

Advanced Java Programming (4351603) - Summer 2024 Solution

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Question 1(a) [3 marks]

Explain the difference between AWT and Swing.

Solution

Table 1. AWT vs Swing

Feature	AWT	Swing
Platform	Platform dependent	Platform independent
Components	Heavy weight	Light weight
Look & Feel	Native OS look	Pluggable look & feel
Performance	Faster	Slower than AWT

Key Points:

- **Heavy vs Light:** AWT uses native OS components, Swing uses pure Java.
- **Appearance:** AWT follows OS style, Swing offers consistent look across platforms.
- **Features:** Swing provides more advanced components like JTable, JTree.

Mnemonic

“Swing Provides Lightweight Components”

Question 1(b) [4 marks]

Explain Mouse Motion Listener with example.

Solution

MouseMotionListener interface handles mouse movement events in Java Swing applications.

Table 2. Mouse Motion Events

Method	Purpose
mouseDragged()	Called when mouse is dragged
mouseMoved()	Called when mouse is moved

Code Example:

```
1 import javax.swing.*;
2 import java.awt.event.*;
3
4 class MouseMotionExample extends JFrame implements MouseMotionListener {
5     JLabel label;
```

```

6
7     MouseMotionExample() {
8         label = new JLabel("Move mouse here");
9         add(label);
10        addMouseListener(this);
11        setSize(400, 300);
12        setVisible(true);
13    }
14
15    public void mouseMoved(MouseEvent e) {
16        label.setText("Mouse at: " + e.getX() + ", " + e.getY());
17    }
18
19    public void mouseDragged(MouseEvent e) {
20        label.setText("Dragging at: " + e.getX() + ", " + e.getY());
21    }
22 }

```

Mnemonic

“Mouse Motion Makes Dynamic”

Question 1(c) [7 marks]

Develop a program to create checkboxes for different courses belonging to a university such that the course selected would be displayed.

Solution

```

1  import javax.swing.*;
2  import java.awt.*;
3  import java.awt.event.*;
4
5  public class CourseSelection extends JFrame implements ItemListener {
6      JCheckBox java, python, cpp, web;
7      JTextArea display;
8
9      public CourseSelection() {
10         setTitle("University Course Selection");
11         setLayout(new FlowLayout());
12
13         // Create checkboxes
14         java = new JCheckBox("Java Programming");
15         python = new JCheckBox("Python Programming");
16         cpp = new JCheckBox("C++ Programming");
17         web = new JCheckBox("Web Development");
18
19         // Add listeners
20         java.addItemListener(this);
21         python.addItemListener(this);
22         cpp.addItemListener(this);
23         web.addItemListener(this);
24
25         // Display area
26         display = new JTextArea(10, 30);
27         display.setEditable(false);
28     }

```

```

29 // Add components
30 add(new JLabel("Select Courses:"));
31 add(java); add(python); add(cpp); add(web);
32 add(new JScrollPane(display));
33
34 setSize(400, 300);
35 setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
36 setVisible(true);
37 }
38
39 public void itemStateChanged(ItemEvent e) {
40     String courses = "Selected Courses:\n";
41     if(java.isSelected()) courses += "- Java Programming\n";
42     if(python.isSelected()) courses += "- Python Programming\n";
43     if(cpp.isSelected()) courses += "- C++ Programming\n";
44     if(web.isSelected()) courses += "- Web Development\n";
45     display.setText(courses);
46 }
47
48 public static void main(String[] args) {
49     new CourseSelection();
50 }
51 }

```

Key Features:

- **ItemListener:** Detects checkbox state changes.
- **Dynamic Display:** Updates selected courses in real-time.
- **Multiple Selection:** Allows selecting multiple courses.

Mnemonic

“Check Items Listen Dynamically”

Question 1(c OR) [7 marks]

Develop a program to Implement Traffic signal (Red, Green and Yellow) by using Swing components (Using JFrame, JRadioButton, ItemListener etc.)

Solution

```

1 import javax.swing.*;
2 import java.awt.*;
3 import java.awt.event.*;
4
5 public class TrafficSignal extends JFrame implements ItemListener {
6     JRadioButton red, green, yellow;
7     ButtonGroup group;
8     JPanel signalPanel;
9
10    public TrafficSignal() {
11        setTitle("Traffic Signal Simulator");
12        setLayout(new BorderLayout());
13
14        // Create radio buttons
15        red = new JRadioButton("Red");
16        green = new JRadioButton("Green");
17        yellow = new JRadioButton("Yellow");
18

```

```

19 // Group radio buttons
20 group = new ButtonGroup();
21 group.add(red); group.add(green); group.add(yellow);
22
23 // Add listeners
24 red.addItemListener(this);
25 green.addItemListener(this);
26 yellow.addItemListener(this);
27
28 // Signal display panel
29 signalPanel = new JPanel() {
30     public void paintComponent(Graphics g) {
31         super.paintComponent(g);
32         g.setColor(Color.BLACK);
33         g.fillRect(50, 50, 100, 200);
34
35         // Draw circles
36         g.setColor(red.isSelected() ? Color.RED : Color.GRAY);
37         g.fillOval(65, 65, 70, 70);
38
39         g.setColor(yellow.isSelected() ? Color.YELLOW : Color.GRAY);
40         g.fillOval(65, 105, 70, 70);
41
42         g.setColor(green.isSelected() ? Color.GREEN : Color.GRAY);
43         g.fillOval(65, 145, 70, 70);
44     }
45 };
46
47 JPanel controlPanel = new JPanel();
48 controlPanel.add(red); controlPanel.add(yellow); controlPanel.add(green);
49
50 add(controlPanel, BorderLayout.SOUTH);
51 add(signalPanel, BorderLayout.CENTER);
52
53 setSize(300, 400);
54 setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
55 setVisible(true);
56 }
57
58 public void itemStateChanged(ItemEvent e) {
59     signalPanel.repaint();
60 }
61
62 public static void main(String[] args) {
63     new TrafficSignal();
64 }
65 }

```

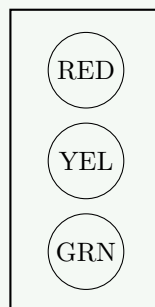


Figure 1. Traffic Signal Representation

Mnemonic

“Radio Buttons Paint Graphics”

Question 2(a) [3 marks]

Explain JDBC type-4 driver.

Solution**JDBC Type-4 Driver (Native Protocol Driver)****Table 3.** JDBC Type-4 Features

Feature	Description
Type	Pure Java driver
Communication	Direct database protocol
Platform	Platform independent
Performance	Highest performance

Key Points:

- **Pure Java:** No native code required.
- **Direct Connection:** Communicates directly with database.
- **Network Protocol:** Uses database's native network protocol.
- **Best Performance:** Fastest among all driver types.

Mnemonic

“Pure Java Direct Protocol”

Question 2(b) [4 marks]

Explain Commonly used Methods of Component class.

Solution**Table 4.** Component Class Methods

Method	Purpose
add()	Adds component to container
setSize()	Sets component dimensions
setLayout()	Sets layout manager
setVisible()	Makes component visible/invisible
setBounds()	Sets position and size
getSize()	Returns component size

Key Features:

- **Layout Management:** Controls component arrangement.
- **Visibility Control:** Shows/hides components.
- **Size Management:** Controls component dimensions.
- **Container Operations:** Manages child components.

Mnemonic

“Add Set Get Visibility”

Question 2(c) [7 marks]

Develop a program using JDBC to display student's record (Enroll No, Name, Address, Mobile No and Email-ID) from table 'StuRec'.

Solution

```
1  import java.sql.*;
2  import javax.swing.*;
3  import javax.swing.table.DefaultTableModel;
4
5  public class StudentRecordDisplay extends JFrame {
6      JTable table;
7      DefaultTableModel model;
8
9      public StudentRecordDisplay() {
10         setTitle("Student Records");
11
12         // Create table model
13         String[] columns = {"Enroll No", "Name", "Address", "Mobile", "Email"};
14         model = new DefaultTableModel(columns, 0);
15         table = new JTable(model);
16
17         // Load data
18         loadStudentData();
19
20         add(new JScrollPane(table));
21         setSize(600, 400);
22         setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
23         setVisible(true);
24     }
25
26     private void loadStudentData() {
27         try {
28             // Database connection
29             Class.forName("com.mysql.cj.jdbc.Driver");
30             Connection con = DriverManager.getConnection(
31                 "jdbc:mysql://localhost:3306/university", "root", "password");
32
33             // Execute query
34             Statement stmt = con.createStatement();
35             ResultSet rs = stmt.executeQuery("SELECT * FROM StuRec");
36
37             // Add data to table
38             while(rs.next()) {
39                 String[] row = {
40                     rs.getString("enrollno"),
41                     rs.getString("name"),
42                     rs.getString("address"),
43                     rs.getString("mobile"),
44                     rs.getString("email")
45                 };
46                 model.addRow(row);
47             }
48
49             con.close();
```

```

50         } catch(Exception e) {
51             JOptionPane.showMessageDialog(this, "Error: " + e.getMessage());
52         }
53     }
54
55     public static void main(String[] args) {
56         new StudentRecordDisplay();
57     }
58 }

```

Database Table Structure:

```

1 CREATE TABLE StuRec (
2     enrollno VARCHAR(20) PRIMARY KEY,
3     name VARCHAR(50),
4     address VARCHAR(100),
5     mobile VARCHAR(15),
6     email VARCHAR(50)
7 );

```

Mnemonic

“Connect Query Display Records”

Question 2(a OR) [3 marks]

Write down the advantages and disadvantages of JDBC.

Solution

Table 5. JDBC Advantages and Disadvantages

Advantages	Disadvantages
Platform Independent	Performance Overhead
Database Independent	Complex for beginners
Standard API	SQL dependency
Supports transactions	Manual resource management

Key Points:

- **Portability:** Works across different platforms and databases.
- **Standardization:** Uniform API for database operations.
- **Performance:** Additional layer causes overhead.
- **Complexity:** Requires proper resource management.

Mnemonic

“Platform Independent Standard Complex”

Question 2(b OR) [4 marks]

Explain Border Layout.

Solution

BorderLayout divides container into five regions: North, South, East, West, and Center.

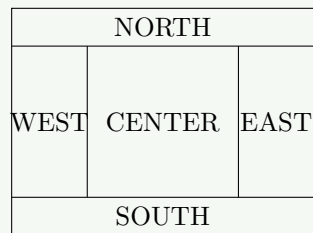


Figure 2. Border Layout Regions

Table 6. Border Layout Regions

Region	Position	Behavior
NORTH	Top	Preferred height, full width
SOUTH	Bottom	Preferred height, full width
EAST	Right	Preferred width, full height
WEST	Left	Preferred width, full height
CENTER	Middle	Takes remaining space

Code Example:

```

1  setLayout(new BorderLayout());
2  add(new JButton("North"), BorderLayout.NORTH);
3  add(new JButton("Center"), BorderLayout.CENTER);

```

Mnemonic

“North South East West Center”

Question 2(c OR) [7 marks]

Develop an application to store, update, fetch and delete data of Employee (NAME, AGE, SALARY and DEPARTMENT) using Hibernate CRUD operations.

Solution**Employee Entity Class:**

```

1  import javax.persistence.*;
2
3  @Entity
4  @Table(name = "employees")
5  public class Employee {
6      @Id
7      @GeneratedValue(strategy = GenerationType.IDENTITY)
8      private int id;
9
10     private String name;
11     private int age;
12     private double salary;
13     private String department;
14
15     // Constructors, getters, setters

```



```

16     public Employee() {}
17
18     public Employee(String name, int age, double salary, String dept) {
19         this.name = name;
20         this.age = age;
21         this.salary = salary;
22         this.department = dept;
23     }
24
25     // Getters and Setters
26     public int getId() { return id; }
27     public void setId(int id) { this.id = id; }
28
29     public String getName() { return name; }
30     public void setName(String name) { this.name = name; }
31
32     // ... other getters/setters
33 }

```

CRUD Operations Class:

```

1  import org.hibernate.*;
2  import org.hibernate.cfg.Configuration;
3
4  public class EmployeeCRUD {
5      private SessionFactory factory;
6
7      public EmployeeCRUD() {
8          factory = new Configuration()
9              .configure("hibernate.cfg.xml")
10             .addAnnotatedClass(Employee.class)
11             .buildSessionFactory();
12     }
13
14     // CREATE
15     public void saveEmployee(Employee emp) {
16         Session session = factory.openSession();
17         Transaction tx = session.beginTransaction();
18         session.save(emp);
19         tx.commit();
20         session.close();
21     }
22
23     // READ
24     public Employee getEmployee(int id) {
25         Session session = factory.openSession();
26         Employee emp = session.get(Employee.class, id);
27         session.close();
28         return emp;
29     }
30
31     // UPDATE
32     public void updateEmployee(Employee emp) {
33         Session session = factory.openSession();
34         Transaction tx = session.beginTransaction();
35         session.update(emp);
36         tx.commit();
37         session.close();
38     }
39
40     // DELETE
41     public void deleteEmployee(int id) {
42         Session session = factory.openSession();

```

```

43     Transaction tx = session.beginTransaction();
44     Employee emp = session.get(Employee.class, id);
45     session.delete(emp);
46     tx.commit();
47     session.close();
48 }
49 }

```

Mnemonic

“Save Get Update Delete Hibernate”

Question 3(a) [3 marks]

Explain Deployment Descriptor.

Solution

Deployment Descriptor (web.xml) is configuration file for web applications containing servlet mappings, initialization parameters, and security settings.

Table 7. Deployment Descriptor Elements

Element	Purpose
<servlet>	Defines servlet configuration
<servlet-mapping>	Maps servlet to URL pattern
<init-param>	Sets initialization parameters
<welcome-file-list>	Default files to serve

Key Features:

- **Configuration:** Central configuration for web app.
- **Servlet Mapping:** URL to servlet mapping.
- **Parameters:** Initialization and context parameters.
- **Security:** Authentication and authorization settings.

Mnemonic

“Web XML Configuration Mapping”

Question 3(b) [4 marks]

Explain the difference between get and post method in servlet.

Solution

Table 8. GET vs POST Methods

Feature	GET	POST
Data Location	URL query string	Request body
Data Size	Limited (2048 chars)	Unlimited
Security	Less secure (visible)	More secure
Caching	Can be cached	Not cached
Bookmarking	Can bookmark	Cannot bookmark
Purpose	Retrieve data	Submit/modify data

Key Points:

- **Visibility:** GET data visible in URL, POST hidden.
- **Capacity:** POST can handle large data.
- **Security:** POST better for sensitive data.
- **Usage:** GET for fetching, POST for form submission.

Mnemonic

“GET Visible Limited, POST Hidden Unlimited”

Question 3(c) [7 marks]

Develop a simple servlet program which maintains a counter for the number of times it has been accessed since its loading; initialize the counter using deployment descriptor.

Solution**Servlet Code:**

```

1  import java.io.*;
2  import javax.servlet.*;
3  import javax.servlet.http.*;
4
5  public class CounterServlet extends HttpServlet {
6      private int counter;
7
8      public void init() throws ServletException {
9          String initialValue = getInitParameter("initialCount");
10         counter = Integer.parseInt(initialValue);
11     }
12
13     protected void doGet(HttpServletRequest request,
14                           HttpServletResponse response)
15         throws ServletException, IOException {
16
17         response.setContentType("text/html");
18         PrintWriter out = response.getWriter();
19
20         synchronized(this) {
21             counter++;
22         }
23
24         out.println("<html><body>");
25         out.println("<h2>Page Access Counter</h2>");
26         out.println("<p>This page has been accessed " + counter + " times</p>");
27         out.println("<p><a href='CounterServlet'>Refresh</a></p>");
28         out.println("</body></html>");
29
30         out.close();

```

```

31     }
32 }

```

web.xml Configuration:

```

1  <?xml version="1.0" encoding="UTF-8"?>
2  <web-app>
3      <servlet>
4          <servlet-name>CounterServlet</servlet-name>
5          <servlet-class>CounterServlet</servlet-class>
6          <init-param>
7              <param-name>initialCount</param-name>
8              <param-value>0</param-value>
9          </init-param>
10         <load-on-startup>1</load-on-startup>
11     </servlet>
12
13     <servlet-mapping>
14         <servlet-name>CounterServlet</servlet-name>
15         <url-pattern>/counter</url-pattern>
16     </servlet-mapping>
17 </web-app>

```

Key Features:

- **Thread Safety:** Synchronized counter increment.
- **Initialization:** Counter initialized from web.xml.
- **Persistent:** Counter maintained across requests.
- **Configuration:** Deployment descriptor setup.

Mnemonic

“Initialize Synchronize Count Display”

Question 3(a OR) [3 marks]

Explain the life cycle of a servlet.

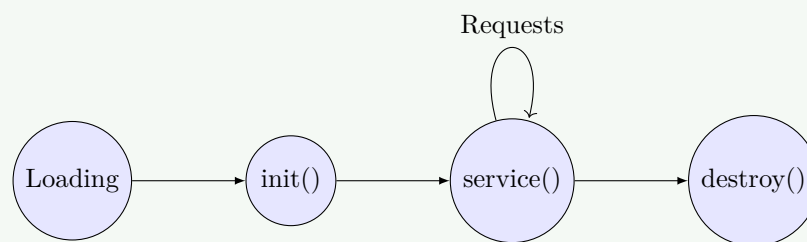
Solution

Figure 3. Servlet Life Cycle

Table 9. Servlet Life Cycle Methods

Method	Purpose	Called
init()	Initialize servlet	Once at startup
service()	Handle requests	For each request
destroy()	Cleanup resources	Once at shutdown

Key Points:

- **Initialization:** Called once when servlet loads.
- **Service:** Handles all client requests.
- **Cleanup:** Called before servlet unloads.
- **Container Managed:** Web container controls lifecycle.

Mnemonic

“Initialize Service Destroy”

Question 3(b OR) [4 marks]

Explain Servlet Config class with suitable example.

Solution

ServletConfig provides servlet-specific configuration information and initialization parameters.

Table 10. ServletConfig Methods

Method	Purpose
<code>getInitParameter()</code>	Gets init parameter value
<code>getInitParameterNames()</code>	Gets all parameter names
<code>getServletContext()</code>	Gets servlet context
<code>getServletName()</code>	Gets servlet name

Example:

```

1 public class ConfigServlet extends HttpServlet {
2     String databaseURL, username;
3
4     public void init() throws ServletException {
5         ServletConfig config = getServletConfig();
6         databaseURL = config.getInitParameter("dbURL");
7         username = config.getInitParameter("dbUser");
8     }
9
10    protected void doGet(HttpServletRequest request,
11                          HttpServletResponse response)
12                          throws ServletException, IOException {
13
14        PrintWriter out = response.getWriter();
15        out.println("Database URL: " + databaseURL);
16        out.println("Username: " + username);
17    }
18 }
```

web.xml:

```

1 <servlet>
2     <servlet-name>ConfigServlet</servlet-name>
3     <servlet-class>ConfigServlet</servlet-class>
4     <init-param>
5         <param-name>dbURL</param-name>
6         <param-value>jdbc:mysql://localhost:3306/test</param-value>
7     </init-param>
8     <init-param>
9         <param-name>dbUser</param-name>
10        <param-value>root</param-value>

```

```

11     </init-param>
12 </servlet>

```

Mnemonic

“Config Gets Parameters Context”

Question 3(c OR) [7 marks]

Develop a simple program, when user select the subject code, name of the subject will be displayed using servlet and mysql database.

Solution

HTML Form (index.html):

```

1 <!DOCTYPE html>
2 <html>
3 <head>
4     <title>Subject Selection</title>
5 </head>
6 <body>
7     <h2>Select Subject Code</h2>
8     <form action="SubjectServlet" method="get">
9         <select name="subjectCode">
10             <option value="">Select Subject</option>
11             <option value="4351603">4351603</option>
12             <option value="4351604">4351604</option>
13             <option value="4351605">4351605</option>
14         </select>
15         <input type="submit" value="Get Subject Name">
16     </form>
17 </body>
18 </html>

```

Servlet Code:

```

1 import java.io.*;
2 import java.sql.*;
3 import javax.servlet.*;
4 import javax.servlet.http.*;
5
6 public class SubjectServlet extends HttpServlet {
7
8     protected void doGet(HttpServletRequest request,
9                           HttpServletResponse response)
10         throws ServletException, IOException {
11
12         response.setContentType("text/html");
13         PrintWriter out = response.getWriter();
14
15         String subjectCode = request.getParameter("subjectCode");
16         String subjectName = "";
17
18         if(subjectCode != null && !subjectCode.equals("")) {
19             try {
20                 Class.forName("com.mysql.cj.jdbc.Driver");
21                 Connection con = DriverManager.getConnection(
22                     "jdbc:mysql://localhost:3306/university", "root", "password");

```

```

23
24         PreparedStatement ps = con.prepareStatement(
25             "SELECT subject_name FROM subjects WHERE subject_code = ?");
26         ps.setString(1, subjectCode);
27
28         ResultSet rs = ps.executeQuery();
29         if(rs.next()) {
30             subjectName = rs.getString("subject_name");
31         }
32
33         con.close();
34     } catch(Exception e) {
35         subjectName = "Error: " + e.getMessage();
36     }
37 }
38
39 out.println("<html><body>");
40 out.println("<h2>Subject Information</h2>");
41 if(!subjectName.equals("")) {
42     out.println("<p>Subject Code: " + subjectCode + "</p>");
43     out.println("<p>Subject Name: " + subjectName + "</p>");
44 } else {
45     out.println("<p>Please select a subject code</p>");
46 }
47 out.println("<p><a href='index.html'>Back</a></p>");
48 out.println("</body></html>");
49 }
50 }

```

Database Table:

```

1 CREATE TABLE subjects (
2     subject_code VARCHAR(10) PRIMARY KEY,
3     subject_name VARCHAR(100)
4 );
5
6 INSERT INTO subjects VALUES
7 ('4351603', 'Advanced Java Programming'),
8 ('4351604', 'Web Technology'),
9 ('4351605', 'Database Management System');

```

Mnemonic

“Select Query Display Subject”

Question 4(a) [3 marks]

Explain JSP life cycle.

Solution

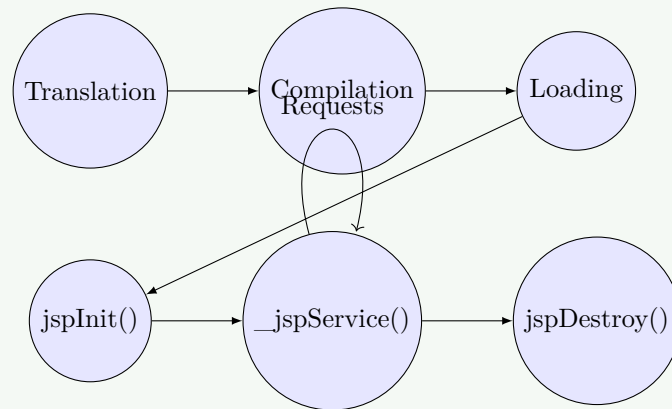


Figure 4. JSP Life Cycle

Table 11. JSP Life Cycle Phases

Phase	Description
Translation	JSP to Servlet conversion
Compilation	Servlet to bytecode
Loading	Load servlet class
Initialization	jspInit() called
Request Processing	_jspService() handles requests
Destruction	jspDestroy() cleanup

Mnemonic

“Translate Compile Load Initialize Service Destroy”

Question 4(b) [4 marks]

Compare JSP and Servlet.

Solution

Table 12. JSP vs Servlet Comparison

Feature	JSP	Servlet
Code Type	HTML with Java code	Pure Java code
Development	Easier for web designers	Better for Java developers
Compilation	Automatic	Manual
Modification	No restart needed	Restart required
Performance	Slower first request	Faster
Maintenance	Easier	More complex

Key Points:

- **Ease of Use:** JSP easier for presentation layer.
- **Performance:** Servlet better for business logic.
- **Flexibility:** JSP better for dynamic content.
- **Control:** Servlet provides more control.

Mnemonic

“JSP Easy HTML, Servlet Pure Java”

Question 4(c) [7 marks]

Develop a JSP web application to display student monthly attendance in each subject of current semester via enrolment number.

Solution**Input Form (attendance.html):**

```

1  <!DOCTYPE html>
2  <html>
3  <head>
4      <title>Student Attendance</title>
5  </head>
6  <body>
7      <h2>Check Student Attendance</h2>
8      <form action="attendanceCheck.jsp" method="post">
9          <table>
10             <tr>
11                 <td>Enrollment Number:</td>
12                 <td><input type="text" name="enrollNo" required></td>
13             </tr>
14             <tr>
15                 <td>Month:</td>
16                 <td>
17                     <select name="month" required>
18                         <option value="">Select Month</option>
19                         <option value="January">January</option>
20                         <option value="February">February</option>
21                         <option value="March">March</option>
22                     </select>
23                 </td>
24             </tr>
25             <tr>
26                 <td colspan="2">
27                     <input type="submit" value="Check Attendance">
28                 </td>
29             </tr>
30         </table>
31     </form>
32 </body>
33 </html>

```

JSP Page (attendanceCheck.jsp):

```

1  <%@ page import="java.sql.*" %>
2  <%@ page contentType="text/html; charset=UTF-8" %>
3
4  <html>
5  <head>
6      <title>Attendance Report</title>
7      <style>
8          table { border-collapse: collapse; width: 100%; }
9          th, td { border: 1px solid black; padding: 8px; text-align: center; }
10         th { background-color: #f2f2f2; }
11     </style>
12 </head>

```

```

13 <body>
14     <h2>Monthly Attendance Report</h2>
15
16     <%
17         String enrollNo = request.getParameter("enrollNo");
18         String month = request.getParameter("month");
19
20         if(enrollNo != null && month != null) {
21             try {
22                 Class.forName("com.mysql.cj.jdbc.Driver");
23                 Connection con = DriverManager.getConnection(
24                     "jdbc:mysql://localhost:3306/university", "root", "password");
25
26                 // Get student info
27                 PreparedStatement ps1 = con.prepareStatement(
28                     "SELECT name FROM students WHERE enroll_no = ?");
29                 ps1.setString(1, enrollNo);
30                 ResultSet rs1 = ps1.executeQuery();
31
32                 String studentName = "";
33                 if(rs1.next()) {
34                     studentName = rs1.getString("name");
35                 }
36
37                 out.println("<p><strong>Student:</strong> " + studentName +
38                     " (" + enrollNo + ")</p>");
39                 out.println("<p><strong>Month:</strong> " + month + "</p>");
40
41                 // Get attendance data
42                 PreparedStatement ps2 = con.prepareStatement(
43                     "SELECT s.subject_name, a.total_classes, a.attended_classes, " +
44                     "ROUND((a.attended_classes/a.total_classes)*100, 2) as percentage " +
45                     "FROM attendance a JOIN subjects s ON a.subject_code = s.subject_code " +
46                     "WHERE a.enroll_no = ? AND a.month = ?");
47                 ps2.setString(1, enrollNo);
48                 ps2.setString(2, month);
49                 ResultSet rs2 = ps2.executeQuery();
50
51                 out.println("<table>");
52                 out.println("<tr><th>Subject</th><th>Total Classes</th> " +
53                     "<th>Attended</th><th>Percentage</th><th>Status</th></tr>");
54
55                 while(rs2.next()) {
56                     String subjectName = rs2.getString("subject_name");
57                     int totalClasses = rs2.getInt("total_classes");
58                     int attendedClasses = rs2.getInt("attended_classes");
59                     double percentage = rs2.getDouble("percentage");
60                     String status = percentage >= 75 ? "Good" : "Poor";
61                     String rowColor = percentage >= 75 ? "lightgreen" : "lightcoral";
62
63                     out.println("<tr style='background-color:" + rowColor + "'>");
64                     out.println("<td>" + subjectName + "</td>");
65                     out.println("<td>" + totalClasses + "</td>");
66                     out.println("<td>" + attendedClasses + "</td>");
67                     out.println("<td>" + percentage + "%</td>");
68                     out.println("<td>" + status + "</td>");
69                     out.println("</tr>");
70                 }
71
72                 out.println("</table>");
73                 con.close();
74

```

```

75         } catch(Exception e) {
76             out.println("<p style='color:red'>Error: " + e.getMessage() + "</p>");
77         }
78     }
79     %>
80
81     <br />
82     <a href="attendance.html">Check Another Student</a>
83 </body>
84 </html>

```

Mnemonic

“JSP Database Query Display Table”

Question 4(a OR) [3 marks]

Explain implicit objects in JSP.

Solution

Table 13. JSP Implicit Objects

Object	Type	Purpose
request	HttpServletRequest	Gets request data
response	HttpServletResponse	Sends response
out	JspWriter	Output to client
session	HttpSession	Session management
application	ServletContext	Application scope
config	ServletConfig	Servlet configuration
pageContext	PageContext	Page scope access
page	Object	Current servlet instance
exception	Throwable	Error page exception

Key Features:

- **Automatic:** Available without declaration.
- **Scope Access:** Different scope levels.
- **Request Handling:** Input/output operations.
- **Session Management:** User session tracking.

Mnemonic

“Request Response Out Session Application”

Question 4(b OR) [4 marks]

Explain why JSP is preferred over servlet.

Solution

Table 14. JSP Advantages over Servlet

Aspect	JSP Advantage
Development	Easier HTML integration
Maintenance	Separates presentation from logic
Compilation	Automatic compilation
Modification	No server restart needed
Design	Web designer friendly
Code Reuse	Tag libraries and custom tags

Key Points:

- **Separation of Concerns:** Clear separation of presentation and business logic.
- **Rapid Development:** Faster development cycle.
- **Designer Friendly:** Web designers can work with HTML-like syntax.
- **Automatic Features:** Container handles compilation and lifecycle.

Mnemonic

“Easy HTML Automatic Designer Friendly”

Question 4(c OR) [7 marks]

Develop a JSP program to display the grade of a student by accepting the marks of five subjects.

Solution

Input Form (gradeInput.html):

```

1  <!DOCTYPE html>
2  <html>
3  <head>
4      <title>Student Grade Calculator</title>
5  </head>
6  <body>
7      <h2 style="text-align: center;">Student Grade Calculator</h2>
8      <form action="gradeCalculator.jsp" method="post">
9          <table border="1">
10             <tr>
11                 <td>Student Name:</td>
12                 <td><input type="text" name="studentName" required></td>
13             </tr>
14             <!-- Subject inputs (1-5) -->
15             <tr>
16                 <td>Subject 1 Marks:</td>
17                 <td><input type="number" name="marks1" min="0" max="100" required></td>
18             </tr>
19             <!-- Repeat for marks2 to marks5 -->
20             <tr>
21                 <td colspan="2" style="text-align: center;">
22                     <input type="submit" value="Calculate Grade">
23                 </td>
24             </tr>
25         </table>
26     </form>

```

```
27 </body>
28 </html>
```

JSP Grade Calculator (gradeCalculator.jsp):

```
1 <%@ page contentType="text/html; charset=UTF-8" %>
2 <html>
3 <head>
4     <title>Grade Result</title>
5 </head>
6 <body>
7     <h2 style="text-align: center;">Grade Report</h2>
8
9     <%
10         String studentName = request.getParameter("studentName");
11
12         // Get marks
13         int marks1 = Integer.parseInt(request.getParameter("marks1"));
14         int marks2 = Integer.parseInt(request.getParameter("marks2"));
15         int marks3 = Integer.parseInt(request.getParameter("marks3"));
16         int marks4 = Integer.parseInt(request.getParameter("marks4"));
17         int marks5 = Integer.parseInt(request.getParameter("marks5"));
18
19         // Calculate total and percentage
20         int totalMarks = marks1 + marks2 + marks3 + marks4 + marks5;
21         double percentage = totalMarks / 5.0;
22
23         // Determine grade
24         String grade;
25         if(percentage >= 90) grade = "A+";
26         else if(percentage >= 80) grade = "A";
27         else if(percentage >= 70) grade = "B";
28         else if(percentage >= 60) grade = "C";
29         else if(percentage >= 50) grade = "D";
30         else grade = "F";
31
32         String result = percentage >= 50 ? "PASS" : "FAIL";
33     %>
34
35     <table>
36         <tr><th colspan="2">Student Information</th></tr>
37         <tr><td><strong>Name:</strong></td><td><%= studentName %></td></tr>
38         <tr><th colspan="2">Result Summary</th></tr>
39         <tr><td><strong>Total Marks:</strong></td><td><%= totalMarks %> / 500</td></tr>
40         <tr><td><strong>Percentage:</strong></td><td><%= String.format("%.2f", percentage)
41         ↪ %></td></tr>
42         <tr><td><strong>Grade:</strong></td><td><%= grade %></td></tr>
43         <tr><td><strong>Result:</strong></td><td><%= result %></td></tr>
44     </table>
45 </body>
46 </html>
```

Mnemonic

“Calculate Total Percentage Grade Result”

Question 5(a) [3 marks]

Explain Aspect-oriented programming (AOP).

Solution

AOP is programming paradigm that separates cross-cutting concerns from business logic using aspects.

Table 15. AOP Core Concepts

Concept	Description
Aspect	Module encapsulating cross-cutting concern
Join Point	Point in program execution
Pointcut	Set of join points
Advice	Action taken at join point
Weaving	Process of applying aspects

Key Benefits:

- **Separation:** Separates business logic from system services.
- **Modularity:** Improves code modularity.
- **Reusability:** Cross-cutting concerns are reusable.
- **Maintenance:** Easier to maintain and modify.

Mnemonic

“Aspect Join Pointcut Advice Weaving”

Question 5(b) [4 marks]

List various features of Servlet.

Solution**Table 16.** Servlet Features

Feature	Description
Platform Independent	Runs on any server supporting Java
Server Independent	Works with different web servers
Protocol Independent	Supports HTTP, HTTPS, FTP
Persistent	Remains in memory between requests
Robust	Strong memory management
Secure	Built-in security features
Portable	Write once, run anywhere
Powerful	Full Java API access

Key Points:

- **Performance:** Better performance than CGI.
- **Memory Management:** Efficient memory usage.
- **Multithreading:** Handles multiple requests simultaneously.
- **Extensible:** Can be extended for specific protocols.

Mnemonic

“Platform Server Protocol Persistent Robust”

Question 5(c) [7 marks]

Explain Model layer, View layer and Controller layer in details.

Solution

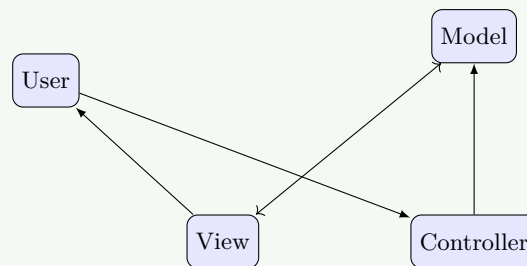


Figure 5. MVC Architecture

Table 17. MVC Layer Details

Layer	Responsibility	Components	Purpose
Model	Data and business logic	Entities, DAOs, Services	Data management
View	Presentation layer	JSP, HTML, CSS	User interface
Controller	Request handling	Servlets, Actions	Flow control

Layer Details:

- **Model:** Handles database operations, business logic, validation, and entity classes.
- **View:** Handles presentation, display logic, user interaction, and responsive design.
- **Controller:** Handles requests, flow control, model coordination, and response generation.

Benefits of MVC:

- **Separation of Concerns:** Clear responsibility division.
- **Maintainability:** Easier to maintain and modify.
- **Testability:** Each layer can be tested independently.
- **Scalability:** Supports large application development.

Mnemonic

“Model Data View Present Controller Handle”

Question 5(a OR) [3 marks]

Explain Features in Spring Boot.

Solution

Table 18. Spring Boot Features

Feature	Description
Auto Configuration	Automatic configuration based on dependencies
Starter Dependencies	Curated set of dependencies
Embedded Servers	Built-in Tomcat, Jetty servers
Production Ready	Health checks, metrics, monitoring
No XML Configuration	Annotation-based configuration
Developer Tools	Hot reloading, automatic restart

Key Benefits:

- **Rapid Development:** Quick project setup and development.
- **Convention over Configuration:** Sensible defaults.
- **Microservices Ready:** Easy microservices development.

Mnemonic

“Auto Starter Embedded Production Annotation Developer”

Question 5(b OR) [4 marks]

Write Short note on JSP scripting elements.

Solution

Table 19. JSP Scripting Elements

Element	Syntax	Purpose
Scriptlet	<% %>	Java code execution
Expression	<%= %>	Output value
Declaration	<%! %>	Variable/method declaration
Directive	<%@ %>	Page configuration
Comment	<%-- --%>	JSP comments

Example:

```

1  <%-- JSP Comment --%>
2  <%@ page contentType="text/html" %>
3
4  <%!
5      private int counter = 0;
6  %>
7
8  <html>
9  <body>
10     <%
11         String name = "Student";
12         counter++;
13     %>
14
15     <h1><%= "Welcome " + name %></h1>
16     <p>Page visited <%= counter %> times</p>
17 </body>
18 </html>

```

Mnemonic

“Script Express Declare Direct Comment”

Question 5(c OR) [7 marks]

Explain Dependency injection (DI) and Plain Old Java Object (POJO) in details.

Solution

Dependency Injection (DI): Dependency Injection is design pattern where objects receive their dependencies from external source rather than creating them internally.

Table 20. DI Types

Type	Description	Example
Constructor	Dependencies via constructor	<code>public Service(Repo r)</code>
Setter	Dependencies via setter methods	<code>setRepo(Repo r)</code>
Field	Direct field injection	<code>@Autowired Repo r</code>

Plain Old Java Object (POJO): POJO is simple Java object that doesn't inherit from any specific framework classes or implement specific interfaces.

POJO Characteristics:

- **No inheritance:** Doesn't extend framework classes.
- **No interfaces:** Doesn't implement framework interfaces.
- **No annotations:** Can work without framework annotations.
- **Simple:** Contains only business logic and data.

Example:

```

1  // POJO Entity
2  public class Student {
3      private String name;
4      // constructors, getters, setters
5  }
6
7  // Service with DI
8  @Service
9  public class StudentService {
10     @Autowired
11     private StudentRepository repository;
12
13     public void save(Student s) {
14         repository.save(s);
15     }
16 }
```

Benefits:

- **DI:** Loose coupling, Testability, Flexibility.
- **POJO:** Simplicity, Testability, Portability, Lightweight.

Mnemonic

“DI Injects Dependencies, POJO Plain Objects”