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M. Tech. 1st Semester (CSE) CBCS Scheme
Examination, December–2024

DATA COMMUNICATION AND COMPUTER NETWORKS

Paper-MTCSE21C1

Time allowed : 3 hours]   *[Maximum marks : 100*

*Note : Question No. 1 is compulsory. Attempt five questions by in all selecting **one** question from each unit. All questions carry equal marks.*

1. (a) What are the transmission modes ? Explain their advantages and limitations.

    (b) What is Link State Routing?

    (c) What are DHCP operation?

    (d) What is a digital signature? How does it differ from an electronic signature?

Unit-I

2. Explain TCP/IP? Draw TCP protocol header format? Explain does IP protects data on the network. How does the TCP protocol provide reliability? Also, write the name of the Well-Known Ports used by TCP/IP.

22638-P-2-Q-9(24)   [P. T. O.

3.	Compare CSMA, CSMA/CD with their advantages and disadvantages.

Unit-II

4.	Explain the classes in IPv4. How to calculate Subnet Mask? Compare IPv4 and IPv6.

5.	What is CIDR? Also, focus on CIDR addressing, CIDR address blocks, and Bit masks.

Unit-III

6.	What is the difference between UDP and TCP Protocol? Write TCP services and their TCP features.

7.	Write various protocols used in E-Mail in. Compare SMTP, POP, IMAP and MIME.

Unit-IV

8.	What is Cryptography? Compare public and private key.

9.	What is Congestion Control? How many phases does TCP congestion control have? Explain them.

M. Tech. 1st Semester (CSE) (CBCS Scheme)
Examination, November–2023
DATA COMMUNICATION AND COMPUTER
NETWORKS
Paper–MTCSE21Cl

Time allowed : 3 hours]   _[Maximum marks : 100_

Note: _**Question No. 1 is compulsory.** Attempt any five_
         questions by selecting **one** question from each unit.
         All questions carry equal marks.

1. (a) Differentiate between Digital and Analog
         communication? What techniques come under
         these communications?

    (b) Explain global unicast addresses and their useless.

    (c) What is DHCP?

    (d) What do you understand by key management?
         Write the techniques for it.

Unit-I

2. Compare OSI and TCP/IP model.

3. What is Switching? Compare the advantages and
    limitations of packet switching, circuit switching, and
    message switching.

Unit-II

4. Discuss Classless Addressing and Classful Addressing
    in detail by taking a suitable example.

5. State various Routing Algorithms in detail. Which algorithm is better and why?

Unit-III

6. What is SCTP Protocol? Write its SCTP services and SCTP features.

7. What are the services provided by the Application layer? Write and explain various protocols present on this layer.

Unit-IV

8. What is Digital Signature? Why do we adopt digital signatures? How is Digital Signature Validated and Secured?

9. What is Firewall? Discuss its types.

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M. Tech. 1st Semester (CSE)

CBCS Scheme

Examination – January, 2023

DATA COMMUNICATION AND COMPUTER NETWORKS

Paper : MTCSE21C1

Time : Three Hours]   *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is **compulsory**. All questions carry equal marks.

1. Write short notes on following :   20

    (a) ALOHA

    (b) ICMP

    (c) POP

    (d) VPN

UNIT – I

2. Define data communication. Explain serial and parallel communication in detail.   20

3. Describe ISO-OSI reference model in detail with proper diagram.   20

UNIT – II

4. Explain the following :   20

   (i)   CIDR and CIDR Addressing

   (ii) Subnet and supernetting

5. Describe the following :   20

   (i)   Hierarchical Routing

   (ii) BGP

UNIT – III

6. Define transport layer and explain the following :   20

   (i)   TCP Protocol

   (ii) Connection Management

7. Explain the following :   20

   (i)   MIME

   (ii) DHCP

UNIT – IV

8. (i)   What is Cipher ? Explain in detail about it.   10

   (ii) What do you mean by Quality of Service ? Explain.   10

9. (i)   What do you mean by quality of service ? Explain.   10

   (ii) Give a complete description about Digital Signatures.   10

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ADVANCED OPERATING SYSTEMS

Paper-MTCSE21C2

Time allowed : 3 hours]   *[Maximum marks : 100*

Note : *Question No. 1 is compulsory. Attempt any five questions. All questions carry equal marks.*

1. (a) Discuss the Critical Section Problem in an operating system.

   (b) What is Distributed Mutual Exclusion?

   (c) Differentiate between Synchronous and Asynchronous Check-pointing.

   (d) What are Data Operating System? Write its component.

Unit-I

2. What is Deadlock? Write its necessary and sufficient conditions. Discuss methods for handling deadlock.

3. Discuss various concepts of Advanced Operating Systems. What are the different types of Advanced Operating System? Give the functions of an Operating System. Also, discuss various design Approaches.

22639-P-3-Q-9(24)   **[P.T.O.**

Unit-II

4. Write and explain Suzuki-Kasami's Broadcast Algorithm.

5. What are Distributed File Systems also, give its architecture.

Unit-III

6. Classification of failures, Basic Approaches to Recovery; Recovery in Concurrent System.

7. What are different Fault Tolerance Issues? Explain Two-phase and Non-blocking Commit Protocols. What are the difference between Voting Protocols and Dynamic Voting Protocols.

Unit-IV

8. What do you mean by Process? Explain the various types of processing queues. Consider the following set of 5 processes.

Processes	Burst Time	Priority
P1	2	1
P2	5	2
P3	7	4
P4	6	3
P5	4	2

Calculate the average waiting time and average turnaround time for the following algorithms :

(i) FCFS

(ii) SJF (Non-Preemptive and Preemptive)

(iii) Round Robin Scheduling (Time Quantum=2 units)

(iv) Priority Scheduling (Non-Preemptive and Preemptive)

9. Differentiate between paging and segmentation with an example.

Consider the following set of page references :

7,4,4,3,2,3,7,5,5,4,4,8,9,2,1,4,5

Calculate the page fault rate for the following algorithms:

(a) FIFO

(b) LRU

(c) Optimal Page Replacement

Initially, there are three empty frames.

M. Tech. 1st Semester (CSE) (CBCS Scheme)
Examination, November–2023
ADVANCED OPERATING SYSTEMS
Paper–MTCSE21C2

Time allowed : 3 hours]   _[Maximum marks : 100_

Note: _Question No. 1 is compulsory. Attempt five questions in total, **first being compulsory** and selecting **one** question from each unit._

1. Write short note on the following: 5×4=20

   (a) Concurrent Processes

   (b) Agreement Protocol

   (c) Voting Protocol

   (d) Fault Tolerance

Unit-I

2. What is an Operating System? Explain the various types for Advanced Operating System in detail.   20

3. (i) Differentiate between Consumable and re-usable Resources.   10

   (ii) Explain the Critical Section Problem.   10

Unit-II

4. Explain the following: 2×10=20

   (a) Distributed deadlock detection

   (b) Distributed mutual exclusion

22639-P-2-Q-9 (23)   [P. T. O.

5. What is Distributed File System? Explain Distributed Scheduling and related issues in detail. 20

Unit-III

6. Write short note on the following:

    (a) Dynamic Voting Protocol 7

    (b) Two-phase commit protocols 7

    (c) Non-blocking commit protocols 6

7. What is Recovery? Explain the concept of recovery in concurrent system. 20

Unit-IV

8. Explain the concept of Concurrency Control. Describe the various Concurrency Control Algorithms in detail. 20

9. (i) Explain the concept Processor scheduling for database operating system. 10

    (ii) What is Distributed Database System? Explain its various design issues, advantages and disadvantages. 10

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M. Tech. 1st Semester (CSE) CBCS
Scheme Examination – January, 2023

ADVANCED OPERATING SYSTEMS

Paper : MTCSE21C2

Time : Three Hours]   *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*.

1. Write short notes on the following : $5 \times 4 = 20$

     (a) Axiomatic Verification of Parallel Programs

     (b) Vector Clock

     (c) Check pointing in Distributed Database System

     (d) Threads

UNIT – I

2. What is an Operating System ? Explain the various types for Advanced operating system in detail.   20

3. (i) Differentiate between Consumable and re-usable Resources.   10

   (ii) Explain the Process deadlock and Models of deadlocks in detail.   10

UNIT – II

4. Explain the following :

   (a) Non-Token Based Algorithms   10

   (b) Lamport's Algorithm -Token-Based Algorithms   10

5. What is Distributed File System ? Explain its architecture and Design issues in detail.   20

UNIT – III

6. What is Recovery ? Explain the basic approaches to recovery in detail.   20

7. Write short notes on the following :

   (a) Dynamic Voting Protocol   7

   (b) Two-phase commit protocols   7

   (c) Fault Tolerance   6

UNIT – IV

8. Explain the concept of Concurrency Control. Describe the various Concurrency Control Algorithms in detail.   20

9. (i) What is Process synchronization ? Explain by taking suitable example.   10

   (ii) Explain various design issue of Multiprocessor Operating System.   10

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M. Tech. 1ˢᵗ Semester (CSE) CBCS Scheme

Examination, December–2024

ADVANCED DATABASE MANAGEMENT SYSTEMS

Paper-MTCSE21C3

Time allowed : 3 hours]   [Maximum marks : 100

Note : Attempt *five* questions in all. *Question No.1 is compulsory.* Remaining, attempt *one* question from each unit. Each question carries equal marks.

1.   Write short note on the following :   4×5=20

    (a)   Architecture of DBMS

    (b)   Disaster Recovery

    (c)   Object Oriented Database

    (d)   Enhanced SQL

Unit-I

2.   Explain various data models present in DBMS in details.
                                                          20

3.   What is Normalization? Explain various normal form with relevant example.   20

22640-P-2-Q-9(24)   [P.T.O.

Unit-II

4. What is buffer management logging scheme? Also explain recovery technique for centralized DBMS. 20

5. Write short note on following locking techniques:

   $2 \times 10 = 20$

   (a) Time stamp-based technique

   (b) Multi-version technique

Unit-III

6. What is Object Oriented Database? Explain one Object Query Language used in DBMS. 20

7. What is Distributed database? Explain its merit and demerits on parallel database. 20

Unit-IV

8. What is Data Warehousing? Explain its architecture in detail. 20

9. What is Object Relational Database? Explain its advantages and disadvantages. 20

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M.Tech 1st Semester (Computer Science)
CBCS Scheme
Examination, November-2023
ADVANCED DATA BASE MANAGEMENT
SYSTEM
Paper–MTCSE21C3

Time allowed : 3 hours]   *[Maximum marks : 100*

Note: ***Question No. 1 is compulsory.*** *Attempt any **five** questions by selecting at least any **one** question from each section.*

1. Explain the following: -

   (a) Object Database and relational database

   (b) OQL.

   (c) Hash Join and Nested Join

   (d) Semantic query optimizing   4×5=20

Section-A

2. (a) What is data model? Discuss all type of data model.   10

   (b) Explain the Heuristics that should be applied for processing a query.   10

3. (a) What are the main strategies for implementing join operation? Explain all types or Join operation.   10

22640-P-3-Q-9 (23)   [P. T. O.

(b) Discuss the Boyce-Codd normal form. Differentiate it with 3NF. Give an example also. 10

Section-B

4. (a) Explain 2-way locking protocol to ensure serializability. 10

   (b) Explain log based recovery scheme in terms of ease of implementation and overhead cost. 10

5. (a) Explain:

   (i) Conflict Serializability and view Serializability 10

   (ii) Pessimistic and optimistic concurrency control 10

   (b) Compare and contrast deferred update and immediate update recovery protocols. 1 0

Section-C

6. (a) Describe different architectures for an object oriented DBMS. Also explain complex and structured data types. 10

   (b) What is the function of ODMG object definition language and object manipulation language? 10

7. (a) What are the advantages and disadvantages and disadvantages of extending the relational data model to incorporate object orientation. 10

(b) Explain distributed database with its components. Explain concurrency control in distributed environment. 10

Section-D

8. (a) What are the cuses of data warehouse? Explain its architecture with reconciled data layer. 10

   (b) How object identity, encapsulation, inheritance operations are specified in ORDBMS? 10

9. (a) Explain the significance of ORDBMS over RDBMS. Explain some operations performed in ORDBMS. 10

   (b) Describe how star, snowflake and starflake schemas differs. Explain with example. 10

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M.Tech. 1st Semester (CSE) CBCS Scheme
Examination – January, 2023

ADVANCED DATABASE MANAGEMENT SYSTEM

Paper : MTCSE21C3

Time : Three hours]   *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions by selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) What is Query Optimization ? What are the different rules for analyzing equivalent relational expressions ?

   (b) What is Serializability ? What are the Benefits of Serialization ?

   (c) How do you create object instances ?

   (d) What is Data Reconciliation ? Why is Data Reconciliation important ?

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UNIT – I

2. What are Normal forms ? Why do they essential part ? State different types of it.

3. What is ADBMS ? What is its advanced feature in it ? Explain its architecture, advantages, and disadvantages.

UNIT – II

4. What is Concurrency Control ? What are the problems with Concurrent Execution ? State the Concurrency Control Protocols.

5. What is Deadlocks ? Discuss Deadlock management strategies in DBMS.

UNIT – III

6. Explain Object Oriented Database. What are its features ? Why is it different from a traditional database ? Also, use object query language for creating, deleting and updating an OODB.

7. What is the Distributed Database ? What are the different options for distributing a database-distributed DBMS ?

UNIT – IV

8. What is Data Warehousing ? What are the benefits of data warehousing ? Draw and explain the data warehouse architecture with its key components.

9. What are Object Relational Databases ? What are the advantages of the object relational approach over the traditional approach ? Also, state its limitations.

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M. Tech. 1st Semester (CSE) CBCS Scheme
Examination, December–2024
DATA WAREHOUSE AND MINING
Paper-MTCSE21C4

Time allowed : 3 hours]   *[Maximum marks : 100*

Note : Question No. 1 is compulsory. Attempt any five questions by selecting one question from each unit. All questions carry equal marks.

1. **Compulsory question :**

   (a) What is an Operational Data Store (ODS)?

   (b) Define ETL in the context of data warehousing.

   (c) What is association rule mining?

   (d) What is the basic principle of the Apriori algorithm?

   (e) What is the Naive Bayes methods used for ?

   (f) Define Knowledge Discovery in Databases (KDD).

   (g) What is partitional clustering?

   (h) Explain the concept of hierarchical clustering.

Unit-I

2. Explain OLAP, its characteristics and the importance of multidimensional views.

3. What is data cube? Describe data cube operations and how they are used in data analysis.

Unit-II

4. Compare and contrast the Naive Algorithm and the Apriori Algorithm for association rule mining.

5. Evaluate the performance of various association rule mining algorithm and discuss their use cases.

Unit-III

6. Explain the Decision Tree. Explain the Tree Induction Algorithm by taking a suitable example.

7. Explain the split algorithm based on the Gini index and its application in decision tree classification.

Unit-IV

8. Explain Web Content Mining, Web Usage Mining and Web Structure Mining and provide examples of their applications.

9. Compare and contrast different web mining techniques and discuss their relevance in analyzing web data.

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M. Tech. 1st Semester (CSE) CBCS
Scheme Examination – January, 2023

DATA WAREHOUSE AND MINING

Paper : MTCSE21C4

Time : Three hours]   *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions by selecting *one* question from each Unit. Question No. **1** is *compulsory*. All questions carry equal marks.

1. (a) What is OLAP ?

   (b) Explain association rules for mining.

   (c) What is KDD ? Write various steps in it.

   (d) Explain Web Content Mining.

UNIT – I

2. What is Data Warehousing ? List the process that is involved in Data Warehousing. Also, give the design guidelines for data warehouse implementation.

3. What is Data Cube ? Explain various operations in it in detail.

UNIT – II

4. Explain Apriori algorithms. How would you evaluate the performance of algorithms ?

5. What is Dynamic Item set Counting (DIC) ? Explain it by taking a suitable example.

UNIT – III

6. Explain the Naïve Bayes method by taking a suitable example.

7. Explain tree induction algorithms. Also, explain the split algorithm based on information theory the split algorithm based on the Gini index.

UNIT – IV

8. What are the methods for dealing with large databases ? Explain partitional, hierarchical methods.

9. Write the notes on the following :

   (a) Density-based methods

   (b) Locality and Hierarchy in the web

   _____

22641-   -(P-2)(Q-9)(23)   (2)

M. Tech 1st Semester (CSE)-(CBCS Scheme)
Examination, Dec–2022
DATA WAREHOUSE AND MINING
Paper– MTCSE21 C4

Time allowed : 3 hours]   [Maximum marks : 100

Note: **Question No. 1 is compulsory.** Attempt any **five** questions by selecting **one** question from each unit. All questions carry equal marks.

1.   (a)   What is a Data Cube? Give its different variations.

     (b)· What is Data Mining? Write its advantages, limitations, and application.

     (c)   Why do we use KDD? Write the steps involved in KDD Process.

     (d)   What is Web Structure Mining?

Unit-I

2.   What is a Data warehouse? Discuss design guidelines for data warehouse implementation.

3.   What is OLAP? What are its characteristics of it? What are the types of OLAP Servers? Write and explain LAP Operations.

Unit-II

4.   Explain Direct Hashing and Pruning (DHP). How do you do the performance evaluation of algorithms?

5. Explain the Apriori algorithms in detail. What are the limitations of the Apriori Algorithm?

Unit-III

6. Explain the Decision Tree. Explain the Tree Induction Algorithm by taking a suitable example.

7. What are the benefits of using the Nave Bayes method over other competitors' strategies? Explain it in detail.

Unit-IV

8. What is Web Data mining? Write its characteristics. What is the difference between Data mining and Web data mining?

9. What is Cluster analysis? Explain partitioned methods, and hierarchical methods in context with cluster analysis.

M. Tech. 1st Semester (CSE) (CBCS) Scheme

Examination, December–2024

MATHEMATICAL FOUNDATION OF COMPUTER

SCIENCE

Paper–MTCSE21C5

Time allowed : 3 hours]   [Maximum marks : 100

Note : **Question No. 1 is compulsory.** *Attempt five questions in total, selecting one question from each section.*

1. (a) Design a transition diagram of DFA for the language $L = \{x \in (a, b)^* \mid x$ contains aa as a substring.

    (b) Design a transition diagram of DFA for the language $L = \{(1)^{2n} \mid n \geq 1\}$.

    (c) Define DPDA and NDPDA mathematically.

    (d) Write short note on Top-Down Parsing.

    (e) Briefly explain halting problem of TM.

    (f) Design and explain TM for language $L = \{1^n \mid n$ is even$\}$

    (g) Explain ZERO function with the help of example.

    (h) What are decidable and undecidable problems ?

Section–A

2. (a) Write the steps to reduce a given grammar and reduce the following grammar : 10
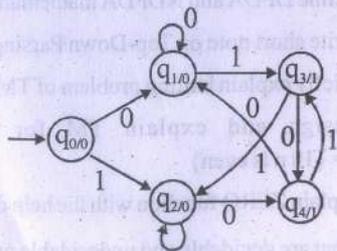
$S \rightarrow ABC$

$A \rightarrow CD$

$C \rightarrow a/\varepsilon$

$D \rightarrow bD \mid \varepsilon$

(b) Design a FA over the alphabet = {0, 1} which accept the set of strings that either start with 01 or end with 01. 10

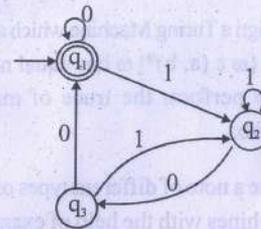3. (a) Convert the following Moore Machine to Mealy Machine. 10

(b) Convert the following FA to regular expression using Arden's method. 10

Section–B

4. (a) Construct a PDA equivalent to the following CFL.

$S \rightarrow 0BB$

$A \rightarrow 0S \mid 1S \mid 0$

Test whether 010^4 is in N(P) ? 10

(b) Construct a PDA accepting all palindromes over {a, b}. 10

5. (a) Design a PDA (transition table and diagram both) to accept the language $L = \{a^{2n} b^n \mid n \geq 1\}$. Also show the acceptance of string aaaabb belongs to L. 10

(b) Construct a deterministic PDA that accept balanced strings of brackets. 10

Section–C

6.   (a) Explain the different variants of TM.   10

     (b) Design a Turing Machine which accept the language
        $L = \{\omega \ \varepsilon \ (a, b)^* | \ \omega$ has equal number of a's b's$\}$.
        Also perform the trace of machine for string
        aababb.   10

7.   (a) Write a note of different types of restricted Turing
        Machines with the help of example of each.   10

     (b) Prove that the halting problem of Turing machine
        is undecidable.   10

Section–D

8.   (a) Show that the $f(x, y) = x^y$ is a primitive recursive
        function.   6

     (b) Show that the function $f(x, y) = x + y$ is primitive
        recursive.   6

     (c) Prove that the language Halt $= \{(M, w) |$ M halts
        on w$\}$ is undecidable.   8

9.   Write notes on :   7+7+6

     (a) Primitive Recursive Functions

     (b) Post Correspondence Problem

     (c) Church Turing thesis

M. Tech. (CSE) 1st Semester (CBCS Scheme)
Examination, Dec–2023
MATHEMATICAL FOUNDATIONS OF COMPUTER
SCIENCE
Paper–MTCSE21C5

Time allowed : 3 hours]   *[Maximum marks : 100*

Note: *Question 1 is compulsory. Attempt five questions in total selecting one question from each section.*

1.   (a)   Design a transition diagram of PDA for language $L = \{a^n b a^n \mid n \geq 1\}$

    (b)   Design a transition diagram of DFA to accept a string containing even number of 0's and any number of 1's.

    (c)   What is Normal form in CFG. Explain the rule to write the productions in CNF and GNF.

    (d)   Short note on Bottom-up Parsing.

    (e)   Define NDTM mathematically?

    (f)   Explain PCP.

    (g)   Write short note on Decidable problems.

    (h)   Define Reducibility? $8 \times 2.5 = 20$

Section-A

2.   (a)   Convert the given grammar into GNF   10

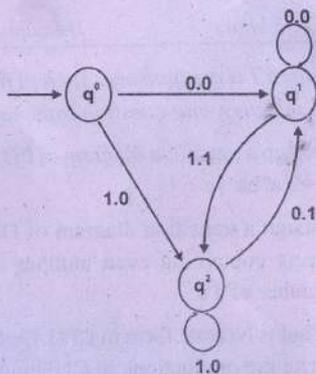 $S \rightarrow AA \mid a$

     $A \rightarrow SS \mid b$

(b) Explain in detail the methods of Ambiguity removal in CFG by taking suitable example. 10

3. (i) Convert the following Mealy Machine to Moore Machine by dividing the states into substates method.   10

(ii) Design a DFA that accept all strings in which number of 0's is multiple of 3 and number of 1's is divisible by 2.   10

Section-B

4. (i) Construct a PDA equivalent to the following CFL.   10

$S \longrightarrow 0BB$

$A \longrightarrow 0S \mid 1S \mid 0$

Test whether 010^4 is in N(P)?

(ii) Construct a PDA for the language.   10

$L = \{wCw^r \mid w \in \{a, b\}^*\}$

5. (i) Design a top-down parser for the expression x+y*z for the grammar G with the following production rules.   10

$S \longrightarrow S + X \mid X.$

$X \longrightarrow X*Y \mid Y.$

$Y \longrightarrow (S) \mid id.$

(ii) Construct a PDA for the language   10

$L = \{w w^r \mid w \in \{a, b\}^*\}$

Section-C

6. (i) Given two regular languages L1 and L2, is the problem of finding whether a string 'w' exists in both LI and L2, a decidable problem or not.   5

(ii) Design a Turing Machine which decrements input decimal number by 1.   5

(iii) Design a Turing Machine that performs the coping of strings with transition diagram, table and trace of machine.   10

7. (i) Explain different variants of Turing Machine. 8

(ii) Design a T.M. to perform multiplication. Draw only transition diagram.   6

(iii) Find out whether the following problem is decidable or not -Is a number 'm' prime?   6

Section-D

8. (a) Show that the Addition and exponentiation function
        is primitive recursive. 10

    (b) Write a detailed note on undecidable problems
        from language theory. 10

9. Write notes on 7+7+6

    (a) Theory of optimization in Automata

    (b) Recursive Enumerable Language

    (c) Church Turing thesis

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M. Tech. 1st Sem. (CSE) CBCS Scheme
Examination – January, 2023

MATHEMATICAL FOUNDATION OF COMPUTER
SCIENCE

Paper : MTCSE21C5

Time : Three Hours]   *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Questions No. 1 is *compulsory*. All questions carry equal marks.

1. Explain the following :   20

    (a) Define acceptability of automata and the limitations of Transition systems.

    (b) Briefly explain two types of normal forms in CFG.

    (c) Explain Top down parsing briefly.

(d) What is Context free grammar ? How Ambiguity can be removed ?

SECTION – A

2. (a) What is the difference between DFA & NDFA ? 10

$M = (\{q_1, q_2, q_3\}, (0, 1), \delta, q_1, \{q_3\})$ is a NFA, where δ is given by :

$\delta(q_1, 0) = \{q_2, q_3\}, \delta(q_1, 1) = \{q_1\}$

$\delta(q_2, 0) = \{q_1, q_2\}, \delta(q_2, 1) = \{\phi\}$

$\delta(q_3, 0) = \{q_2\}, \delta(q_3, 1) = \{q_1, q_2\}$

Construct an equivalent DFA.

(b) What is Arden's method ? Describe the Arden's theorem with its proof. 10

3. (a) Construct the finite automata equivalent to the regular expression : 10

$(0 + 1)^* (00 + 11) (0 + 1)^*$

(b) What is Chomsky Normal Form (CNF) ? How to reduce to the CNF ? Reduce the following grammar G to CNF. 10

G is $S \to aAD, A \to aB/ bAB, B \to b, D \to d$

SECTION – B

4. (a) State and Prove Pumping Lemma for regular sets. What are the applications of Pumping Lemma ? 10

(b) What do you mean by Push Down Automata (PDA) ? How PDA are different from Finite Automata (FA) ?. Also discuss some applications of PDA. 10

5. (a) Design a PDA for the language 10

$L = \{w\,w^r \mid w\,\varepsilon\,(a, b)^*\}$

(i.e., without marker in the middle).

(b) Briefly explain Top-Down Parsing and Bottom-up Parsing in context with PDA. 10

SECTION – C

6. (a) Design a Turing machine M to recognize the language $\{1^n 2^n 3^n \mid n > = 1\}$. 10

(b) Explain the ID and move of a Turing Machine ? Indicate the major differences between Turing Machine and PDA. 10

7. (a) Explain halting problem of Turing machine. 8

   (b) Discuss Decidable problems concerning Context free languages in detail. 12

SECTION – D

8. (a) What is PCP problem ? Explain with the help of example. 10

   (b) What are Primitive recursive functions ? Show that the following functions is primitive recursive : 10

   $$r(x, y) = x\text{-}y$$

9. Define the following : 20

   (a) Church- Turing Thesis

   (b) Partial recursive functions

   (d) Tractable decision problems

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