[Total No. of Questions: 09]
Uni. Roll No. 9203751

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Program: B.Tech. (Batch 2018 onward)
Semester: 5th.
Name of Subject: Theory of Computation
Subject Code: PCIT-112
Paper ID: 16443.
Scientific calculator is Not Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1. Parts A and B are compulsory
2. Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3. Any missing data may be assumed appropriately

<center>Part – A   [Marks: 02 each]</center>

Q1.

    a) List the application of Context Free Grammar.
    b) Is NDPDA more Powerful than DPDA? Justify.
    c) Distinguish Kleen Star and Kleen Positive with suitable example.
    d) Elaborate Sentential Form.
    e) Construct a Finite Automata for the regular expression $((a+b)(a+b))^*$.
    f) Prove that following regular expressions are equivalent:
        $aa(b^* +a) + a(ab^* +aa) = aa(b^* +a)$

<center>Part – B   [Marks: 04 each]</center>

Q2. Design a Finite Automation that recognizes a specific language described in words.
Explain Arden's theorem in the context of regular grammars.

Q3. Describe Chomsky Classification of Languages in detail.

Q4. State and prove pumping lemma for regular grammars.

Q5. Differentiate between Moore and Mealy Machines.

Q6. Construct PDA for the given CFG, and test whether 0104 is acceptable by this PDA.
    $S \rightarrow 0BB$
    $B \rightarrow 0S \mid 1S \mid 0$

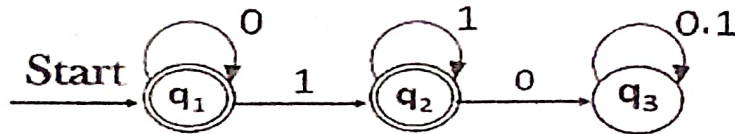Q7. Compare and contrast Push down Automata with Turing Machine.

Q8. Illustrate the need for minimization of automata and minimize the following Finite Automata:
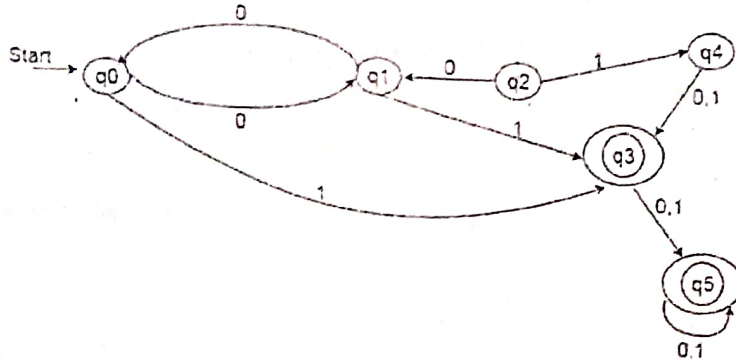
OR

Construct a regular expression corresponding to the automata given using Arden's Theorem.

Q9. Illustrate Turning Machine Model and design a Turing machine for $L = \{0^n1^n2^n\}$ where $n \geq 1$.

OR

Construct a PDA that accepts the language L over $\{0, 1\}$ by empty stack which accepts all the string of 0's and 1's in which a number of 0's are twice of number of 1's.

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Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)
Semester: 5
Name of Subject: Internet of Things
Subject Code: PCIT-111
Paper ID: 16442
Scientific calculator is Not Allowed

Time Allowed: 03 Hours   Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

<center>Part – A   [Marks: 02 each]</center>

Q1.

a) Demonstrate the role of sensors and actuators in an IoT application.

b) What is a sensor, and how is it used to sense the real world?

c) Define the key components of the Modified OSI Model for IoT/M2M systems.

d) Define cloud computing.

e) Evaluate two major advantages and disadvantages of using Wi-Fi over Ethernet for IoT applications.

f) Compare and contrast with two significant features of CoAP and MQTT in terms of their use cases and performance.

<center>Part – B   [Marks: 04 each]</center>

Q2. Illustrate the use of Security Tomography in detecting IoT vulnerabilities.

Q3. Identify an industry and suggest appropriate cloud service models it can adopt.

Q4. Explain the differences between static and dynamic IP addressing.

Q5. Justify the need for robust Identity Management in large-scale IoT deployments.

Q6. Critique the use of RFID in retail applications based on cost, scalability, and performance.

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Q7. Debate the effectiveness of message communication protocols for ensuring secure connectivity between IoT devices.

<center>**Part – C**</center>

<div align="right">[Marks: 12 each]</div>

Q8. a. Summarize the role of MIME Types in supporting multimedia data exchange.

     b. Differentiate with atleast four differences between Machine-to-Machine (M2M) communication and IoT.

<center>OR</center>

     a. Differentiate between public and private cloud models in terms of security and cost

     b. Illustrate the steps involved in establishing WSN infrastructure for a smart city application.

Q9.

     a. Assess the ease of designing an IoT system using the Modified OSI Model compared to the traditional OSI model.

     b. Justify the use of IPv6 over IPv4 in large-scale IoT networks.

<center>OR</center>

     a. Compare and contrast the security requirements for IoT applications in smart cities and environment monitoring.

     b. Differentiate between the WSN and RFID architectures in terms of communication and data flow.

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Program: B.Tech. (Batch 2018 onward)
Semester: 5th / (2018)
Name of Subject: Programming in Java
Subject Code: PCIT-109
Paper ID: 16440

Time Allowed: 03 Hours   Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A   [Marks: 02 each]

Q1.

a) Define **object-oriented programming** and list its main principles.

b) Compare **Java applets** and **Java applications** based on their structure and usage.

c) Identify the key **primitive data types** in Java? List their sizes and default values.

d) Describe the role of the **Java Virtual Machine (JVM)** in program execution.

e) A university maintains student attendance using arrays. Write a Java program to track the attendance percentage for five students and identify those who have less than 75%.

f) Design a Java program to calculate the **area of shapes (Circle, Rectangle)** using **method overloading**.

Part – B   [Marks: 04 each]

Q2. Describe the **Java Bytecode** and its role in platform independence. Also, explain the steps in the **Java Compilation Process** with an example.

Q3. Explain **exception handling** in Java. Write a program that uses try, catch, and finally blocks to handle division by zero.

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Q4. Explain **access specifiers** in Java with examples. Highlight the difference between `public`, `private`, and `protected` access modifiers.

Q5. A company wants to maintain employee details using Java. You are required to create a Java program that includes: A class `Employee` with attributes like `name`, `age`, and `salary`. A method to calculate the annual salary of the employee. Write the program and explain how **constructors** and **methods** are used in your solution.

Q6. Differentiate between **recursion** and **iteration** in Java. Write a Java program to calculate the factorial of a number using **recursion**.

Q7. Write a program to perform **string operations** such as:

- Comparing two strings.
- Converting a string to uppercase.
- Finding the length of a string.

Part – C   [Marks: 12 each]

Q8. Write an applet to accept a student's marks in three subjects, calculate the total and average, and explain the **applet life cycle**.

OR

Implement a Java program to demonstrate the concept of **inheritance**:

- Create a base class `Shape`.
- Create derived classes `Circle` and `Rectangle` with methods to calculate their areas.

Q9. A library system uses packages to manage book and member data. Write a program to: Create a package `library` with classes `Book` and `Member`. Demonstrate importing and using this package in another program.

OR

What are **thread priorities** in Java? Create a multithreaded Java program to demonstrate assigning and using thread priorities.

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Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)
Semester: 5th
Name of Subject: Discrete Mathematics
Subject Code: PCIT-110
Paper ID: 16441
Scientific calculator is NotAllowed

Time Allowed: 03 Hours   Max. Marks: 60

NOTE:

1) Parts A and B are compulsory

2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice

3) Any missing data may be assumed appropriately

Part – A   [Marks: 02 each]

Q1.

a) Define a group. Prove that the set of integers under addition forms a group.

b) Differentiate between equal and equivalent sets.

c) Evaluate the number of distinct arrangements of the letters in "MISSISSIPPI" where the I's are always placed together, and compare it to the total number of arrangements without this restriction.

d) Determine the number of possible arrangements for seating 5 people in a row, ensuring that two specific individuals always sit adjacent to each other.

e) Translate the following statement into a propositional logic formula "If it rains, then the ground will be wet. If the ground is wet, then the game will be cancelled."

f) Prove that the complete graph K_5 is non-planar.

Part – B   [Marks: 04 each]

Q2. Let R be a relation on the set B= {a,b,c,d} defined as:

R= {(a,b), (b,c), (c,d)}

Find the reflexive closure, symmetric closure and transitive closure of the relation R on B.

Q3. Define Generating functions. Find the generating function for the sequence:

a) 1,1,1,1,1 ...... (a constant sequence of 2's)

b) 0,1,2,3,4,5,...........

c) 1,1,2,3,5,..............,

Q4 If R is an Equivalence Relation, prove that R^{-1} is also an equivalence relation.

Q5. Solve the following recurrence relation:

$$a_n = 4a_{(n-1)} - 4a_{(n-2)} + 2, \text{ for } n \geq 2$$

With initial conditions: $a_0 = 3$ and $a_1 = 7$

Find the closed-form solution for a_n.

Q6. A group of 200 students is surveyed about their preferences for soccer, basketball, and tennis. 120 students like soccer, 100 students like basketball, 80 students like tennis, 50 students like both soccer and basketball, 40 students like both basketball and tennis, 30 students like both soccer and tennis, and 20 students like all three sports. Using Venn diagram, find.

a) The number of students who like only soccer.

b) The number of students who like only basketball.

c) The number of students who like only tennis.

d) The number of students who like exactly two of the three sports.

Q7. Explain the different properties of an algebraic system, and provide appropriate examples to demonstrate each property.

<center>Part – C   [Marks: 12 each]</center>

Q8. a) Compare and contrast Kruskal's algorithm and Prim's algorithm by identifying and explaining at least 8 key differences between them. (6 marks)

b) Outline the steps of Kruskal's algorithm and use it to determine the Minimum Spanning Tree (MST) for the given graph: (6 marks)

<center>OR</center>

<center>**P.T.O.**</center>
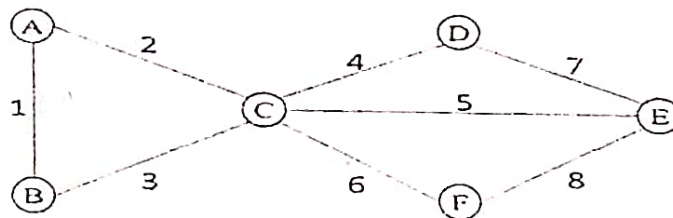
Q8. Explain the meaning of the given terms and illustrate each with suitable examples:

    i)   Pigeonhole Principle

    ii)   Inclusion- exclusion Principle

    iii)   Poset

    iv)   Planar Graphs

    v)   Chromatic Number

    vi)   Invertible Functions

Q9. Distinguish between Hamiltonian and Eulerian circuits by identifying at least six key differences (4 marks) and answer the following:

a) Prove or disprove. Every Eulerian circuit is also a Hamiltonian circuit. (2 Marks)

b) Provide an example of a graph that has a Hamiltonian circuit but not an Eulerian circuit. (2 Marks)

c) Given a connected graph with 6 vertices and 9 edges, determine whether it has a Hamiltonian circuit or an Eulerian circuit. (2 Marks)

d) Prove that a complete graph K_n (where n≥3) always has a Hamiltonian circuit. (2 Marks)

OR

a) Explain the Floyd-Warshall's algorithm for finding the shortest paths between all pairs of vertices in a weighted graph. Describe its working principle, time complexity and how it handles negative edge weights. (4 marks)

b) Solve the following graph using Floyd Warshall's Algorithm: (8 marks)
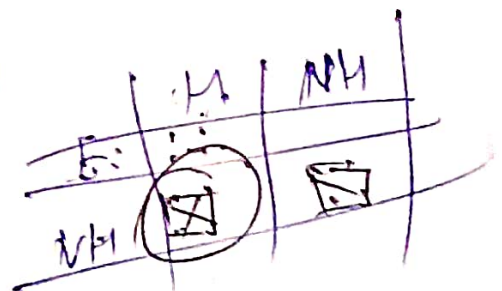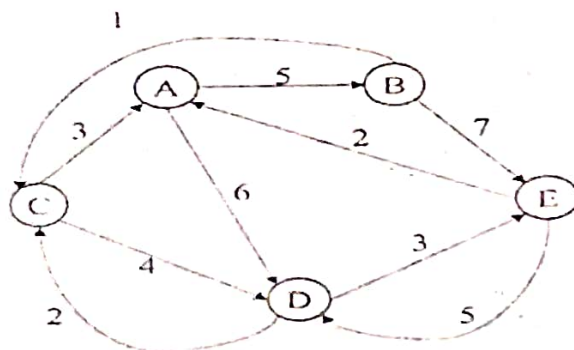
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[Total No. of Questions: 09]   [Total No. of Pages: 2]
Uni. Roll No. 9203751

Program: B.Tech. (Batch 2018 onward)
Semester: 5th
Name of Subject: Advanced Web Technologies
Subject Code: PEIT-102
Paper ID: 16445

Time Allowed: 03 Hours   Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A   [Marks: 02 each]

Q1.

a) Can using Bootstrap speed up development time? Why or why not?
b) Define the role of Typography in Bootstrap.
c) Differentiate between **git status** and **git diff** command.
d) How do you establish a database connectionn in any PHP framework.
e) Explain the concept of responsive design and its importance in web development.
f) Discuss the advantages of using Laravel over other PHP frameworks.

Part – B   [Marks: 04 each]

Q2. Describe how the "Grid System" and "Responsive Classes" in Bootstrap facilitate web design.

Q3. Explain the process of creating a new branch in Git and merging it with the main branch.

Q4. With the help of example illustrate the working of MVC pattern.

Q5. Compare and contrast the features of CodeIgniter and Laravel frameworks.

Q6. Discuss benefits of database migration in Laravel/Codeigniter frameworks.

Q7. In Laravel, how can you define a route that redirects users to another route or URL? Create a sample implementation for redirecting to the home page.

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P.T.O.

Q8. Design a responsive web page layout using Bootstrap's grid system, incorporating navigation bars and modals.

<div align="center">OR</div>

Create and explain a dynamic form using CodeIgniter/Laravel framework that performs CRUD operations on a database.

Q9. Develop a Laravel/CodeIgniter application for any type of user creation/registration process.

<div align="center">OR</div>

You are part of a collaborative web development project using Bootstrap 5 for frontend design and GIT for version control. The team is developing a user creation/registration process, but challenges arise in maintaining a consistent design across all pages and resolving frequent version control conflicts.

Tasks:

1. Evaluate the challenges your team faces in maintaining consistent styling and layout during the development of the user registration process. Devise a comprehensive strategy using Bootstrap 5 to ensure design uniformity across all related web pages.

2. Considering the issues with version control conflicts in GIT, propose an actionable plan that includes workflows and tools to effectively manage these conflicts. Justify how this plan would improve the team's collaboration during the development of the user registration process.

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