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**Question Paper Code : 30116**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Computer Science and Engineering

CS 3301 – DATA STRUCTURES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the uses of Abstract Data Type (ADT).
2. List the advantages of doubly linked list.
3. Give the limitations of linear queue.
4. Write the underflow and overflow conditions in stack?
5. Mention the types of rotations performed on AVL tree.
6. State the properties of binary search tree.
7. Define critical path.
8. State the uses of topological sort.
9. Outline perfect minimal hashing function.
10. Identify the principle behind the external sorting algorithms.

PART B — (5 × 13 = 65 marks)

11. (a) Explain how list operations can be implemented using Arrays.

Or

- (b) Explain how polynomial expression can be represented using linked list.

12. (a) Write an algorithm for Push and Pop operations on Stack using Linked list.

Or

- (b) Explain the addition and deletion operations performed on a circular queue with necessary algorithms.
13. (a) Identify the types of Priority Queue. Explain about min heap insertion and deletion operations.

Or

- (b) Explain Heap tree ADT in detail.
14. (a) Write and explain the prim's algorithm and depth first search algorithm.

Or

- (b) Explain about B+ trees with algorithms to insert a node into a B+ tree.
15. (a) Write an algorithm to implement Bubble sort with suitable example.

Or

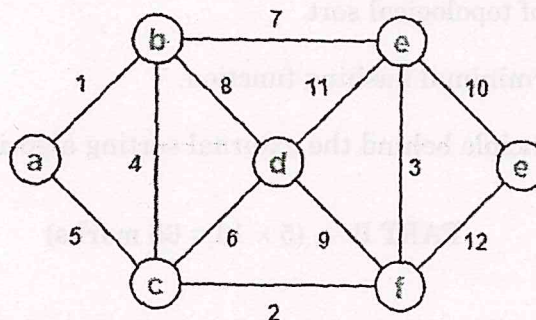
- (b) Discuss the common collision resolution strategies used in closed hashing system.

PART C — (1 × 15 = 15 marks)

16. (a) The keys 12,18,13,2,3,23,5, and 15 are inserted into an initially empty hash table of length 10 using linear probing with hash function  $h(k) = k \text{ mod } 10$ . What is the resultant hash table?

Or

- (b) Using Prim's Algorithm, find the cost of minimum spanning tree (MST) of the given graph.





PART B — (5 × 16 = 80 marks)

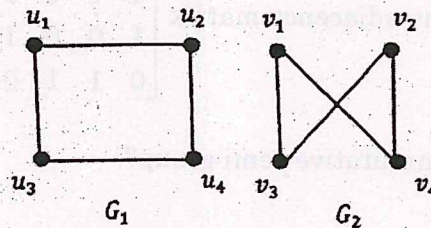
11. (a) (i) Show that  $(\sim p \wedge (\sim q \wedge r)) \vee (q \wedge r) \vee (p \wedge r) \Leftrightarrow r$ . (8)
- (ii) Show that the following argument is valid, "Every, micro computer has a serial interface port. Some micro computers have a parallel port. Therefore some micro computers have both serial interface port and parallel port". (8)

Or

- (b) (i) Find a principal disjunctive normal form and a principal conjunctive normal form of  $p \vee (\sim p \rightarrow (q \vee (\sim q \rightarrow r)))$ . (8)
- (ii) Using the indirect method, Show that  $(x)(P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x)$ . (8)
12. (a) (i) Use mathematical induction to show that  $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$ , whenever  $n$  is a positive integer. (8)
- (ii) Solve :  $T(k) - 7T(k-1) + 10T(k-2) = 6 + 8k, T(0) = 1, T(1) = 2$ . (8)

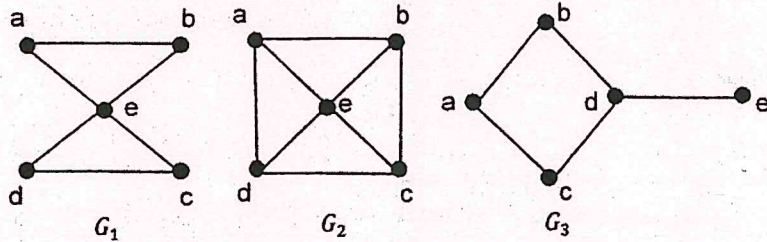
Or

- (b) (i) Solve the recurrence relation  $y_{n+2} - 4y_{n+1} + 3y_n = 0, y_0 = 2, y_1 = 4$ , using the generating function. (8)
- (ii) In a survey of 100 students, it was found that 40 studied Mathematics, 64 studied Physics, 35 studied Chemistry, 1 studied all the three subjects, 25 studied Mathematics and Physics, 3 studied Mathematics and Chemistry, 20 studied Physics and Chemistry. Use the principle of inclusion and exclusion, find the number of students who studied Chemistry only and the number who studied none of these subjects? (8)
13. (a) (i) Prove that the number of vertices of odd degree in a graph  $G$  is always even. (8)
- (ii) Determine whether the following pairs of graphs  $G_1$  and  $G_2$  are isomorphic. (8)



Or

- (b) (i) Prove that there is a simple path between every pair of distinct vertices of a connected undirected graph. (8)
- (ii) Find an Euler path or an Euler circuit, if it exists in each of the following three graphs. If it does not exist, explain why? (8)

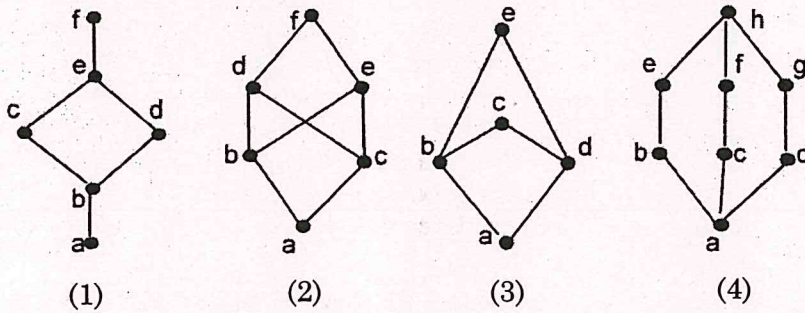


14. (a) (i) Prove that  $[Z_5, +_5]$  is an abelian group. (8)
- (ii) Show that any two right (left) cosets of  $H$  in  $G$  are either disjoint or identical. (8)

Or

- (b) (i) State and prove Lagrange's Theorem. (8)
- (ii) Show that the intersection of two normal subgroups of a group of  $(G, *)$  is a normal subgroup of  $(G, *)$ . (8)

15. (a) (i) Determine whether the following partial ordering sets with the Hasse diagrams are lattices. (8)

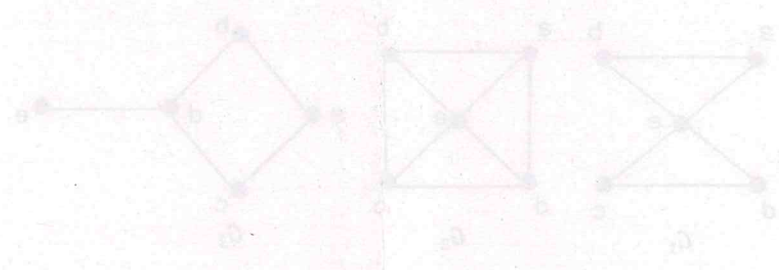


- (ii) Let  $(L, \leq)$  be a lattice in which  $\wedge$  and  $\vee$  denote the operations of meet and join respectively. For any  $a, b \in L$ , prove that  $a \leq b \Leftrightarrow a \wedge b = a \Leftrightarrow a \vee b = b$ . (8)

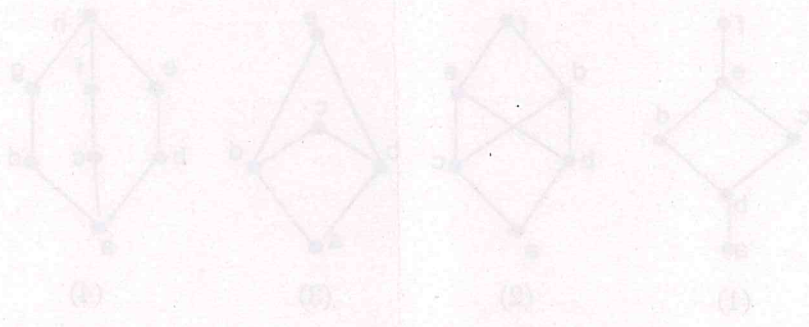
Or

- (b) (i) If  $L$  is a distributive lattice, prove  $(a \vee b) \wedge (b \vee c) \wedge (c \vee a) = (a \wedge b) \vee (b \wedge c) \vee (c \wedge a)$ . (8)
- (ii) In a Boolean algebra, prove
- (1)  $b \leq c \Rightarrow a \cdot b \leq a \cdot c$  and
- (2)  $b \leq c \Rightarrow a + b \leq a + c$ . (8)

- (i) Prove that there is a simple path between every pair of distinct vertices of a connected undirected graph. (8)
- (ii) Find an Euler path or an Euler circuit, if it exists in each of the following three graphs. If it does not exist, explain why. (8)



14. (a) Prove that  $[N_G(H), H]$  is an abelian group. (8)
- (i) Show that any two right (left) cosets of  $H$  in  $G$  are either disjoint or identical. (8)
- Or
- (b) (i) State and prove Lagrange's Theorem. (8)
- (ii) Show that the intersection of two normal subgroups of a group  $(G, \cdot)$  is a normal subgroup of  $(G, \cdot)$ . (8)
15. (a) (i) Determine whether the following partial ordering sets with the Hasse diagrams are lattices. (8)



- (ii) Let  $(L, \geq)$  be a lattice in which  $\wedge$  and  $\vee$  denote the operations of meet and join respectively. For any  $a, b, c \in L$ , prove that  $a \wedge (b \vee c) = (a \wedge b) \vee (a \wedge c)$ . (8)
- Or
- (b) (i) Let  $L$  be a distributive lattice. Prove  $(a \vee b) \wedge (b \vee c) = (a \wedge b) \vee (b \wedge c)$ . (8)
- (ii) In a Boolean algebra, prove  $b + c = a + b + c$  and  $b + c = a + b + c$ . (8)

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**Question Paper Code : 30117**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Computer Science and Engineering

CS 3351 – DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

(Common to Computer and Communication Engineering/  
Artificial Intelligence and Data Science/Computer Science and Business  
Systems/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Construct Half-adder and full adder circuits.
2. Evaluate the logic circuit of 2 bit comparator.
3. Distinguish sequential logic with combinational logic.
4. Give the excitation table of JK flip flop.
5. Draw the stock diagram of Von-Neumann architecture.
6. List the types of addressing modes.
7. What do you mean by pipelining? List its types.
8. Differentiate data hazards and control hazards.
9. Why do we need cache memory?
10. Which signal is used to notify the processor that the transfer is completed?  
Define.

PART B — (5 × 13 = 65 marks)

11. (a) (i) How will you design a full adder using two half adders. (7)  
(ii) Simplify the function using multiplexer  $f = \sum(0, 1, 3, 4, 8, 9, 15)$ . (6)

Or

- (b) (i) Demonstrate 4 bit magnitude comparator with three outputs  
 $A > B, A = B, A < B$ . (7)  
(ii) Build a 4 bit priority encoder using gates. (6)
12. (a) (i) Realize D flip flop using SR flip flop. (7)  
(ii) Construct a 4 bit down counter using logic gates. (6)

Or

- (b) Give the analysis and design of clocked sequential circuits.
13. (a) (i) Explain about functional units in digital computer. (7)  
(ii) Discuss about instruction cycle. (6)

Or

- (b) (i) Explain about encoding in assembly language and types of instructions. (7)  
(ii) Discuss the interaction between assembly language and high level language. (6)
14. (a) An instruction pipeline has five stages where each stage takes 2 nanoseconds and all instructions use all five stages, branch instruction are not overlapped (i.e.) the instruction after the branch is not fetched till the branch instruction is completed. Under ideal condition.

Calculate the average instruction execution time assuming that 20% of all instruction executed are branch instructions. Ignore the fact that some branch instructions may be conditional.

Or

- (b) (i) What is hazard? Give hazard free realization for the following Boolean function  $F(A, B, C, D) = \sum m(1, 5, 6, 7)$  using AND-OR gate network. (10)  
(ii) Define essential hazards. (3)

15. (a) (i) Explain in detail about DMA operation. (7)  
(ii) Give the modes of DMA transfer. (6)

Or

- (b) Elucidate interconnection standards. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Explain the functions with the state diagram and characteristic equation of T, D and JK flip flop. Compare and Contrast. (15)

Or

- (b) Implement the following Boolean function using  $8 \times 1$  multiplexer. Considering D as the input and A, B, C as selection lines

$$f(A, B, C, D) = AB' + BD + B'CD' . \quad (15)$$



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**Question Paper Code : 30140**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Computer and Communication Engineering

EC 3354 — SIGNALS AND SYSTEMS

(Common to Electronics and Communication Engineering/Electronics and  
Telecommunication Engineering/Medical Electronics)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine whether the signal  $x[n]$  is periodic. If yes, find its fundamental period.  $X[t] = je^{j10t}$ .
2. Define even and odd signal.
3. State the Dirichlet's conditions for the Fourier transform to exist.
4. Draw the ROC of the Laplace transform of a signal  $x(t) = e^{at} u(-t)$ .
5. Find the step response of a LTI system with impulse response  $h(t) = \delta(t) - \delta(t-1)$ .
6. When the Linear time invariant continuous time system is said to be stable?
7. Determine the system function of the discrete time system described by the difference equation.  $y[n] - \frac{1}{2}y[n-1] + \frac{1}{4}y[n-2] = x[n] - x[n-1]$
8. Mention the effects of aliasing.
9. Convolve the two sequences  $x(n) = \{1, 2, 3\}$  and  $h(n) = \{5, 4, 6, 2\}$
10. List the difference between recursive and non-recursive system.

PART B — (5 × 13 = 65 marks)

11. (a) Explain all classification of systems with Examples for Each Category. (13)

Or

- (b) For the given  $x(n) = \{1, 4, 3, -1, 2\}$  Plot the following signals.

(i)  $x(-n-1)$  (5)

(ii)  $x(-n/2)$  (4)

(iii)  $x(-n/2) + 2$  (4)

12. (a) Consider a casual discrete time LTI system whose input  $x[n]$  and output  $y[n]$  are related by the following difference equation :  
 $y[n] - \frac{1}{4}y[n-1] = x[n]$ . Find the Fourier series representation of the output  $y[n]$  for each of the following inputs :

(i)  $x[n] = \sin\left[\frac{3\pi}{4}n\right]$  (7)

(ii)  $x[n] = \cos\left[\frac{\pi}{4}n\right] + 2\cos\left[\frac{\pi}{2}n\right]$  (6)

Or

- (b) (i) Determine the Fourier transform of double-sided exponential signal. (5)  
 (ii) Solve the given differential equation using Laplace transform

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 10u(t), \quad t \geq 0$$

with the initial conditions  $y(0) = 1$  and  $y'(0) = -2$ . (8)

13. (a) (i) The input and output of a casual LTI system are related, by the differential equation

$$\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$$

Find the impulse response  $h(t)$  and the output response  $y(t)$  of the system when  $x(t) = u(t)$ . (7)

- (ii) Explain the properties of convolution integral. (6)

Or

- (b) Realize the system with transfer function in cascade form

$$H(s) = \frac{4(s^2 + 4s + 3)}{s^3 + 6.5s^2 + 11s + 4} \quad (13)$$

14. (a) Consider an LTI system with input  $x[n]$  and  $y[n]$  for which  $y[n-1] - \frac{5}{2}y[n] + y[n+1] = x[n]$ . This system may or may not be stable or casual.

By considering pole zero pattern of the difference equation, determine the three possible choices for the unit sample response of the system and prove that each choices satisfies the difference equation. (13)

Or

- (b) State and prove sampling theorem for a band limited signal. (13)

15. (a) Consider a discrete time LTI System

$$y[n] - \frac{3}{2}y[n-1] + \frac{1}{2}y[n-2] = 2x[n] + \frac{3}{2}x[n-1] \text{ where}$$

$$y[-1] = 0, y[-2] = 1 \text{ and } x[n] = \left(\frac{1}{4}\right)^n u(n)$$

Find output response using Z-transform

Draw its ROC of the transfer function and comment its causality of the system. (13)

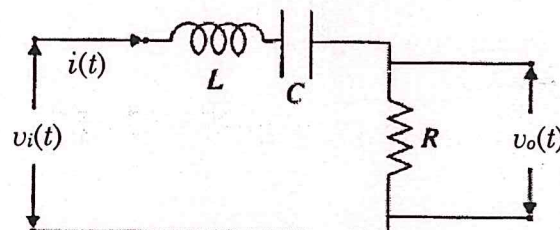
Or

- (b) Find the linear convolution of  $x(n) = \{1, 2, 3, 4, 5\}$ ,  $h(n) = \{1, 2, 3, 3, 2, 1\}$  Use graphical methods. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider the R.LC. series circuit shown with  $L = 1H$ ,  $C = 1F$  and  $R = 2.5$  ohms. Derive an expression for the output voltage  $V_o(t)$  if the input is an

- (i) Impulse  
(ii) Unit step. Assume zero initial conditions. (15)



Or

ENB

(b) Consider the following system function:

$$H(s) = \frac{z}{\left(z - \frac{1}{4}\right)\left(z + \frac{1}{4}\right)\left(z - \frac{1}{2}\right)}$$

For different possible ROCs, determine the causality, stability and the impulse response of the system. (15)



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**Question Paper Code : 50427**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third/Fourth/Fifth/Eighth Semester

Computer Science and Engineering

CS 8492 – DATABASE MANAGEMENT SYSTEMS

(Common to: Computer and Communication Engineering / Mechanical and Automation Engineering / Mechatronics Engineering / Computer Science and Business Systems/ Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a data model? Name the categories of data models.
2. Outline referential integrity with an example.
3. Consider a binary relationship set R between two entity sets A and B, name the mapping cardinalities.
4. Outline functional dependency with an example.
5. What are serializable schedules?
6. Name the four conditions for deadlock.
7. Outline the difference between dense index and sparse index.
8. What is a hash function?
9. Outline the difference between homogeneous and heterogeneous distributed database management systems.
10. Outline the motivations of replication in a distributed database environment

PART B — (5 × 13 = 65 marks)

11. (a) Outline equi join, left outer join, right outer join and full outer join with an example. (13)

Or

- (b) Outline the aggregate functions in SQL with an example. (13)

12. (a) A university registrar's office maintains data about the following entities: (i) courses, including number, title, credits, syllabus, and prerequisites; (ii) course offerings, including course number, year, semester, section number, instructor, timings, and classroom; (iii) students, including student-id, name, and program; and (iv) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints. (13)

Or

- (b) What is database normalization? Outline first normal form, second normal form and third normal form with an example. (13)

13. (a) (i) What is a transaction? Outline the states a transaction can be in during execution with a diagram. (6)  
(ii) Outline the desirable properties of a transaction. (7)

Or

- (b) (i) Outline the two phase locking protocol with an example. (7)  
(ii) Outline the SQL statements used for transaction control with an example. (6)

14. (a) (i) Elaborate a B+ tree index with an example. (6)  
(ii) What is bucket overflow? Outline the reasons for bucket overflow in hashing and outline how to overcome bucket overflow. (7)

Or

- (b) What is query processing? Outline the steps in query processing with a diagram. (13)

15. (a) Outline the necessary characteristics a system must satisfy to be considered as an object oriented database. (13)

Or

- (b) What are information-retrieval systems? Outline relevance ranking with an example. (13)

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PART C — (1 × 15 = 15 marks)

16. (a) Consider the following scenario for a school admission system for higher secondary classes:

A student is admitted to a group. A group can be Mathematics with Biology, Mathematics with Computer Science, Mathematics with Commerce, Mathematics with Commerce and Computer Science etc. Student can be admitted to a group under a quota. Quota can be General, Ex-service man, Sports, etc. The fees each student must pay depends on the group and quota

- (i) Model an entity relationship diagram for the school admission system. Identify appropriate attributes and relationships. (7)
- (ii) Map the entity relationship diagram to relations. (8)

Or

- (b) Consider the following relations for a boat management application for a beach resort:

SAILOR (SID, NAME, DOB, GENDER, RATING)

BOAT (BID, BTYPE, BNAME, COLOR)

BTYPE can take two values (D, S)

D — Deluxe

S — Super Deluxe

SAILS (SID, BID, DOT, SHIFT)

DOT — Date of Trip

SHIFT can take two values — FN or AN

A sailor is assigned a boat on a day. A sailor is permitted to sail the boat for only one shift on a day. The primary keys of each relation is underlined.

Write SQL queries to perform the following:

- (i) List the details of sailors who have rating more than average rating of all sailors. (4)
- (ii) List the details of boats whose type is super deluxe and color is red. (3)
- (iii) List the details of sailors who have been assigned afternoon shift on '24-DEC-2021'. (4)
- (iv) List the details of sailors who have sailed more than fifty times. (4)





PART B — (5 × 13 = 65 marks)

11. (a) Register R5 is used in a program to point to the top of a stack containing 32-bit numbers. Write a sequence of instructions using the Index, Autoincrement, and Autodecrement addressing modes to perform each of the following tasks;
- (i) Pop the top two items off the stack, and then, then push the result onto the stack. (5)
  - (ii) Copy the fifth item from the top into register R3. (4)
  - (iii) Remove the top ten items from the stack. (4)

For each case, assume that the stack contains ten or more elements.

Or

- (b) Multiply each of the following pairs of signed 2's- complement numbers using the Booth algorithm. In each case, assume that A is the multiplicand and B is the multiplier.
- (i) A = 010111 and B = 110110 (4+1)
  - (ii) A = 110011 and B = 101100 (4)
  - (iii) A = 001111 and B = 001111 (4)

12. (a) Explain hardware implementation of floating – point operations with neat sketch.

Or

- (b) (i) Draw the flowchart and explain about booth algorithm (6)  
(ii) Multiply 100111 with 11011 using booths algorithm. (7)

13. (a) Explain basic MIPS implementation with neat diagram.

Or

- (b) With neat diagram discuss data hazard and stalls.

14. (a) (i) Brief the difficulties in parallel processing. Explain how speed-up challenge is addressed with example. (7)  
(ii) What are the performance metrics of parallel systems? (6)

Or

- (b) Explain the flynn's classification of computer with suitable diagram.

15. (a) With neat sketch explain various mapping techniques of cache memory?

Or

(b) Define Interrupts. Explain how to interrupts from multiple devices in detail.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Consider three processors P1, P2, and P3 executing same instruction set. P1 has 2 GHz of clock rate and CPI of 1.5. P2 has a 3.5 GHz clock rate and a CPI of 1.0. P3 has 3.0 GHz clock rate and has CPI of 2.2. Find which processor has the highest performance expressed in instructions per second. Also find the number of cycles and number of instructions in each processor if each processor executes a program in 10 seconds. (7)

(ii) Discuss DMA controller with neat block diagram? (8)

Or

(b) (i) Consider a two address format specified as source, destination. Examine the following sequence of instruction and explain the addressing modes used and the operations done in each instruction.

(1) MOVE (R3) +, R0 (2)

(2) ADD (R3) +, R0 (2)

(3) MOVE R0, (R3) (2)

(4) MOVE 8(R3), (R5) (2)

(5) ADD #70, R3 (2)

(ii) Compare and contrast fine grained multi-threading and coarse grained multi-threading? (5)

15. (a) With neat sketch explain various mapping techniques of cache memory?

Or

(b) Define interrupts. Explain how to interrupt from multiple devices in detail.

PART C — (1 × 10 = 10 marks)

16. (a) (i) Consider three processors P1, P2, and P3 executing same instruction set. P1 has 2 GHz of clock rate and CPI of 1.5. P2 has a 3.5 GHz clock rate and a CPI of 1.0. P3 has 3.0 GHz clock rate and has CPI of 2.2. Find which processor has the highest performance expressed in instructions per second. Also find the number of cycles and number of instructions in each processor if each processor executes a program in 10 seconds.

(ii) Discuss DMA controller with neat block diagram.

Or

(b) (i) Consider a two address format specified as source, destination. Examine the following sequence of instruction and explain the addressing modes used and the operations done in each instruction.

- (1) MOVE (R3), R0
- (2) ADD (R3), R0
- (3) MOVE R0, (R3)
- (4) MOVE (R3), (R3)
- (5) ADD #10, R3

(ii) Compare and contrast the shared multi-threading and coarse grained multi-threading.

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**Question Paper Code : 30125**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Computer Science and Engineering

CS 3492 – DATABASE MANAGEMENT SYSTEMS

(Common to: Computer and Communication Engineering/Computer Science and Business Systems/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define foreign key with an example.
2. What is data definition language?
3. What is a derived attribute? Give example.
4. What is functional dependency? Give example.
5. Define serializability.
6. Name the four conditions for deadlock.
7. Outline the need for indexing.
8. What is a hash function? Give example.
9. What is a distributed database management system?
10. Define encryption with an example.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the database management system architecture with a neat sketch. (13)

Or

- (b) (i) Outline select and project operations in relational algebra with an example. (5)
- (ii) What is embedded SQL? Explain with an example. (8)
12. (a) Elaborate on first normal form, second normal form and third normal form with examples. (13)

Or

- (b) Explain Boyce Codd normal form, fourth normal form and fifth normal form with examples. (13)
13. (a) (i) What is a transaction? List and explain ACID properties with an example. (6)
- (ii) Outline the two phase locking protocol with an example. (7)

Or

- (b) What is recovery? Outline the steps in the Algorithm for Recovery and Isolation Exploiting Semantics (ARIES) algorithm with an example. (13)
14. (a) (i) Outline B tree index and B+ tree index with an example. (6)
- (ii) Explain static hashing with an example. (7)

Or

- (b) What is query processing? Elaborate about the steps in query processing with a diagram. (13)
15. (a) What is a distributed transaction? Explain distributed query processing with an example. (13)

Or

- (b) (i) What is NoSQL? Outline the features of NoSQL databases. (8)
- (ii) Discuss role based access control with an example. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Consider the following relations:

EMPLOYEE

<u>ENO</u>	<u>NAME</u>	<u>DOB</u>	<u>GENDER</u>	<u>DCODE</u>
12345	HAMEN	24-MAR-2001	M	201
12346	VINI	12-MAR-2001	F	202
12347	ANI	11-JAN-1999	F	
12348	PETER	14-FEB-2001	M	

DEPARTMENT

<u>DCODE</u>	<u>DNAME</u>
201	COMPUTER SC
202	INFN SC
203	CIVIL
204	MECHANICAL

The primary key of each relation is underlined. Outline Cartesian product, equi join, left outer join, right outer join and full outer join operations in relational algebra. Illustrate the above relational algebra operations with the EMPLOYEE and DEPARTMENT relations.

Or

- (b) A Company is organized into departments. Each department has employees working in it. The attributes of department include department number and department name. The attributes of employee include employee number, employee name, date of birth, gender, date of joining, designation and basic pay. Each department has a manager managing it. There are also supervisors in each department who supervise a set of employees. Each department controls a number of projects. The attributes of project include project code and project name. A project is controlled only by one department. An employee can work in any number of distinct projects on a day. The date an employee worked, in time and out time has to be kept track. The company also keeps track of the dependents of each employee. The attributes of dependent include dependent name, date of birth, gender and relationship with the employee.

- (i) Model an Entity Relationship diagram for the above scenario. (7)
- (ii) Map the Entity Relationship diagram you have modeled to relations. (8)



Reg. No. :

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**Question Paper Code : 50836**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Computer and Communication Engineering

MA 8451 — PROBABILITY AND RANDOM PROCESSES

(Common to Electronics and Communication Engineering/Electronics and  
Telecommunication Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Suppose that two events A and B are mutually exclusive and  $P[B] > 0$ . Under what conditions will A and B be independent?

2. Balls are tossed at random into 50 boxes. Find the expected number of tosses required to get the first ball in the fourth box.

3. X and Y are two continuous random variables whose joint PDF is given by

$$f_{XY}(x, y) = \begin{cases} e^{-(x+y)}, & 0 \leq x < \infty, 0 \leq y < \infty \\ 0 & \text{otherwise.} \end{cases}$$

Are X and Y independent?

4. The joint PMF of two random variables X and Y is given by

$$P_{XY}(x, y) = \begin{cases} k(2x + y) & x = 1, 2; y = 1, 2 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant. What is the value of k?

5. Define irreducible Markov Chain.

6. Does difference of two independent Poisson process a Poisson process? Justify.

7. If  $X(t)$  is periodic, then prove that its auto correlation function is also periodic.

8. Define power spectral density function.

9. Give an example of linear time invariant system.

10. What is time-invariant system with example?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A student buys 1000 integrated circuits (ICs) from supplier A, 2000 ICs from supplier B, and 3000 ICs from supplier C. He tested the ICs and found that the conditional probability of an IC being defective depends on the supplier from whom it was bought. Specifically, given that an IC came from supplier A, the probability that it is defective is 0.05; given that an IC came from supplier B, the probability that it is defective is 0.10; and given that an IC came from supplier C, the probability that it is defective is 0.10. If the ICs from the three suppliers are mixed together and one is selected at random, what is the probability that it is defective? (8)

- (ii) A test engineer discovered that the CDF of the lifetime of an equipment in years is given by  $F_X(x) = \begin{cases} 0, & x < 0 \\ 1 - e^{-\frac{x}{5}}, & 0 \leq x < \infty \end{cases}$

- (1) What is the expected lifetime of the equipment?  
(2) What is the variance of the lifetime of the equipment? (8)

Or

- (b) (i) Messages arrive at a switchboard in a Poisson manner at an average rate of 6 per hour. Find the probability for each of the following events:

- (1) Exactly two messages arrive within one hour.  
(2) No message arrives within one hour.  
(3) At least three messages arrive within one hour.  
(4) Also, calculate the mean and variance. (8)

- (ii) The weights in pounds of parcels arriving at a package delivery company's warehouse can be modeled by an  $N(5; 16)$  normal random variable,  $X$ .

- (1) What is the probability that a randomly selected parcel weighs between 1 and 10 pounds?  
(2) What is the probability that a randomly selected parcel weighs more than 9 pounds? (8)

12. (a) (i) A fair coin is tossed three times. Let  $X$  be a random variable that takes the value 0 if the first toss is a tail and the value 1 if the first toss is a head. Also, let  $Y$  be a random variable that defines the total number of heads in the three tosses.

- (1) Determine the joint PMF of  $X$  and  $Y$ .  
(2) Are  $X$  and  $Y$  independent? (8)

(ii) The joint PMF of two random variables  $X$  and  $Y$  is given by

$$p_{XY}(x, y) = \begin{cases} k(2x + y), & x = 1, 2; y = 1, 2 \\ 0, & \text{otherwise} \end{cases}$$

where  $k$  is a constant.

- (1) What is the value of  $K$ ?
- (2) Find the marginal PMFs of  $X$  and  $Y$ .
- (3) Are  $X$  and  $Y$  independent? (8)

Or

(b) (i) The joint PDF of the random variables  $X$  and  $Y$  is defined as follows:

$$f_{XY}(x, y) = \begin{cases} 25e^{-5y}, & 0 < x < 0.2, y > 0 \\ 0, & \text{otherwise} \end{cases}$$

- (1) Find the marginal PDFs of  $X$  and  $Y$ .
  - (2) What is the covariance of  $X$  and  $Y$ ? (8)
- (ii) Assume that the random variable  $S_n$ , is the sum of 48 independent experimental values of the random variable  $X$  whose PDF is given by

$$f_X(x) = \begin{cases} \frac{1}{3}, & 1 \leq x \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability that  $S_n$  lies in the range  $108 \leq S_n \leq 126$ .

13. (a) (i) Consider the process  $\{X(t)\} = \cos(\omega_0 t + \theta)$ , where  $\theta$  is uniformly distributed in the interval  $-\pi$  to  $\pi$ . Check whether  $X(t)$  is stationary or not? (8)

(ii) The transition probability matrix of the Markov chain  $X(n)$ ,  $n = 1, 2, 3 \dots$  having 3 states 1, 2, and 3 is

$$\begin{matrix} & \begin{matrix} 1 & 2 & 3 \end{matrix} \\ \begin{matrix} 1 \\ 2 \\ 3 \end{matrix} & \begin{pmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{pmatrix} \end{matrix}$$

and the initial distribution is  $(0.7 \ 0.2 \ 0.1)$ . Find  $P(X_2 = 3)$  and  $P(X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2)$  (8)

Or

- (b) (i) Find the mean and covariance of the random telegraph signal (8)
- (ii) A machine goes out of order, whenever a component fails. The failure of this part follows a Poisson process with a mean rate of 1 per week. Find the probability that 2 weeks have elapsed since last failure. If there are 5 spare parts of this component in an inventory and that the next supply is not due in 10 weeks, find the probability that the machine will not be out of order in the next 10 weeks. (8)

14. (a) A random process is defined by  $X(t) = K \cos \omega t \geq 0$ , where  $\omega$  is a constant and  $K$  is uniformly distributed between 0 and 2. Determine the following:
- (i)  $E[X(t)]$  (6)
- (ii) The autocorrelation function of  $X(t)$  (5)
- (iii) The autocovariance function of  $X(t)$  (5)

Or

- (b) (i) The auto correlation of the random binary transmission is given by
- $$R_{XX}(\tau) = \begin{cases} 1 - \frac{|\tau|}{T}, & \text{for } |\tau| \leq T \\ 0, & \text{for } |\tau| > T \end{cases} \text{ Find the power spectrum. (8)}$$
- (ii) The cross-power spectrum of real random process  $X(t)$  and  $Y(t)$  is given by  $S_{XY}(\omega) = \begin{cases} a + j\omega, & \text{for } |\omega| \leq 1 \\ 0, & \text{elsewhere.} \end{cases}$  Find the cross correlation function. (8)

15. (a) Let  $X(t)$  be a zero-mean WSS process with  $R_X(\tau) = \exp(-|\tau|)$ .  $X(t)$  is input to an LTI with

$$|H(f)| = \begin{cases} \sqrt{1 + 4\pi^2 f^2} & \text{if } |f| < 2 \\ 0 & \text{otherwise} \end{cases}$$

Let  $Y(t)$  be the output. Find  $E[Y(t)]$ ,  $R_Y(t)$  and  $E[Y(t)^2]$ . (16)

Or

- (b) Let  $X(t)$  be a random process with mean function  $\mu_X(t)$  and autocorrelation function  $R_X(s, t)$  ( $X(t)$  is not necessarily a WSS process). Let  $Y(t)$  be given by

$$Y(t) = h(t) * X(t)$$

where  $h(t)$  is the impulse response of the system. Show that

(i)  $\mu_Y(t) = \mu_X(t) * h(t)$  (8)

(ii)  $R_{XY}(t_1, t_2) = h(t_2) * R_X(t_1, t_2) = \int_{-\infty}^{\infty} h(\alpha) R_X(t_1, t_2 - \alpha) d\alpha$ . (8)

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**Question Paper Code : 30124**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Computer Science and Engineering

CS 3491 – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Common to: Computer and Communication Engineering/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define artificial intelligence.
2. What is adversarial search?
3. Define uncertainty.
4. State Bayes' rule.
5. Outline the difference between supervised learning and unsupervised learning.
6. What is a random forest?
7. Define ensemble learning.
8. What is the significance of Gaussian mixture model?
9. Draw the architecture of multilayer perceptron.
10. Name any two activation functions.

PART B — (5 × 13 = 65 marks)

11. (a) Outline the uniformed search strategies like breadth-first search and depth-first search with examples. (13)

Or

- (b) State the constraint satisfaction problem. Outline local search for constraint satisfaction problem with an example. (13)
12. (a) (i) Elaborate on unconditional probability and conditional probability with an example. (6)
- (ii) What is a Bayesian network? Explain the steps followed to construct a Bayesian network with an example. (7)

Or

- (b) What do you mean by inference in Bayesian networks? Outline inference by enumeration with an example. (13)
13. (a) Elaborate on logistics regression with an example. Explain the process of computing coefficients. (13)

Or

- (b) What is a classification tree? Explain the steps to construct a classification tree. List and explain about the different procedures used. (13)
14. (a) (i) What is bagging and boosting? Give example. (3)
- (ii) Outline the steps in the AdaBoost algorithm with an example. (10)

Or

- (b) Elaborate on the steps in expectation-maximization algorithm. (13)
15. (a) Explain the steps in the back propagation learning algorithm. What is the importance of it in designing neural networks? (13)

Or

- (b) Explain a deep feedforward network with a neat sketch. (13)

PART C — (1 × 15 = 15 marks)

16. (a) The values of  $x$  and their corresponding values of  $y$  are shown in the table below.

$x$	1	2	3	4	5	6	7
$y$	3	4	5	5	6	8	10

- (i) Find the least square regression line  $y = ax + b$  (12)
- (ii) Estimate the value of  $y$  when  $x = 10$  (3)

Or

- (b) Consider five points  $\{x_1, x_2, x_3, x_4, x_5\}$  with the following coordinates as a two-dimensional sample for clustering:

$$x_1 = (0.5, 1.75), x_2 = (1, 2), x_3 = (1.75, 0.25), x_4 = (4, 1), x_5 = (6, 3)$$

Illustrate the  $k$ -means algorithm on the above data set. The required number of clusters is two, and initially, clusters are formed from random distribution of samples:  $C_1 = \{x_1, x_2, x_4\}$  and  $C_2 = \{x_3, x_5\}$  (15)



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**Question Paper Code : 50429**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023

Fourth/Fifth Semester

Computer Science and Engineering

CS 8494 – SOFTWARE ENGINEERING

(Common to Computer and Communication Engineering / Computer Science and Business Systems / Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out key challenges in software engineering.
2. Define legacy software.
3. Differentiate between functional and non-functional requirements.
4. Differentiate evolutionary and incremental prototype.
5. How inheritance is referred in class based modeling?
6. What is abstraction?
7. Distinguish between white box and black box testing.
8. Depict the reverse engineering process.
9. How the Budgeted Cost of Work Scheduled (BCWS) is determined for each work task in the schedule?
10. Write any two differences between "known risks" and "predictable risks".

(d) Explain how Business Process Reengineering (BPR) helps to achieve a defined business outcome. (8)

(ii) Explain how the reverse engineering process helps to improve the legacy software. (3)

14. (a) Develop a register sheet showing the interactions involved when a student registers for a course in a university. Courses may have limited enrollment so the registration process must include checks that places are available. Assume that the student accesses an electronic course catalog to find out about available courses. (10)

(b) For the Medical Health Care (MHC) Patient Management System (PMS), propose a set of use cases that illustrates the interactions between a doctor who sees patients and prescribes medicine and treatments and the MHC PMS. (10)

(c) Explain the cost estimation COCOMO model. (9)

(ii) Write the guidelines that U.S. Air Force has suggested for software risk identification and reduction. (4)

(b) You have a project to be completed in 24 months and total cost of project is \$2,00,000. Six months have been passed and \$30,000 is spent but on closer look, you find that only 35% of work is completed so far. Find the Schedule Variance (SV) and Cost Variance (CV) for the project. (10)

PART C — (1 x 15 = 15 marks)

16. (a) Draw the DFD (level 0, level 1, level 2, and level 3) diagram for the Railway Ticket Registration process. (10)

(b) Explain how the changes in requirement engineering are handled and managed with an example. (10)



8. What do you mean by useless symbol? Explain with an example.

9. When is a language L recursively enumerable?

10. What are tractable problems?

PART B — (5 × 13 = 65 marks)

11. (a) Construct NFA accepting the set of strings  $\Sigma = \{0, 1\}$  such that two 0's are separated by a string whose length is  $4i$ , for some  $i \geq 0$ . (13)

Or

(b) Prove that for every L recognized by an NFA, there exists an equivalent DFA accepting the same language L. (13)

12. (a) Prove that regular expressions are closed under union, concatenation, Kleene closure, complement. (13)

Or

(b) Prove that any language accepted by a DFA can be represented by a regular expression and also construct a finite automata for the regular expression  $10+(0+11)0^*1$ . (13)

13. (a) Let  $G = (V, E, R, S)$  be the CFG, where  $V = \{A, B, S\}$ ,  $E = \{a, b\}$ , S is the start variable and R consists of the rules

$S \rightarrow aB \mid bA$

$A \rightarrow a \mid aS \mid BAA$

$B \rightarrow b \mid bS \mid ABB$

(i) Prove that  $ababba \in L(G)$  (7)

(ii) Prove that  $L(G)$  is the set of all non-empty strings w over the alphabet  $\{a, b\}$  such that the number a's in w is equal to the number of b's in w. (6)

Or

(b) (i) Design a PDA that will accepts strings  $(a+b)^*$  in which the number of a's is greater than the number of b's given the alphabet  $\Sigma = \{a, b\}$ . (7)

(ii) Convert the above PDA to its equivalent CFG. (6)

14. (a) (i) Convert the following grammar to CNF (7)

$S \rightarrow ASB \mid \epsilon$

$A \rightarrow aAS \mid a$

$B \rightarrow SbS \mid A \mid bb$

(ii) Design a Turing machine to compute proper subtraction. (6)

Or

(b) (i) Convert the following grammar to GNF (7)

$$A_1 \rightarrow A_3A_2 | A_2A_3$$

$$A_2 \rightarrow A_3A_3 | A_2A_2 | a$$

$$A_3 \rightarrow A_2A_2 | b$$

(ii) Design a Turing machine that takes a binary number as input and increments the number by 1. (6)

15. (a) (i) Prove that Post Correspondence Problem is undecidable. (7)

(ii) Write short notes on P and NP completeness. (6)

Or

(b) (i) Explain about Universal Turing Machine. (7)

(ii) Discuss Travelling Salesman Problem in terms of P and NP completeness. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Consider the NFA  $N = (Q, \Sigma, \delta, q, F)$ , where  $Q = \{1, 2, 3\}$ ,  $\Sigma = \{a, b\}$ ,  $q = 1$ ,  $F = \{2\}$ , and  $\delta$  is given by the following table :

	a	b	c
1	{3}	$\phi$	{2}
2	{1}	$\phi$	$\phi$
3	{2}	{2, 3}	$\phi$

Convert the NFA (N) into DFA (M) that accepts the same language. (15)

Or

(b) (i) Write the regular expression for the set of all strings of 0's and 1's not containing 101 as substring. (5)

(ii) Design a Turing machine to recognize the language  $\{0^n1^n0^n \mid n \geq 0\}$ . (10)

- (b) (i) Convert the following grammar to LL(1)
- $$A_1 \rightarrow A_2 A_3 A_4 A_5$$
- $$A_2 \rightarrow A_3 A_4 A_5 A_6$$
- $$A_3 \rightarrow A_4 A_5 A_6$$
- (ii) Design a Turing machine that takes a binary number as input and increments the number by 1.
- (iii) Prove that Post Correspondence Problem is undecidable.
- (iv) Write short notes on P and NP completeness.
- Or
- (i) Explain about Universal Turing Machine.
- (ii) Discuss Travelling Salesman Problem in terms of P and NP completeness.

PART C — (1 × 15 = 15 marks)

16. Consider the NFA  $N = (Q, \Sigma, \delta, q_0, F)$ , where  $Q = \{1, 2, 3, 4\}$ ,  $\Sigma = \{a, b\}$ ,  $q_0 = 1$ ,  $F = \{3\}$ , and  $\delta$  is given by the following table:

	a	b
1	2	3
2	4	1
3	3	4

- Convert the NFA (a) into DFA (b) that accepts the same language.
- Or
- (i) Write the regular expression for the set of all strings of 0's and 1's not containing 101 as substring.
- (ii) Design a Turing machine to recognize the language  $\{0^i 1^j \mid i \geq j\}$ .

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**Question Paper Code : 30121**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Computer Science and Engineering

CS 3401 – ALGORITHMS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define time complexity of an algorithm.
2. List the types of asymptotic notations in analysing complexity of algorithms.
3. Outline a directed graph with an example.
4. What is minimum spanning tree?
5. Outline divide-and conquer algorithm design paradigm.
6. Define a multistage graph.
7. What is backtracking?
8. State the travelling salesman problem.
9. Outline the difference between a tractable problem and an intractable problem.
10. State the bin packing problem.

PART B — (5 × 13 = 65 marks)

11. (a) Write an algorithm to perform linear search on an array of 'N' numbers. Illustrate the best case, average case and worst case complexity of the linear search algorithm with an example. (13)

Or

- (b) What is pattern searching? Outline the steps in the Rabin-Karp algorithm for pattern searching with an example. (13)

12. (a) Outline the breadth first search graph traversal algorithm and depth first search graph traversal algorithm with an example. (13)

Or

- (b) Explain the Dijkstra's shortest path algorithm with an example. (13)
13. (a) Outline the merge sort algorithm with an example. (13)

Or

- (b) What is a Huffman tree? Outline the steps to build a Huffman tree using greedy algorithm design paradigm with an example. (13)
14. (a) State the Hamiltonian circuit problem. Outline the steps to find the Hamiltonian circuit using backtracking algorithm design paradigm with an example. (13)

Or

- (b) State the Knapsack problem. Outline how Knapsack problem can be solved using branch and bound algorithm design paradigm with an example. (13)
15. (a) Elaborate NP-complete problem and NP-hard problem with an example. (13)

Or

- (b) Outline the randomized quick sort algorithm with an example. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Apply the insertion sort algorithm to sort the following sequence of  $n$  numbers stored in an array A.

15,9,1,22,26,19,55,43,99,2

Illustrate each step of the sorting process. (15)

Or

- (b) What is dynamic programming? Explain the dynamic programming solution for matrix chain multiplication with an example. (15)

Reg. No. :

**Question Paper Code : 30144**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Computer and Communication Engineering

EC 3491 — COMMUNICATION SYSTEMS

(Common to Electronics and Communication Engineering/Electronics and  
Telecommunication Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is modulation?
2. What is the Hilbert Transform of an impulse function,  $\delta(t)$ ?
3. Define sampling theorem.
4. What is use of a compander?
5. Write the properties of Line coding.
6. Write the advantages of delta modulation over PCM.
7. What are the bandpass digital modulation techniques?
8. Draw constellation diagram of 8-QAM.
9. Define correlation receiver.
10. What is the meaning of the term "likelihood" in maximum likelihood decoding.

PART B — (5 × 13 = 65 marks)

11. (a) A DSB-SC signal is to be generated with a carrier frequency  $f_c = 1$  MHz using a non-linear device with input-output relation given by  $V_o = aV_i + bV_i^3$ , where  $a$  and  $b$  are constants. The output of the non-linear device is filtered by a band pass filter. Let the  $V_i = A_c^i \cos(2\pi f_c^i t) + m(t)$ , where  $m(t)$  is the message signal. Then, calculate the value of  $f_c^i$ .

Or

- (b) Calculate the Hilbert Transform of the function,  $f(t) = \cos(\omega_1 t) + \sin(\omega_2 t)$ .
12. (a) A message signal of  $10 \cos[(4\pi \times 10^3)t]$  is transmitted through PCM system. If sampling frequency equal to twice the Nyquist rate, and signal to quantization noise ratio (SQNR) should be minimum of 22 dB, then find the transmission bandwidth and SQNR in dB. (13)

Or

- (b) Calculate the Nyquist sampling rate for the signal given below :

$$x(t) = \frac{\sin(100\pi t) \cdot \text{sinc}(200t)}{\pi t}$$

13. (a) Explain in detail viterbi decoders.

Or

- (b) Explain DPCM transmitter and receiver in detail.
14. (a) What is difference between M-ary QAM and M-ary PSK? Explain it using constellation diagram for different values of  $M = 2, 4$  and  $16$ .

Or

- (b) A message signal of  $10 \cos[(2\pi \times 10^4)t]$  is given to 1024 level PCM system. The resulting signal is transmitted through free space by using binary signaling technique. Find the transmission bandwidth if modulation technique is (i) ASK and (ii) BPSK. (6+7)
15. (a) What is matched filter receiver? Derive the expression for impulse response of a matched filter receiver. (3+10=13)

Or

- (b) What is Intersymbol Interference (ISI)? What are the ways to reduce ISI? Discuss in detail. (5+8=13)

PART C — (1 × 15 = 15 marks)

16. (a) Let  $m(t) = \cos[4\pi \cdot 10^3 t]$  be the message signal and  $c(t) = 5\cos[2\pi \cdot 10^6 t]$  be the carrier signal.  $c(t)$  and  $m(t)$  are used to generate an FM signal. If the peak frequency deviation of the generated FM signal is three times the transmission bandwidth of the AM signal. Then, calculate the coefficient of the term  $\cos[4\pi(1006 \cdot 10^3)t]$  in the FM signal in terms of the Bessel coefficients.

Or

- (b) An analog voltage signal with maximum significant frequency of 1kHz and voltage range of 0 to 5 V, is to be digitally encoded with a resolution of 0.005%. To avoid the loss of information, calculate the following :
- (i) Minimum sampling rate required (2)
  - (ii) Minimum number of bits in the digital code (4)
  - (iii) R.M. S value of the quantization noise (5)
  - (iv) Signal to quantization noise ratio (SQNR) in DB. (4)





PART B — (5 × 16 = 80 marks)

11. (a) (i) Suppose you have two coins, one biased, one fair, but you don't know which coin is which. Coin 1 is biased. It comes up heads with probability  $3/4$ , while coin 2 will flip heads with probability  $1/2$ . Suppose you pick a coin at random and flip it. Let  $C_i$  denote the event that coin 'i' is picked. Let H and T denote the possible outcomes of the flip. Given that the outcome of the flip is head, what is the probability that you picked the biased coin? Given that the outcome is a tail, what is the probability that you picked the fair coin? (8)
- (ii) If the random variable X takes the values 1,2,3 and 4 such that  $2P(X=1)=3P(X=2)=P(X=3)=5P(X=4)$ , find the probability distribution and cumulative distribution of X. (8)

Or

- (b) (i) If the random variable 'K' is uniformly distributed over (0, 5). what is the probability that the roots of the equation  $4x^2 + 4kx + (k+2) = 0$  are real? (8)
- (ii) In a class of 50, the average mark of students in a subject is 48 and standard deviation is 24. Find the number of students who got (1) above 50 (2) between 35 and 50. (8)
12. (a) (i) If the joint pdf of (X, Y) is  $f(x, y) = 6e^{-2x-3y}; x \geq 0, y \geq 0$ , then find the marginal density function of X and conditional density function of Y given X. (8)
- (ii) The lifetime of a certain brand of an electric bulb may be considered a random variable with mean 1200 h and standard deviation 250 h. find the probability, using the central limit theorem, that the average lifetime of 60 bulbs exceeds 1250 h. (8)

Or

- (b) (i) Let the joint pmf (probability mass function) of X and Y be given by  $p(x, y) = \begin{cases} k(2x+y): & \text{if } x=1,2; y=1,2 \\ 0: & \text{otherwise} \end{cases}$ . Find the value of k, conditional pmf of Y given X, conditional pmf of X given Y. (8)
- (ii) Find the coefficient of correlation between X and Y, using following data: (8)

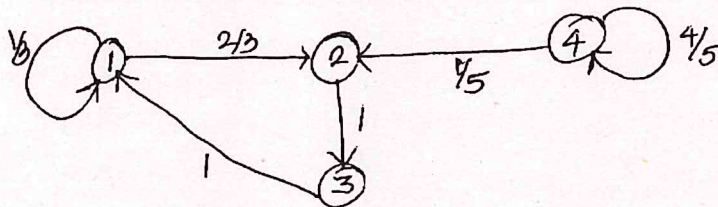
X 65 66 67 67 68 69 70 72

Y 67 68 65 68 72 72 69 71

13. (a) (i) A machine goes out of order, whenever a component fails. The failure of this part follows a Poisson process with a mean rate of 1 per week. Find the probability that 2 weeks have elapsed since the last failure. If there are 5 spare parts of this component in an inventory and that the next supply is not due in 10 weeks, find the probability that the machine will not be out of order in the next 10 weeks. (8)
- (ii) There are two white marbles in urn A and 3 red marbles in urn B. At each step of the process, a marble is selected from each urn and the 2 marbles selected are interchanged. Let the state  $a_i$  of the system be the number of red marbles in A after 'i' changes. What is the probability that there are 2 red marbles in A after 3 steps? In the long run, what is the probability that there are 2 red marbles in urn A? (8)

Or

- (b) (i) State and prove Chapman-Kolmogorov equation. (8)
- (ii) Consider the Markov chain with the state-transition diagram shown in the below figure. Identify the transient states, the recurrent states, and the periodic states with their periods. How many chains are there in the process? (8)



14. (a) There are three typists in an office. Each typist can type an average of 6 letters per hour. If letters arrive for being typed at the rate of 15 letters per hour,
- (i) What fraction of the time all the typists will be busy? (4)
- (ii) What is the average number of letters waiting to be typed? (4)
- (iii) What is the average time a letter has to spend for waiting and for being typed? (4)
- (iv) What is the probability that a letter will take longer than 20 min waiting to be typed and being typed? (4)

Or

- (b) Explain Markovian Birth - Death process and obtain the expressions for steady state probabilities.

15. (a) Derive Pollaczek — Khintchine formula of an M/G/1 queue.

Or

- (b) Write short notes on :

- (i) Open queueing networks and (8)
- (ii) Closed queueing networks. (8)

mech

A machine goes out of order whenever a component fails. The failure of this part follows a Poisson process with a mean rate of 1 per week. Find the probability that 2 weeks have elapsed since the last failure if there are 2 spare parts of this component in an inventory and that the next supply is not due in 10 weeks. Find the probability that the machine will not be out of order in the next 10 weeks.

(1) (a) 15

There are two white marbles in urn A and 3 red marbles in urn B. At each step of the process, a marble is selected from each urn and the 2 marbles selected are interchanged. Let the state  $x$  of the system be the number of red marbles in A after  $T$  changes. What is the probability that there are 2 red marbles in A after 3 steps? In the long run, what is the probability that there are 2 red marbles in urn A?

(ii)

State and prove Chapman-Kolmogorov equation.  
Consider the Markov chain with the state transition diagram shown in the below figure. Identify the transient states, the recurrent states, and the periodic states with their periods. How many chains are there in the process?

(3) (b)



There are three typists in an office. Each typist can type an average of 6 letters per hour. If letters arrive for being typed at the rate of 15 letters per hour.  
(i) What fraction of the time all the typists will be busy?  
(ii) What is the average number of letters waiting to be typed?  
(iii) What is the average time a letter has to spend for waiting and for being typed?  
(iv) What is the probability that a letter will take longer than 20 min waiting to be typed and being typed?

(a) 14

Explain Markovian Birth-Death process and obtain the expressions for steady state probabilities.

(b)

Derive Pollaczek-Khintchine formulae of an MGI queue.

(a) 15

Write short notes on:  
(i) Open queueing networks and  
(ii) Closed queueing networks.

(b)



PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine whether  $(Z, \oplus, \odot)$  is a ring with the binary operation  $x \oplus y = x + y - 7$ ,  $x \odot y = x + y - 3xy$  for all  $x, y \in Z$ . (8)
- (ii) Prove that  $Z_n$  is a field if and only if  $n$  is a prime. (8)

Or

- (b) (i) Prove that commutative properties is invariant under homomorphism. (8)
- (ii) Find  $[777]^{-1}$  in  $Z_{1009}$ . (8)
12. (a) (i) If  $R$  is a ring under usual addition and multiplication, show that  $(R[x], +, \cdot)$  is a ring of polynomials over  $R$ . (8)
- (ii) Find all the roots of  $f(x) = x^2 + 4x$  in  $Z_{12}[x]$ . (8)

Or

- (b) (i) If  $f(x) \in F[x]$  has degree  $n \geq 1$ , then prove that  $f(x)$  has atmost  $n$  roots in  $F$ . (8)
- (ii) If  $f(x) = 3x^5 - 8x^4 + x^3 - x^2 + 4x - 7$ ,  $g(x) = x + 9$  and  $f(x), g(x) \in Z_{11}[x]$ , find the remainder when  $f(x)$  is divide by  $g(x)$ . (8)

13. (a) (i) Using the canonical decomposition of 1050 and 2574, find their lcm. (8)
- (ii) Apply Euclidean algorithm to express the gcd of 3076 and 1976 as a linear combination of themselves. (8)

Or

- (b) (i) Find the number of positive integers  $\leq 999$  that are divisible by 7 and 13. (8)
- (ii) Prove that the product of gcd and lcm of any two positive integers  $a$  and  $b$  is equal to their products. (8)

14. (a) (i) Find the general solution of the linear Diophantine equation  
 $6x + 8y + 12z = 10$ . (8)

(ii) Find the incongruent solutions of  $5x \equiv 3 \pmod{6}$ . (8)

Or

(b) State Chinese Remainder Theorem. Using it solve  
 $x \equiv 1 \pmod{3}, x \equiv 2 \pmod{4},$  and  $x \equiv 3 \pmod{5}$ . (16)

15. (a) (i) Prove that the Euler's Phi function is multiplicative. (8)

(ii) Compute tau and sigma functions for  $n = 2187$ . (8)

Or

(b) State and prove Fermat's Little theorem. Hence, compute the remainder  
when  $7^{1001}$  is divided by 17. (16)





PART B — (5 × 13 = 65 marks)

11. (a) Consider the online bookstore management system which has maintenance of stock, purchase of books if required and sales of a book to customer. Perform the object oriented system development and give use case model for the same which use include, exclude and generalization.

Or

- (b) A Library lends books and magazines to member, who is registered in the system. It also maintains the purchase of new books and magazines for the Library. A member can reserve a book or magazine that is not currently available in the library, so that when it is returned or purchased by the library, that person is notified. The library can easily create, replace and delete information about the books, members, and reservation in the system. The books transactions are stored in the database. The fine list while the member returns the book after the due date must be generated. Design the use case diagram and discover the users and actors of this system and the interactions between them must be depicted.

12. (a) A University conducts examinations and the results are announced. Prepare a report for the following:

- Print the marks in the register number order semester wise for each department.
- Print the Arrear list semester wise.
- Prepare a Rank list for each department.
- Prepare the final aggregate mark list for final year students.

Identify the problem statement and Design and explain the classes for each sequence. Design the Use case and Class diagrams for designing this system.

Or

- (b) Write briefly about elaboration and its techniques. Compare with inception with an example.

13. (a) Consider the hospital management system application with the following requirements.

- (i) System should handle the in-patient, out - patient information through receptionist.
- (ii) Doctors are allowed to view the patient history and give their prescription.
- (iii) There should be a information system to provide the required information.

Explain and give state chart, component and deployment diagrams.

Or

- (b) What is Collaboration diagram? How does it differ from sequence diagram? Design the collaboration diagram to model the details of a seminar. The display is to obtain the details of seminar and the courses enrolled in the seminar. Then it obtains the details of the seminar. . The display is to obtain the details of seminar and the courses enrolled in the seminar. Then it obtains the details of the students enrolled in the seminar. It finds the number of seats left to enroll for the seminar.

14. (a) Examine the following GRASP patterns:
- (i) Creator, (3)
  - (ii) Information Expert, (4)
  - (iii) Low coupling, (3)
  - (iv) High cohesion. (3)

Or

- (b) Create the observer pattern by using your own application and explain the sections of the design pattern.
15. (a) Explain Booch's methodology of object oriented analysis and design. Compare with Jacobson methodologies.

Or

- (b) Analyze the Unit, Integration and system testing for currency converter application.

PART C — (1 × 15 = 15 marks)

16. (a) For the Next Gen POS systems design, explain the following Conceptual class hierarchies.
- (i) Conceptual super class. (3)
  - (ii) Conceptual subclass. (4)
  - (iii) Authorization Transaction classes. (4)
  - (iv) Abstract Conceptual classes. (4)

Or

- (b) Explain the GRASP pattern (Creator, Information Expert, Low coupling) by using Monopoly game.



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Reg. No. :

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**Question Paper Code : 50431**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023

Fifth/Sixth Semester

Computer Science and Engineering

CS 8591 – COMPUTER NETWORKS

(Common to Computer and Communication Engineering / Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How number of links needed to construct topologies is computed?
2. Write down the comparison between packet switching and circuit switching.
3. What is the need for fragmentation?
4. List out the significance of medium access control.
5. Compare unicast, multicast and Broadcast.
6. State the function of ICMP v4 protocol.
7. How does UDP address flow control mechanism.
8. What is the significance of port number in Transport layer when adopting TCP?
9. Provide the significant role played by DNS.
10. Draw the handshaking involved in FTP.

PART B — (5 × 13 = 65 marks)

11. (a) Compare and Contrast OSI model with TCP/IP model.

Or

- (b) Detail the structure of various Transmission media in computer network. Also make comparison between twisted pair with coaxial cable.

12. (a) Discuss in detail about Bluetooth Technology, with its advantages and limitations.

Or

- (b) Explain the architecture of IEEE 802. 11 Wireless LAN.

13. (a) Explain the working mechanism of Routing Information Protocol.

Or

- (b) Discuss the mechanism involved in IPV6 addressing. Also compare IPV4 with IPV6.

14. (a) Explain the congestion control Techniques used to improve QOS of the computer network.

Or

- (b) Explain the operation of Go-Back-N Protocol.

15. (a) Describe the core functionalities of Hypertext transfer Protocol in detail.

Or

- (b) Write your understanding on SNMP and write the applications of SNMP.

PART C — (1 × 15 = 15 marks)

16. (a) (i) For the generator polynomial  $g = 110011$  and the data bits (message)  $m = 11100011$  find the CRC and the transmitted string T (since  $g$  is 6 bits, i.e. a polynomial of degree 5,  $L = 5$  and the CRC should be 5 bits). (10)

- (ii) Suppose  $g = 1001$  and the received  $T = 1010101$ , did any transmission errors occur? (5)

Or

- (b) Consider the Stop and Wait protocol such that :

- (i) the receiver DLC sends a frame with request RN upon the receipt of each frame from the sender DLC (2)

- (ii) the sender DLC sends frame SN upon the receipt of every frame from the receiver DLC with request  $RN = SN$  (even if frame SN has not timed out yet) (3)

- (iii) Show by an example that if the sender times out, each packet can be sent twice (or more) over the network, which may cause congestion and more timeouts. (5)

- (iv) Suggest a fix to the protocol to alleviate this problem. (5)

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**Question Paper Code : 90417**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Computer Science and Engineering

CS 8501 — THEORY OF COMPUTATION

(Common to : Computer Science and Business Systems)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Prove:  $1 + 2 + \dots + n = n(n + 1)/2$  using mathematical induction.
2. Define:  $\varepsilon$ -closure of a state.
3. State: Pumping lemma for regular languages.
4. Consider the following languages.  $L1 = \{ab, abb, abbb, \dots\}$  and  $L2 = \Phi$  (empty language). Identify the list of strings that are part of the language created by  $L1.L2 \cup L2^*$
5. When do you say that given grammar G is ambiguous?
6. Draw a PDA to accept strings of the language,  $L = \{a^n cb^n \mid n \geq 0\}$
7. What is the necessity of forming normal forms of an CFG?
8. List the properties of CFL that are closed.
9. Define "Non-Recursive" languages.
10. Write the significance of NP problems.

PART B — (5 × 13= 65 marks)

11. (a) Draw a Deterministic Finite Automata recognizing the language containing string that are multiples of 4 when represented in binary. Test your DFA using any two strings of the language.

Or

- (b) Draw a Deterministic Finite Automata recognizing the language corresponding to the regular expression  $(a + bca^*)^*$ . Test your DFA using any two strings of the language.
12. (a) Prove the following statement with justification.

“The language  $L = \{a^i b^j c^i \mid i, j > 0\}$  is not regular”.

Or

- (b) Minimize the given automata, G. [Refer Figure. 12(b)]

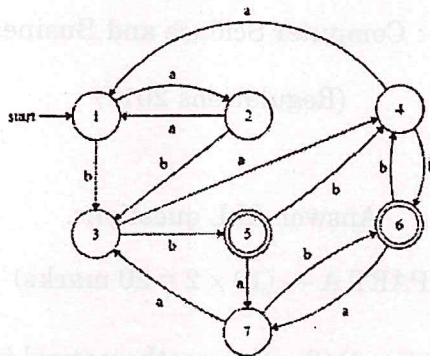


Figure. 12(b)

13. (a) Examine whether the language,  $L = \{a^n b^p c^n d^{2p} \mid n > 0\}$  can be designed using Pushdown automation. Justify your answer.

Or

- (b) Examine whether the language,  $L = \{a^{2n} b^p c^{2n} \mid n > 0\}$  can be designed using Pushdown automation. Justify your answer.

14. (a) Convert the following grammar to be in Chomsky Normal Form.

$$S \rightarrow AaA$$

$$A \rightarrow aaBa \mid CDA \mid CD$$

$$B \rightarrow bB$$

$$C \rightarrow Ca \mid D$$

$$D \rightarrow bD \mid \epsilon$$

Or

- (b) Design a Turing machine to perform the following function,  
 $f(x) = 2x + 2, x > 0$ .

15. (a) State and prove the halting problem.

Or

- (b) State whether the instances of the Post Correspondence Problem (PCP) have a solution. The following are the instances with  $\Sigma = \{0,1\}$ .

Index	List A	List B
1	10	01
2	110	011
3	110	01
4	000	00
5	10	010

In case the PCP has a solution, describe the post-correspondence solution with justification.

PART C — (1 × 15 = 15 marks)

16. (a) Identify the type of grammar as per Chomsky's hierarchy and design an appropriate automation model.

$S \rightarrow aSBC$        $S \rightarrow aBC$   
 $CB \rightarrow BC$        $aB \rightarrow ab$   
 $bB \rightarrow bb$        $bC \rightarrow bc$   
 $cC \rightarrow dd$

Or

- (b) Identify the type of grammar as per Chomsky's hierarchy and design an appropriate automation model.

$S \rightarrow aSBC$        $S \rightarrow aBC$   
 $CB \rightarrow BC$        $aB \rightarrow ab$   
 $bB \rightarrow bb$        $bC \rightarrow bcc$   
 $cC \rightarrow cccc$

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Reg. No. :

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**Question Paper Code : 50430**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Computer Science and Engineering

CS 8501 – THEORY OF COMPUTATION

(Common to: Computer Science and Business Systems)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the principal of mathematical induction.
2. Compare and contrast NFA and DFA.
3. State: Pumping lemma for regular languages.
4. Consider the following languages.  $L_1 = \{ab, abb, abbb, \dots\}$  and  $L_2 = \Phi$  (empty language). Identify the list of strings that are part of the language created by  $L_1.L_2 \cap L_1^*$ .
5. Write CFG to generate odd length palindromes using input alphabet  $\{0, 1\}$ .
6. Consider the following Context Free Grammar, G:  
 $A \rightarrow A@A \mid A \& A \mid \sim A$   
 $A \rightarrow i \mid (A)$   
Check whether the grammar is ambiguous or not using derivation.
7. State: Pumping lemma for CFL.
8. Define: Turing machine.
9. Define Undecidable languages.
10. Write the significance of NP problems with an example.

PART B — (5 × 13 = 65 marks)

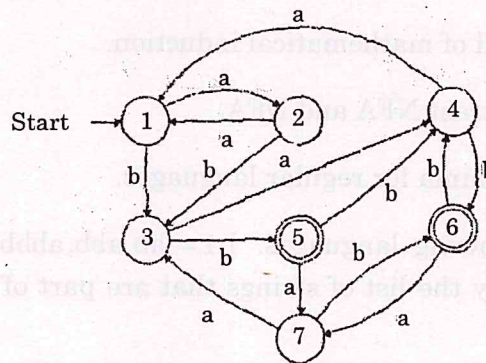
11. (a) Design an  $\epsilon$ -NFA (Nondeterministic finite automaton) to recognize the language L, containing only binary strings of non-zero length whose bits sum to a multiple of 5. Convert  $\epsilon$ -NFA into an equivalent deterministic finite automaton. Illustrate the computation of your model on any sample input.

Or

- (b) Draw a Deterministic Finite Automata recognizing (DFA) the language corresponding to the regular expression  $(ab + bc^*a^*)^*$ . Test your DFA using any two strings of the language.
12. (a) Find a Deterministic Finite Automata recognizing the language corresponding to the regular expression  $(0^*10 + 1^*0)(01)^*$ .

Or

- (b) Minimize the given automata, G.



13. (a) Design a pushdown automata to recognize the language,  $L = \{a^n b^p c^p d^{(n/2)} \mid p, n > 0\}$ . Justify your answer.

Or

- (b) Design a Context Free Grammar to accept the language,

$$L = \left\{ W \mid W \text{ is of the form } a^m b^n c^{n1} d^{m/2} \mid n.m > 0 \right\}$$

Test your design using three sample strings.

14. (a) Convert the following grammar to be in Chomsky Normal Form.

$$S \rightarrow AaA$$

$$A \rightarrow aaBa \mid CDA \mid CD$$

$$B \rightarrow bB$$

$$C \rightarrow Ca \mid D$$

$$D \rightarrow bD \mid \epsilon$$

Or

(b) Design a Turing machine to perform the following function,  
 $f(x) = \{2(x+2), x > 0\}$ . Justify your design.

15. (a) With suitable examples, explain P and NP complete problems.

Or

(b) State whether the instances of the Post Correspondence Problem (PCP) have a solution. The following are the instances with  $\Sigma = \{0,1\}$ .

Index	List A	List B
1	10	01
2	110	011
3	110	01
4	000	00
5	10	010

In case the PCP has a solution, describe the post-correspondence solution with justification.

PART C — (1 × 15 = 15 marks)

16. (a) Design a pushdown automata to recognize the language,  
 $L = \{a^{2n}b^p c^{2n}d^{2p} \mid p, n > 0\}$ . Justify your answer.

Or

(b) Design a Turing Machine to compute the function,

$$f(x, y) = \begin{cases} x \% y, & \text{if } x \text{ is even} \\ 0, & \text{otherwise} \end{cases}$$

14. (a) Convert the following grammar to be in Chomsky Normal Form.

- $S \rightarrow AaA$
- $A \rightarrow aAb \mid CD \mid CD$
- $B \rightarrow bB$
- $C \rightarrow Ca \mid D$
- $D \rightarrow bD \mid \epsilon$

Or

(b) Design a Turing machine to perform the following function.

$$f(x) = \begin{cases} 2x + 2 & x > 0 \\ 2 & x = 0 \end{cases}$$

Justify your design.

15. (a) With suitable examples, explain P and NP complete problems.

Or

(b) State whether the instances of the Post Correspondence Problem (PCP) have a solution. The following are the instances with  $\Sigma = \{0,1\}$ .

Index List A List B

1	10	01
2	110	011
3	110	01
4	000	00
5	10	010

In case the PCP has a solution, describe the post-correspondence solution with justification.

PART C — (1 × 15 = 15 marks)

16. (a) Design a pushdown automata to recognize the language.

$$L = \{a^n b^m \mid n \geq m > 0\}$$

Justify your answer.

Or

(b) Design a Turing Machine to compute the function.

$$f(x, y) = \begin{cases} x^2 + y^2 & \text{if } x \text{ is even} \\ 0 & \text{otherwise} \end{cases}$$

Reg. No. :

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**Question Paper Code : 51080**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Computer Science and Engineering

OMD 551 — BASIC OF BIOMEDICAL INSTRUMENTATION

(Common to : Computer and Communication Engineering/Electrical and Electronics Engineering/Electronics and Communication Engineering/ Electronics and Telecommunication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Nernst potential?
2. Draw the schematic diagram of origin of biopotentials.
3. Write short note on floating electrodes.
4. Write short note on the Einthoven's triangle.
5. Mention the unique characteristics of EEG amplifiers.
6. Write short note on artifact reduction.
7. Define mean arterial pressure.
8. Define spirometry.
9. Mention the basis of pulse oximetry.
10. Write short note on hematocrit.

PART B — (5 × 13 = 65 marks)

11. (a) Describe the types of microelectrodes and their equivalent circuits used for the measurement of biopotentials. (13)

Or

- (b) Write a detailed account of various types of biopotentials, their origin and their propagation characteristics. (13)

EEE

12. (a) Explain in detail about the basis of ECG, methods of ECG signal acquisition, and characteristic of electrocardiographic signals. (13)

Or

- (b) Elaborate about EEG, methods of EEG signal acquisition, and characteristics of EEG signals. (13)

13. (a) Describe the circuit enhancements for biopotentials measurements with a note on electrical interference reduction. (13)

Or

- (b) With a neat sketch, explain the method employed by the right-leg driven circuit to reject common-mode signals in ECG.

14. (a) Describe the non-invasive methods of blood pressure measurement. (13)

Or

- (b) Write a detailed note on the measurement of blood flow using :

(i) Ultrasound Doppler flowmetry (7)

(ii) Laser Doppler flowmetry. (6)

15. (a) Discuss the instrumentation principles of respiratory volume measurement. (13)

Or

- (b) Write a detailed note on :

(i) blood gas analyzers (7)

(ii) blood cell counter. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Elucidate the functions of signal conditioning circuits with a detailed account of Zener diode. (15)

Or

- (b) Discuss in detail about the non-invasive monitoring of serum electrolytes and metabolites. (15)

CS86

Reg. No. : 

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**Question Paper Code : 50435**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Computer Science and Engineering

CS 8603 – DISTRIBUTED SYSTEMS

(Common to: Artificial Intelligence and Data Science)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define distributed system.
2. What are the main differences between a parallel system and a distributed system?
3. Define asynchronous execution.
4. What are the two phases in obtaining a global snapshot?
5. Identify the three basic approaches for implementing distributed mutual exclusion.
6. Outline the wait-for graph (WFG).
7. What do you mean by checkpoint?
8. What are the difference between the agreement problem and the consensus problem?
9. List the advantages of unstructured overlays.
10. What is memory coherence?

PART B — (5 × 13 = 65 marks)

11. (a) Tabulate the Interaction of the software components at each processor in the distributed system.

Or

- (b) Examine in brief about the two basic models of process communications synchronous and asynchronous.

12. (a) Discuss the operation of Privilege-based algorithms with a neat diagram.

Or

- (b) Identify how individual local checkpoints can be combined with those from other processes to form global snapshots that are consistent.

13. (a) Recognize a distributed mutual exclusion algorithm as an illustration of the clock synchronization scheme.

Or

- (b) Analyze the Correctness criteria of the deadlock detection algorithm.

14. (a) Indicate the several interesting features of the Manivannan-Singhal quasi-synchronous check pointing algorithm.

Or

- (b) Compare the results and lower bounds on agreement on solving the consensus problem under different assumptions.

15. (a) Comprehend the classification of data indexing mechanisms in a P2P network.

Or

- (b) List the seven advantages of distributed shared memory.

PART C — (1 × 15 = 15 marks)

16. (a) Discriminate the Lamport's bakery algorithm in detail by providing the same algorithm.

Or

- (b) Infer the use of causal order in updating replicas of a data item in the communication system.

Reg. No. :

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**Question Paper Code : 50439**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth/Seventh Semester

Computer Science and Engineering

CS 8792 – CRYPTOGRAPHY AND NETWORK SECURITY

(Common to Computer and Communication Engineering/Electronics and  
Communication Engineering/Electronics and Telecommunication  
Engineering/Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare passive and active attacks.
2. Perform encryption for the plain text "CRYPTOGRAPHYANDSTEGANOGRAPHY" using double columnar transposition technique and the key is 341562.
3. Find  $\gcd(68,8)$  using Euclidean algorithm.
4. Compare the AES and DES.
5. Find the value of  $7^8 \pmod{15}$  Using Euler's theorem.
6. Find  $\Phi(21)$ .
7. Compare MAC and hash function.
8. Mention the importance of ElGamal cryptosystem.
9. What are the various types of firewall?
10. What are key loggers?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Describe various security mechanisms. (5)

(ii) Encrypt the following Using playfair cipher. (4)

Plaintext : PRESERVE

Key : AGRICULTURE

(iii) Encrypt the following using single columnar transposition. (4)

Plaintext : CYBERSECURITYISIMPORTANT

Key : 5137462

Or

(b) (i) Discuss about various types of attacks. (5)

(ii) Consider NAN as plain text and QVBPQOUSZ as key. Encipher and decipher using Hill cipher. (8)

12. (a) (i) Find multiplicative inverse of 313 in mod 67. (5)

(ii) Elaborate on AES encryption and decryption. How will you evaluate the AES algorithm? (8)

Or

(b) (i) Discuss about various block mode of operation. (8)

(ii) Find  $\gcd(6432, 768)$  using extended Euclidean algorithm. (5)

13. (a) (i) Explain about elliptic curve cryptography. (10)

(ii) Find  $\Phi(519)$ . (3)

Or

(b) (i) Find X value using Chinese remainder problem. (8)

$$X = 10 \pmod{12}$$

$$X = 7 \pmod{9}$$

$$X = 3 \pmod{5}$$

(ii) Find  $103^{27} \pmod{467}$ . (5)

14. (a) Elaborate the Kerberos. (13)

Or

(b) Explain the various authentication protocols with an example. (13)

15. (a) (i) Discuss about various PGP services. (8)

(ii) Describe the various approaches used for intrusion detection. (5)

Or

(b) (i) Elaborate on SET in detail. (8)

(ii) Describe IPsec services. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Users A and B use the Diffie Hellman key exchange technique,  $q = 139$ ;  $g(\text{primitive root})=3$  (i) If user A has private key  $X_A=56$ . What is A's public key  $Y_A$ ? (ii) If user B has private key  $X_B=115$ . What is B's public key  $Y_B$ ? (iii) What is the shared secret key? Also write the algorithm. (15)

Or

(b) Explain RSA algorithm. Perform decryption and encryption using RSA algorithm with  $p=31$ ,  $q=47$ ,  $e=7$  and  $M=69$ . (15)

CSB

14. (a) Elaborate the Kerberos

(b) Explain the various authentication protocols with an example.

15. (a) Discuss about various PDP services.

(ii) Describe the various approaches used for intrusion detection.

(i) Elaborate on SET in detail.

(ii) Describe P2P services.

PART C - (1 × 15 = 15 marks)

16. (a) Users A and B use the Diffie-Hellman key exchange technique,  $p = 139$ ,  $g(\text{primitive root}) = 3$ . (i) If user A has private key  $X = 56$ . What is A's public key  $Y_A$ ? (ii) If user B has private key  $X = 115$ . What is B's public key  $Y_B$ ? (iii) What is the shared secret key? Also write the algorithm.

(b) Explain RSA algorithm. Perform decryption and encryption using RSA algorithm with  $p=31$ ,  $q=47$ ,  $e=7$  and  $M=68$ .

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**Question Paper Code : 50436**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Computer Science and Engineering

CS 8651 – INTERNET PROGRAMMING

(Common to: Computer and Communication Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL the questions.

PART A — (10 × 2 = 20 marks)

1. What is the difference between web design and web development?
2. Is HTML and CSS enough to create a website?
3. What is a prompt box in JavaScript?
4. What is JSON and write down with example?
5. How session handling is done in server-side scripts?
6. State the purpose of cookies.
7. Is PHP and XML the same? Justify.
8. What is XML DOM? List the benefits of DOM.
9. Differentiate between synchronous and asynchronous requests.
10. What are the real web applications of AJAX currently running in the market?

PART B — (5 × 13 = 65 marks)

11. (a) What are static and dynamic Web sites? Explain with examples. List down the various steps in Web hosting? Explain each.

Or

- (b) Explain forms in HTML5. Develop a Job application form using Text, Text area, label, Check box, Radio buttons, Button, Dropdown Menu items.

12. (a) (i) Evaluate how DOM Nodes and Trees can be used. (6)

(ii) Demonstrate a java script to display the welcome message using the alert whenever button of a html form is pressed. (7)

Or

(b) (i) Differentiate between Exception Handling and Event Handling. (6)

(ii) Write down the concepts of Event Handling. (7)

13. (a) Develop a Book database that has a table Members with two columns Member id and Name. Write a JDBC program that can query and print all entries in the table members. Write down the steps for connecting with database.

Or

(b) Describe in detail the session handling in server-side programming with suitable example.

14. (a) Explain in detail about

(i) XSL and XSLT transformation (6)

(ii) Comparison of DOM & SAX (7)

Or

(b) Explain how you shall carry out the following String Manipulations using a PHP Program.

(i) Tokenizing the sentences (6)

(ii) Identifying the vowels in the sentence (7)

15. (a) (i) Deduce any two elements of WSDL. (7)

(ii) Analyze various concepts of RPC. (6)

Or

(b) Explain the structure of a WSDL document, its elements, and their purposes with appropriate examples.

PART C — (1 × 15 = 15 marks)

16. (a) Develop a website for orphanage which takes care of orphanage children. It should contain Menu pages, submitting information, images using tables, lists and CSS.

Or

- (b) Create an XML HttpRequest to retrieve data from an XML file and display the data in an HTML table. The data to be retrieved is a collection of stationary items stored in an XML file.
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**Question Paper Code : 50816**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Information Technology

IT 8076 – SOFTWARE TESTING

(Common to: Computer Science and Engineering/Computer and Communication Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define software testing.
2. What is the difference between error, failure, and defect?
3. Give the structure of a Test case.
4. Define cyclomatic complexity.
5. Differentiate alpha testing and beta testing.
6. Define regression testing.
7. What will be the contents in the test report?
8. What is meant by test plan?
9. Name few productivity metrics.
10. State the need for test automation.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the need for and importance of defect repository. How does developers and testers support for developing defect repository? (13)

Or

- (b) (i) Bring out the role of tester in software development. (6)  
(ii) Explain the origin of defects and about various defect classes. (7)

12. (a) (i) Differentiate black box testing and white box testing. (6)  
(ii) Write a short note on requirement-based testing and its importance. (7)

Or

- (b) (i) Compare static testing and structural testing with example. (6)  
(ii) What is test adequacy? How to evaluate test adequacy criteria? (7)

13. (a) (i) Define unit testing. Explain the components of unit test environment. (6)  
(ii) Bring out the various types of testing under system testing. (7)

Or

- (b) (i) Define Integration testing. Discuss its types. (6)  
(ii) What are the testing considerations for website testing. (7)

14. (a) (i) Explain the activities involved in test planning. (6)  
(ii) Present the organization structure of testing teams and their roles. (7)

Or

- (b) Discuss the role of test specialist in an organization and explain the skills that are needed by a test specialist. (13)

15. (a) What is the need for test automation? Detail the skills needed for test automation and the challenges involved in it. (13)

Or

- (b) Discuss the role of test metrics towards software quality. With suitable example compare project metrics and progress metrics. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Perform Basis Path testing for student grading system. (15)

Student Grading System Criteria:

Marks range	Grade
91 to 100	S
81 to 90	A
71 to 80	B
61 to 70	C
50 to 60	D
Less than 50	F

Or

- (b) Apply Equivalence partitioning technique and Boundary value analysis for testing student grading system. (15)

Student Grading System Criteria:

Marks range	Grade
91 to 100	S
81 to 90	A
71 to 80	B
61 to 70	C
50 to 60	D
Less than 50	F



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**Question Paper Code : 50438**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth/Seventh/Eighth Semester

CS 8791 — CLOUD COMPUTING

(Common to Computer Science and Engineering/Computer and Communication Engineering/Artificial Intelligence and Data Science/Computer Science and Business Systems/Information Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is cloud elasticity?
2. State the advantages of on-demand provisioning in cloud.
3. What are the technologies that make up the core of web services?
4. Distinguish between Traditional computer and Virtualized computer.
5. How Hybrid Clouds are formed?
6. Mention the design goals of Cloud platform.
7. Define resource management in Cloud.
8. State data lock-in problem in Cloud.
9. What is Hadoop?
10. Identify the four levels of Federations in Cloud.

PART B — (5 × 13 = 65 marks)

11. (a) Illustrate the underlying principles of Parallel and Distributed computing.

Or

- (b) Elaborate the various cloud characteristics and its benefits.

12. (a) With a neat diagram explain the components of service oriented architecture.

Or

- (b) Give the virtualization structure and explain the various types of virtualization.

13. (a) Explain the service delivery models of cloud computing.

Or

- (b) Compare and contrast private, Public and by brid cloud with suitable examples.

14. (a) Discuss about resource provisioning methods in Cloud.

Or

- (b) Elaborate about reputation-guided protection of Data centers.

15. (a) Demonstrate the programming environment of Google App Engine.

Or

- (b) Write short notes on Federation in the cloud.

PART C — (1 × 15 = 15 marks)

16. (a) Consider an organization that is implemented with a private cloud environment. Specify how to virtualize the environment.

Or

- (b) Open stack is open cloud ecosystem. justify it.