**Selenium Notes**

**1. What is Selenium?**

* **Selenium** is an **open-source automation testing tool** for web applications.
* Supports multiple **programming languages**: Java, Python, C#, Ruby, JavaScript.
* Runs on **multiple browsers**: Chrome, Firefox, Edge, Safari.
* Works across **different operating systems**: Windows, macOS, Linux.

**2. Selenium Components**

1. **Selenium IDE**
   * A browser plugin (Chrome/Firefox).
   * Record and playback tool.
   * Good for beginners, not used much in advanced automation.
2. **Selenium WebDriver**
   * Core API for browser automation.
   * Directly interacts with the browser without a separate server.
   * Supports multiple browsers and programming languages.
3. **Selenium Grid**
   * Used for **parallel execution** and **distributed testing**.
   * Allows running tests on multiple machines, browsers, and OS combinations.

**3. Features of Selenium**

* **Cross-browser testing** (Chrome, Firefox, Edge, etc.).
* **Cross-platform testing** (Windows, macOS, Linux).
* Integration with **TestNG/JUnit** for test management.
* Integration with **Maven/Gradle** for build management.
* Supports **parallel execution**.
* Works with **CI/CD tools** like Jenkins.

**4. Selenium WebDriver Architecture**

* **Language Bindings**: Libraries for different programming languages.
* **JSON Wire Protocol / W3C Protocol**: Communication between client and server.
* **Browser Drivers**: ChromeDriver, GeckoDriver (Firefox), EdgeDriver, etc.
* **Browsers**: Actual web browsers where tests run.

**5. Locators in Selenium**

Used to find elements on a webpage.

| **Locator Type** | **Example** | **Description** |
| --- | --- | --- |
| **ID** | driver.findElement(By.id("username")) | Selects by element's ID. |
| **Name** | driver.findElement(By.name("password")) | Selects by name attribute. |
| **Class Name** | driver.findElement(By.className("login-btn")) | Selects by class attribute. |
| **Tag Name** | driver.findElement(By.tagName("input")) | Selects by HTML tag. |
| **Link Text** | driver.findElement(By.linkText("Home")) | Selects by full link text. |
| **Partial Link Text** | driver.findElement(By.partialLinkText("Ho")) | Selects by partial link text. |
| **CSS Selector** | driver.findElement(By.cssSelector("input#username")) | Uses CSS rules. |
| **XPath** | driver.findElement(By.xpath("//input[@id='username']")) | Uses XML path syntax. |

**6. WebDriver Commands**

**Browser Commands**

driver.get("https://example.com");

driver.getTitle();

driver.getCurrentUrl();

driver.close();

driver.quit();

**Element Commands**

driver.findElement(By.id("username")).sendKeys("admin");

driver.findElement(By.id("password")).clear();

driver.findElement(By.id("login")).click();

driver.findElement(By.id("msg")).getText();

**7. Waits in Selenium**

* **Implicit Wait**: Waits for a certain amount of time before throwing NoSuchElementException.

driver.manage().timeouts().implicitlyWait(10, TimeUnit.SECONDS);

* **Explicit Wait**: Waits for specific conditions to be met.

WebDriverWait wait = new WebDriverWait(driver, Duration.ofSeconds(10));

wait.until(ExpectedConditions.visibilityOfElementLocated(By.id("username")));

* **Fluent Wait**: Similar to Explicit Wait but allows polling intervals.

**8. Handling Web Elements**

* **Dropdowns**: Use Select class.
* **Alerts**: Use driver.switchTo().alert().
* **Frames**: Use driver.switchTo().frame(index/name/WebElement).
* **Windows/Tabs**: Use driver.getWindowHandles() and driver.switchTo().window().

**9. Test Framework Integration**

* **TestNG** / **JUnit**: For organizing tests, assertions, and generating reports.
* Example TestNG structure:

@BeforeTest // Setup

@Test // Test Case

@AfterTest // Tear down

**10. Advantages of Selenium**

* Free and open-source.
* Supports multiple languages and browsers.
* Active community support.
* Works with many CI/CD tools.

**11. Limitations of Selenium**

* Only works for **web applications** (no desktop/mobile apps without integration).
* No built-in reporting (needs TestNG/Extent Reports).
* Steep learning curve for beginners.