) Who earns the maximum salary in the 'sales' department?

b) Which department has the minimum number of employees?

c) List the employee who earns more than the average salary of his/her department?

7. a) Define conflict and view serializability. [4+3+8]

b) Justify with an example - "Every conflict serializable is viewed as serializable but not vice-versa".

c) Draw an ER Diagram for a university student registration system that includes teacher, students, courses, and enrollment. One teacher can offer multiple courses, but one course has only one teacher. A student can take one or more courses. Clearly indicate primary keys, foreign keys, attributes, and cardinality of relationships.

8. a) What is a two-phase locking protocol? What are its advantages? [5+5+5]

b) Explain the algorithm of time-stamp-based locking protocol.

c) Describe a preemptive and non-preemptive scheme of deadlock avoidance.

9. a) Write the algorithm for finding the primary key and find out the candidate key(s) for the following - R(A,B,C,D,E,F,G,H) and

F= { A-->CD, AB-->EG, C-->G, D-->EF, AC-->D, G-->FH }

b) Write the algorithm for finding the canonical cover of a FD set. Find the canonical cover of the following F={ W → X, Y → X, Z → WXY, WY → Z } [8+7]

10. a) Explain dense and sparse indexing.

[5+5+5]

b) Discuss dynamic hashing technique.

c) Explain the steps of query optimization.

End – Semester Examination (Autumn Semester) 2023 – 24
(For 3rd Year 5th Semester B.Tech)

Paper Name: Design and Analysis of Algorithms
Paper Code: CSEUGPC12

Full Marks: 80
Time: 3 Hrs

Section – A

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

1. A machine needs a minimum of 100 seconds to sort 1000 names by quick sort. What will be the approximate minimum time needed (in seconds) to sort 100 names?
2. Describe the characteristics of an algorithm.
3. State the recurrence relations for the binary search and quick sort algorithm.
4. A complete binary tree with ' n ' non-leaf nodes contains _____ nodes.
5. Which among the insertion sort, quick sort, merge sort and heap sort perform in least time in the worst case?
6. The way a card game player arranges his cards as he picks them up one by one, is an example of _____ sort.
7. What are the best and worst space complexity of the quick sort algorithm?

Section – B

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

1. State the Big-Oh, Big-Omega notations. Explain their graphical interpretations.
2. Find the longest common subsequences between $X = \{AGACGCG\}$ and $Y = \{GAGCC\}$ using dynamic programming paradigm.
3. Explain the Prim's algorithm implemented through min-heap.
4. You have an array of size 15 in which 12 numbers are arranged into a max-heap. If you want to add a new number into the heap, how to do that? Write the pseudo-code for the above problem.
5. From the recurrence relation, obtain the time complexity of the merge sort algorithm through the back substitution method.
6. Explain the algorithm for matrix chain multiplication problem using dynamic programming approach.
7. Solve the recurrence relation using the recursion tree method: $T(n) = 2T(n/2) + n^2$.

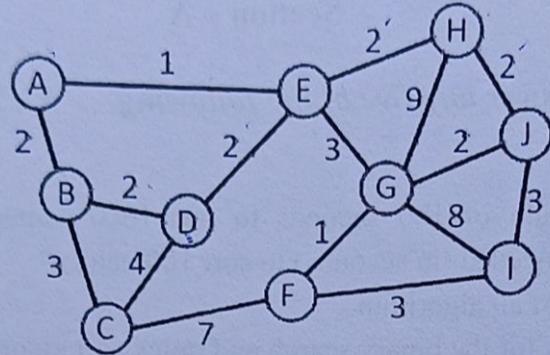
Section – C

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

1. What is dynamic programming? Compare and contrast between dynamic programming and greedy method. Describe the dynamic programming algorithm to find the longest common subsequences (LCS) between two strings. [2 + 2 + 6]

2. Deduce the time complexity of the Strassen's matrix multiplication by solving the recurrence relation using the recursion tree method. The matrices A_1, A_2, A_3, A_4 have the following dimensions $10 \times 5, 5 \times 20, 20 \times 10$, and 10×5 , respectively. Explain the dynamic programming approach to find an optimal parenthesization of the above matrix chain product. [4 + 6]

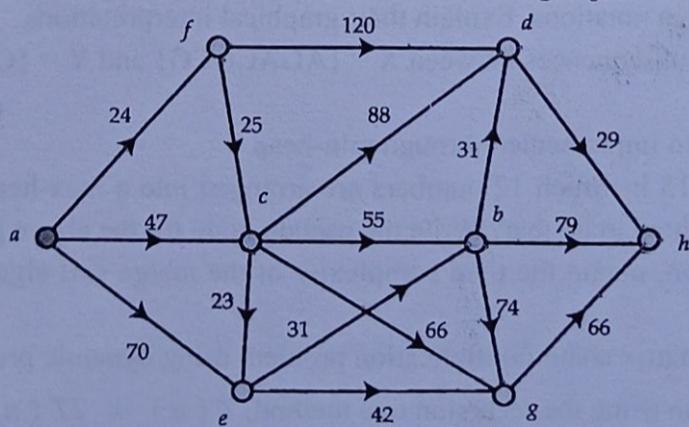
3. What is a spanning tree? How many spanning trees is possible from a graph with 7 nodes? What is a minimum cost spanning tree? Show the step-by-step procedure to find a minimum spanning tree of the given graph by the Kruskal algorithm. [2 + 1 + 1 + 6]



4. Find the percentage of improvement on variable length code over fixed length coding through Huffman encoding when the frequencies of characters a to f are as follows: a : 12, b : 15, c : 3, d : 30, e : 25, f : 15. Let {17, 10, 35, 12, 20, 2, 15, 30, 80, 1} be a list of 10 numbers. Provide a step-by-step explanation of how a heap sort algorithm can be used to sort the list. [5 + 5]

5. State the 0/1 Knapsack problem. Consider instance of the 0/1 knapsack problem as 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 answer using dynamic programming technique. **P: [40 10 50 30 60]** **W = [80 10 40 20 90]** **M : 110**. If fractional part of items is allowed to pick then what will be the optimal solution? [2 + 5 + 3]

6. a) Find the shortest paths from node 'a' to all vertices using 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. $T(n) = 3T(n/2) + n \log n$
- ii. $T(n) = 9T(n/3) + n$.

[6 + 2 + 2]

Aliah University

Odd-Semester (Autumn) Examination - 2023

(For 5th Semester, BTech. CSE)

Paper Name: Formal Languages and Automata Theory

Full Marks: 80

Paper Code: CSEUGPC13

Time: 3 Hrs

Group - A

(5X2=10)

1. Short answers -

- a) Why Type-1 or CSL grammar is called "context-sensitive"? Give an example.
- b) Define Language. How many languages are possible for any alphabet $\Sigma = \{a, b\}$?
- c) Prove that - "Regular languages are closed under intersection operation".
- d) Define Recursively Enumerable and Non-Recursively Enumerable languages.
- e) What is "left recursion" in grammar? How is it removed?

Group - B

(6X5=30)

(Answer any 6 questions)

- 2. What do you mean by the 'power' of machines in theory of computation? Compare different machines as per their power. [1+4]
- 3. Construct Deterministic Finite Automata for the language below-
L: The set of all strings, not starting with 'ba', where $\Sigma = \{a, b\}$. [5]
- 4. Use Pumping Lemma to prove - Language L (given below) is not Regular.
L: The set of all strings with equal number of 'a's and 'b's, where $\Sigma = \{a, b\}$. [5]
- 5. Convert the Mealy Machine (given below) into Moore Machine. [5]

Present State	Input = 0		Input = 1	
	Next State	Output	Next State	Output
A	A	0	B	0
B	B	1	C	0
C	B	0	C	1

- 6. Construct a Turing Machine for Language L (given below).
L: $\{a^i b^j c^i / i=m+n \text{ and } n, m, j > 0 \text{ where } \Sigma = \{a, b, c\}\}$. [5]
- 7. Write a Context Free Grammar for Language L (given below).
L: $\{a^n b^m c^n / i=m+n \text{ and } n, m, i > 0 \text{ where } \Sigma = \{a, b, c\}\}$. [5]
- 8. In the following context-free grammar, the set of terminal symbols is $\Sigma = \{a, b, c\}$, the set of non-terminal symbols is $N = \{S, U, V\}$, and the start symbol is S. Convert the grammar to the Chomsky normal form. Show all the steps of your conversion.
[5]

$$\begin{aligned}S &\rightarrow U \mid V \\U &\rightarrow c \mid aVa \mid \epsilon \\V &\rightarrow c \mid bUb \mid \epsilon\end{aligned}$$

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1 CS

Group - C
(Answer any 4 questions)

(10X4=40)

9. Consider the language below to answer the following questions –

L : The set of all strings containing either even number of 0's or odd number of 1's but not both, $\Sigma = \{0, 1\}$.

a) Construct a minimized DFA for L .

b) Using Arden's theorem, find out the regular expression for L .

[5+5]

10. Consider the language below to answer the following questions –

L : $\{ww^R \mid w \text{ means a string formed over } \Sigma = \{a, b\} \text{ and } W^R \text{ indicates the reverse of string } w\}$

a) Construct a Pushdown Automata (PDA) that accepts L .

b) Write a Context Free Grammar (CFG) which generates L .

[6+4]

11. Construct an \square -NFA for $(0 + 1)^*(00 + 11)(0 + 1)^*$ and Convert to DFA.

[3+7]

- 12.

a) Construct a Transition diagram for the Turing Machine to accept the following language.

$L = \{\sigma^n T \sigma^n \mid n \geq 1, \Sigma = \{0, 1\}\}$

b) Is it a deterministic or non-deterministic Turing machine?

[8+2]

13. Discuss closure properties of Context-Free Languages (with proof) under Union, Intersection, Complement, Concatenation and Kleene-star operations.

[5*2]

- 14.

a) Show that the following CFG is ambiguous- $S \rightarrow iCtS \mid iCtSeS \mid a$
 $C \rightarrow b$

b) Construct a Push Down Automata for Language L (given below).

$L = \{a^n b^m c^{2m} d^n \mid n, m > 0 \text{ where } \Sigma = \{a, b, c, d\}\}$.

[5+5]