Advanced Web Test Automation with Selenium, Java, Cucumber, TestNG, and Generative AI Integration

Automation Testing Fundamentals and Selenium WebDriver Basics

Introduction to Automation Testing

- Definition and Objectives of Automation Testing
- Benefits of Automation Testing Over Manual Testing
- Overview of Test Automation Tools in the Market

Selenium Overview

- Introduction to Selenium Suite (Selenium IDE, WebDriver, Selenium Grid)
- Advantages of Selenium over Other Tools

Setting Up the Selenium Environment

- Installing Required Tools
- Downloading and Installing Java JDK
- Setting Up IDE (Eclipse/IntelliJ)
- Configuring Maven for Dependency Management

Adding Selenium Dependencies

- Using Maven Repository for Selenium
- Adding Related Dependencies (TestNG, Cucumber, WebDriver Manager)

Introduction to Browser Drivers

- Understanding ChromeDriver, GeckoDriver, EdgeDriver, etc.
- Setting Up Drivers for Different Browsers

Selenium WebDriver Architecture

Architecture Overview

- Components of Selenium WebDriver
- Communication Between Browser and Selenium
- Role of Browser Drivers in Test Execution

How WebDriver Works

- Understanding HTTP Requests and Responses
- Interacting with Web Elements Through DOM

Locators in Selenium

Introduction to Locators

- Types of Locators: ID, Name, ClassName, TagName, LinkText, PartialLinkText, CSS Selector, XPath

Writing Effective Locators

- Basic vs Advanced XPath
- CSS Selector Syntax and Usage
- Using Browser Developer Tools to Identify Locators

Dynamic Locators

- Handling Dynamic Web Elements
- Writing Parameterized XPath and CSS Selectors

Selenium WebDriver Commands

Browser Commands

- Opening and Closing Browsers
- Navigating Between URLs (get(), navigate().to(), back(), forward(), refresh())

Web Element Commands

- Interacting with Input Fields, Buttons, Checkboxes, and Radio Buttons
- Handling Drop-Downs Using Select Class
- Retrieving Text and Attributes from Web Elements

Handling Web Elements

Pop-ups and Alerts

- Handling JavaScript Alerts and Confirm Boxes
- Working with Authentication Pop-ups

Frames and Windows

- Switching Between Frames Using WebDriver
- Handling Multiple Windows and Browser Tabs

Dynamic Web Elements

- Handling Stale Element Exceptions
- Working with Elements That Load Dynamically

Synchronization in Selenium

Importance of Synchronization in Test Automation

Types of Waits

- Implicit Wait
- Explicit Wait Using WebDriverWait
- Fluent Wait for Customized Waiting Conditions

Advanced User Interactions

Actions Class

- Performing Mouse Hover and Drag-and-Drop
- Right-Click, Double-Click, and Key Press Operations

Keyboard and Mouse Actions

- Sending Special Keys Using Keys Class
- Handling Complex Mouse Interactions

Working with Tables

Extracting Data from Web Tables

- Identifying Table Rows and Columns
- Iterating Through Table Data
- Validating Specific Values in a Table

Taking Screenshots

- Capturing Screenshots for Test Reports
- Using getScreenshotAs() Method
- Saving Screenshots to Desired Locations
- Full-Page vs Element-Specific Screenshots

Logging and Debugging in Selenium

Logging Test Execution Details

- Integrating Log4j for Logging
- Generating Debug and Info Logs

Debugging Selenium Tests

- Using Breakpoints and Debug Mode in IDE
- Identifying and Fixing Common Selenium Errors

GenAI-Powered Features in Selenium WebDriver

AI-Powered Locator Suggestions

- Using GenAI to Generate Efficient Locators
- Automating Locator Identification with GenAI

Dynamic Test Script Enhancements

- AI-Assisted Suggestions for Synchronization
- Predictive Maintenance of Locators and Test Flows

TestNG Framework and Advanced Selenium

Introduction to TestNG

- Overview of TestNG and Its Benefits
- Setting Up TestNG in a Maven Project
- Writing and Executing TestNG Test Cases

Annotations in TestNG

- Common Annotations: @Test, @BeforeSuite, @AfterSuite, @BeforeMethod, @AfterMethod
- Using TestNG Groups for Organizing Tests

Parameterization in TestNG

- Using Parameters in TestNG
- XML Parameterization
- @DataProvider for Data-Driven Testing
- Passing Data to Tests Dynamically

TestNG Reports

- Generating HTML Reports
- Understanding Default Reports
- Customizing Reports with ReportNG and ExtentReports

Advanced Selenium Concepts

Synchronization Techniques

- Using Wait Commands in Selenium (Implicit, Explicit, Fluent Waits)
- Handling Race Conditions and Dynamic Loading

Browser-Specific Features

- Testing Across Multiple Browsers

- Browser Profiles and Options

GenAI in Test Execution

AI-Driven Synchronization Optimization

- Predictive Wait Suggestions Using GenAI

Enhanced Logging and Reporting

- AI-Generated Failure Analysis Reports

Behavior-Driven Development (BDD) with Cucumber

- Understanding BDD
- Benefits of Adopting BDD for Automation
- Key Features of Cucumber Framework

Writing Feature Files

- Gherkin Language Basics
- Writing Scenarios and Scenario Outlines
- Using Given-When-Then Syntax

Tags in Cucumber

- Organizing Tests with Tags
- Running Tagged Tests

Step Definitions in Java

- Connecting Feature Files to Code
- Writing Step Definitions
- Parameterizing Steps with Placeholders

Data Tables in Step Definitions

- Handling Tabular Data in Tests

Hooks in Cucumber

Pre- and Post-Test Execution

- Using @Before and @After Hooks
- Handling Complex Test Setup and Cleanup

GenAI Integration with Cucumber

AI for Feature File Generation

- Automating Feature File Creation Using GenAI

Dynamic Step Definitions

- AI-Assisted Suggestions for Writing Step Definitions

Intelligent Test Data Generation

- Generating Complex Data Structures Dynamically

Test Automation Framework Design Principles

Scalability and Reusability

- Importance of Modular Test Design
- Adopting Best Practices for Framework Development

Page Object Model (POM)

- Understanding POM
- Separating Test Logic from Page Interactions
- Implementing POM in Selenium

Data-Driven Testing

- Using External Data Sources
- Integrating Excel, CSV, and JSON Files
- Using Apache POI for Data-Driven Testing

Keyword-Driven Testing

- Creating Reusable Keywords
- Writing Keyword Libraries for Automation
- Organizing Keywords in Frameworks

GenAI-Driven Framework Optimization

- AI-Assisted Refactoring
- Improving Framework Design with AI
- Dynamic Test Script Updates Using AI

Integration with CI/CD and Cross-Browser Testing

Jenkins Setup for Test Automation

- Configuring Test Automation Jobs in Jenkins
- Automating Test Execution as Part of CI/CD Pipelines

Cross-Browser Testing using Selenium Grid

- Setting Up Selenium Grid for Parallel Testing
- Configuring Node and Hub for Multi-Browser Testing

Mobile Automation Basics Introduction to Appium

- Setting Up Appium for Mobile Testing
- Running Simple Mobile Automation Scripts

GenAI in Test Infrastructure AI-Optimized Test Suite Execution

- Dynamic Selection of Test Cases for Regression Using AI

AI-Assisted Cross-Browser Compatibility Analysis

- Identifying Browser-Specific Issues Using AI

Generative AI in Test Automation

Overview of GenAI Tools

- Popular GenAI APIs for Testing
- OpenAI API, Azure Cognitive Services
- Setting Up APIs for Automation

AI-Powered Test Case Generation

- Generating Test Cases Using AI
- Automating Test Case Design for New Features
- Handling Edge Cases with AI Insights

AI-Driven Locator and Assertion Generation

- Dynamic Locator Suggestions
- Automating Locator Creation for Web Elements
- Intelligent Assertions
- AI-Powered Suggestions for Assertion Statements

Test Script Maintenance

- Predictive Test ScriptUpdates
- Using AI for Locator and Script Maintenance
- Automating Framework Upgrades with GenAI

Real-World Projects and Best Practices

End-to-End Project Implementation

- Automating a Web Application
- Developing a Complete Test Framework
- Running Tests and Generating Reports

Best Practices in Test Automation

Designing Robust Test Scripts

- Handling Dynamic Web Elements and Synchronization

Future Trends in Test Automation

- AI and ML in Testing
- Preparing for Next-Gen Testing Challenges

Course Deliverables

- Comprehensive Test Automation Framework
- AI-Powered Test Automation Solutions
- Hands-On Practice with Selenium, TestNG, Cucumber, and GenAI Integration