



*CS6474: Software Testing Laboratory
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Contents

| | |
|---|----------|
| 1 Selenium | 2 |
| 1.1 IRCTC | 2 |
| 1.1.1 IRCTC pytest code | 2 |
| 1.2 MyGOV | 4 |
| 1.2.1 MyGov pytest code | 4 |
| 1.3 CoWin | 5 |
| 1.3.1 CoWIN pytest code | 5 |
| 1.4 GFG | 6 |
| 1.4.1 Failure | 7 |
| 1.5 Sarkariresult | 7 |
| 1.5.1 Failed Case | 7 |
| 1.6 UIDAI | 7 |
| 1.6.1 UIDAI pytest code | 7 |
| 1.7 Nasa | 9 |
| 1.7.1 Command Used | 9 |
| 1.7.2 Nasa pytest code | 9 |
| 1.8 Tutorialspoint | 10 |
| 1.8.1 tutorialsoint pytest code | 10 |
| 1.9 Passort Seva Kendra | 11 |
| 1.9.1 Passort Seva Kendra pytest code | 11 |
| 1.10 Wikipedia | 12 |
| 1.10.1 Wikipedia pytest code | 13 |
| 1.11 Zimbra | 14 |
| 1.11.1 Zimbra pytest code | 14 |
| 1.12 EDX | 15 |
| 1.12.1 EDX pytest code | 15 |
| 1.13 LeetCode | 16 |
| 1.13.1 LeetCode pytest code | 16 |
| 1.14 Allnovel | 18 |

| | | |
|---------------------------------|--------------------------------------|-----------|
| 1.14.1 | Allnovel pytest code | 18 |
| 1.15 | Coursera | 19 |
| 1.15.1 | Failed | 19 |
| 2 | Selenium RC | 21 |
| 2.1 | Calculator.net | 22 |
| 2.1.1 | Selenium RC calculator | 22 |
| 2.2 | Coursera | 23 |
| 2.2.1 | Selenium RC Coursera | 23 |
| 2.3 | IRCTC | 24 |
| 2.3.1 | Selenium RC IRCTC | 24 |
| 2.4 | Allnovel | 25 |
| 2.4.1 | Selenium RC Allnovel | 25 |
| 2.5 | EDX | 26 |
| 2.5.1 | Selenium RC EDX | 26 |
| 2.6 | Geeksforgeeks | 27 |
| 2.6.1 | Selenium RC Geeksforgeeks | 27 |
| 2.7 | Leetcode | 28 |
| 2.7.1 | Selenium RC Leetcode | 28 |
| 2.8 | NASA | 29 |
| 2.8.1 | Selenium RC NASA | 29 |
| 2.9 | MyGov | 30 |
| 2.9.1 | Selenium RC MyGov | 30 |
| 2.10 | PassportIndia | 31 |
| 2.10.1 | Selenium RC PassportIndia | 31 |
| 2.11 | Sarkariresult | 32 |
| 2.11.1 | Selenium RC Sarkariresult | 32 |
| 2.12 | Tutorialspoint | 33 |
| 2.12.1 | Selenium RC Tutorialspoint | 33 |
| 2.13 | Wikipedia | 34 |
| 2.13.1 | Selenium RC wikipedia | 34 |
| 222CS3113 Bishwajit Prasad Gond | | 2 |

| | |
|---|-----------|
| 2.14 UIDAI | 35 |
| 2.14.1 Selenium RC UIDAI | 35 |
| 2.15 Zimbra | 36 |
| 2.15.1 Selenium RC Zimbra | 36 |
| 3 Selenium WebDriver | 38 |
| 3.1 Google Search | 39 |
| 3.1.1 Selenium WebDriver google search | 39 |
| 3.2 Calculator.net | 40 |
| 3.2.1 Selenium WebDriver calculator | 40 |
| 3.3 Coursera | 41 |
| 3.3.1 Selenium WebDriver Coursera | 41 |
| 3.4 IRCTC | 42 |
| 3.4.1 Selenium WebDriver IRCTC | 42 |
| 3.5 Allnovel | 43 |
| 3.5.1 Selenium WebDriver Allnovel | 43 |
| 3.6 EDX | 44 |
| 3.6.1 Selenium WebDriver EDX | 44 |
| 3.7 Geeksforgeeks | 45 |
| 3.7.1 Selenium WebDriver Geeksforgeeks | 45 |
| 3.8 Youtube | 46 |
| 3.8.1 Selenium WebDriver Youtube | 46 |
| 3.9 Indgovtjobs | 47 |
| 3.9.1 Selenium WebDriver indgovtjobs | 47 |
| 3.10 MyGov | 48 |
| 3.10.1 Selenium WebDriver MyGov | 48 |
| 3.11 PassportIndia | 49 |
| 3.11.1 Selenium WebDriver PassportIndia | 49 |
| 3.12 Wikipedia | 50 |
| 3.12.1 Selenium WebDriver wikipedia | 51 |
| 3.13 UIDAI | 52 |
| 222CS3113 Bishwajit Prasad Gond | 3 |

| | |
|---|-----------|
| 3.13.1 Selenium WebDriver UIDAI | 52 |
| 3.14 Zimbra | 53 |
| 3.14.1 Selenium WebDriver Zimbra | 53 |
| 3.15 Maxdroid | 54 |
| 3.15.1 Selenium WebDriver Maxdroid | 54 |
| 4 Cuckoo Sandbox | 57 |
| 4.0.1 Tcases CMD command | 57 |
| 4.1 Command Explanation | 59 |
| 4.1.1 Sudo apt update | 59 |
| 4.1.2 Sudo apt upgrade | 59 |
| 4.1.3 sudo apt-get install python python-pip python-dev libffi-dev libssl-dev . | 60 |
| 4.1.4 sudo apt-get install python-virtualenv python-setuptools | 60 |
| 4.1.5 sudo apt-get install libjpeg-dev zlib1g-dev swig | 60 |
| 4.1.6 sudo apt-get install mongodb | 60 |
| 4.1.7 sudo apt-get install postgresql libpq-dev | 60 |
| 4.1.8 sudo apt install virtualbox | 60 |
| 4.1.9 virtualbox | 60 |
| 4.1.10 Create vboxnet0 | 60 |
| 4.1.11 sudo apt-get install tcpdump apparmor-utils | 60 |
| 4.1.12 sudo usermod -a -G pcap cuckoo | 61 |
| 4.1.13 sudo setcap cap_net_raw,cap_net_admin=eip /usr/sbin/tcpdump | 61 |
| 4.1.14 getcap /usr/sbin/tcpdump | 61 |
| 4.1.15 sudo aa-disable /usr/sbin/tcpdump | 61 |
| 4.1.16 sudo pip install m2crypto | 61 |
| 4.1.17 sudo usermod -a -G vboxusers cuckoo | 61 |
| 4.1.18 cuckoo-setup-virtualenv.sh | 61 |
| 4.1.19 sudo –u cuckoo ./cuckoo-setup-virtualenv.sh | 61 |
| 4.1.20 source /.bashrc | 61 |
| 4.1.21 mkvirtualenv –p python2.7 cuckoo-test | 62 |
| 4.1.22 pip install –U pip setuptools | 62 |

| | |
|---|----|
| 4.1.23 pip install -U cuckoo | 62 |
| 4.1.24 wget https://cuckoo.sh/win7ultimate.iso | 62 |
| 4.1.25 ls -lah | 62 |
| 4.1.26 sudo mkdir /mnt/win7 | 62 |
| 4.1.27 sudo chown cuckoo:cuckoo /mnt/win7 | 62 |
| 4.1.28 sudo mount -o ro,loop win7ultimate.iso /mnt/win7 | 62 |
| 4.1.29 sudo apt-get -y install build-essential libssl-dev libffi-dev python-dev genisoimage | 62 |
| 4.1.30 sudo apt-get -y install zlib1g-dev libjpeg-dev | 63 |
| 4.1.31 sudo apt-get -y install python-pip python-virtualenv python-setuptools swig | 63 |
| 4.1.32 pip install -U vmcloak | 63 |
| 4.1.33 vmcloak | 63 |
| 4.1.34 vmcloak-vboxnet0 | 63 |
| 4.1.35 vmcloak init --verbose --win7x64 win7x64base --cpus 2 --ramsize 2048 . | 63 |
| 4.1.36 vmcloak clone win7x64base win7x64cuckoo | 63 |
| 4.1.37 vmcloak install win7x64cuckoo ie11 | 63 |
| 4.1.38 vmcloak snapshot --count 1 win7x64cuckoo 192.168.56.101 | 63 |
| 4.1.39 vmcloak list vms | 64 |
| 4.1.40 cuckoo init | 64 |
| 4.1.41 cd ./cuckoo/ | 64 |
| 4.1.42 ls | 64 |
| 4.1.43 cd conf/ | 64 |
| 4.1.44 ls | 64 |
| 4.1.45 cuckoo community | 64 |
| 4.1.46 nano virtualbox.conf | 64 |
| 4.1.47 make mode = gui | 64 |
| 4.1.48 while read -r vm ip; do cuckoo machine --add \$vm \$ip; done <<(vmcloak list vms) | 64 |
| 4.1.49 nano virtualbox.conf | 65 |
| 4.1.50 sudo sysctl -w net.ipv4.conf.vboxnet0.forwarding=1 | 65 |
| 4.1.51 sudo sysctl -w net.ipv4.conf.eth0.forwarding=1 | 65 |

| | | |
|----------|---|-----------|
| 4.1.52 | workon cuckoo-test | 65 |
| 4.1.53 | cuckoo rooter –sudo –group cuckoo | 65 |
| 4.1.54 | nano routing.conf | 66 |
| 4.1.55 | workon cuckoo-test | 66 |
| 4.1.56 | cuckoo | 67 |
| 4.1.57 | workon cuckoo-test | 67 |
| 4.1.58 | cuckoo web –host 127.0.0.1 –port 8080 | 67 |
| 5 | Tcases | 70 |
| 5.0.1 | Tcases CMD command | 70 |
| 5.1 | Annotations-Test | 70 |
| 5.1.1 | Specification | 70 |
| 5.1.2 | XML Code | 70 |
| 5.2 | Ice-Cream Input | 72 |
| 5.2.1 | Specification | 72 |
| 5.2.2 | XML Code | 72 |
| 5.3 | Tcases-Input | 75 |
| 5.3.1 | Specification | 75 |
| 5.3.2 | Tcases XML Code | 77 |
| 5.4 | Find-Input | 82 |
| 5.4.1 | Specification | 82 |
| 5.4.2 | Find-Input XML Code | 83 |
| 6 | JCute | 87 |
| 6.1 | Checking prime numbers, odd numbers, or even numbers. | 87 |
| 6.2 | Checking odd numbers, or even numbers. | 89 |
| 6.3 | Calculator based on floating-point 32-bit numbers. | 91 |
| 6.4 | Reverse an array. | 93 |
| 6.5 | Decimal to hexadecimal. | 95 |
| 6.6 | Grade students based on marks. | 97 |

| | |
|---|------------|
| 7 Jumble | 100 |
| 7.1 Write a program to generate a Factorial of numbers (where stack length should be at 3 (max)). The numbers should be 5, 3, 8, and 15. | 101 |
| 7.2 Write a program to generate Fibonacci numbers. | 102 |
| 7.3 Write a program that performs sorting of a group of integer values using the quick sort technique. | 103 |
| 7.4 Write a program that accepts elements of a matrix and displays its transpose. | 104 |
| 7.5 Write a program to add two matrices and display the sum matrix. | 105 |
| 7.6 Write a program to Print Prime Numbers from 1 to 100 using Scanner Class and For Loop. | 106 |
| 7.7 Write a program to generate a palindrome of numbers. | 107 |
| 7.8 Write a program to find out the sum of two arrays. | 108 |
| 7.9 Write a program to check whether the number is even or odd. | 109 |
| 7.10 Write a program for binary to hexadecimal conversion. | 110 |
| 8 JMeter | 112 |
| 8.1 NITRKL Stress Testing Using Constant Timer | 113 |
| 8.2 Sending Mail to another mail using SMTP Sampler | 115 |
| 8.3 Using Loop Controller to Google.com | 117 |
| 8.4 Json Extractor | 119 |
| 8.5 While Controller | 122 |
| 8.6 Facebook | 124 |
| 8.7 Mail Reader Sampler | 126 |
| 8.8 Regular Expression Extractor | 128 |
| 8.9 Java Request | 130 |
| 8.10 Duration Assertion | 132 |
| 9 FindBugs | 135 |
| 9.1 Write a program to generate a Factorial of numbers (where stack length should be at 3 (max)). The numbers should be 5, 3, 8, and 15. | 136 |
| 9.2 Write a program to generate Fibonacci numbers. | 136 |
| 9.3 Write a program that performs sorting of a group of integer values using the quick sort technique. | 137 |

| | | |
|-----------|---|------------|
| 9.4 | Write a program that accepts elements of a matrix and displays its transpose. | 137 |
| 9.5 | Write a program to add two matrices and display the sum matrix. | 138 |
| 9.6 | Write a program to Print Prime Numbers from 1 to 100 using Scanner Class and For Loop. | 138 |
| 9.7 | Write a program to generate a palindrome of numbers. | 139 |
| 9.8 | Write a program to find out the sum of two arrays. | 139 |
| 9.9 | Write a program to check whether the number is even or odd. | 140 |
| 9.10 | Write a program for binary to hexadecimal conversion. | 140 |
| 10 | Pytest-Cov | 142 |
| 10.1 | Write a program to generate a Factorial of numbers (where stack length should be at 3 (max)). The numbers should be 5, 3, 8, and 15. | 143 |
| 10.2 | Write a program to generate Fibonacci numbers. | 144 |
| 10.3 | Write a program that performs sorting of a group of integer values using the quick sort technique. | 145 |
| 10.4 | Write a program that accepts elements of a matrix and displays its transpose. | 146 |
| 10.5 | Write a program to add two matrices and display the sum matrix. | 147 |
| 10.6 | Write a program to Print Prime Numbers from 1 to 100 using Scanner Class and For Loop. | 148 |
| 10.7 | Write a program to generate a palindrome of numbers. | 149 |
| 10.8 | Write a program to find out the sum of two arrays. | 150 |
| 10.9 | Write a program to check whether the number is even or odd. | 151 |
| 10.10 | Write a program for binary to hexadecimal conversion. | 152 |
| 11 | Previous Year Lab Exam Questions | 153 |

CS6474: Software Testing Laboratory 2023

SELENIUM

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1 Selenium

Selenium is a free (open-source) automated testing framework used to validate web applications across different browsers and platforms. You can use multiple programming languages like Java, C#, Python, etc to create Selenium Test Scripts. Testing done using the Selenium testing tool is usually referred to as Selenium Testing.

Selenium Tool Suite

Selenium Software is not just a single tool but a suite of software, each piece catering to different Selenium QA testing needs of an organization. Here is the list of tools

- Selenium Integrated Development Environment (IDE)
- Selenium Remote Control (RC)
- WebDriver
- Selenium Grid

1.1 IRCTC

Selenium IDE Screenshot IRCTC website.

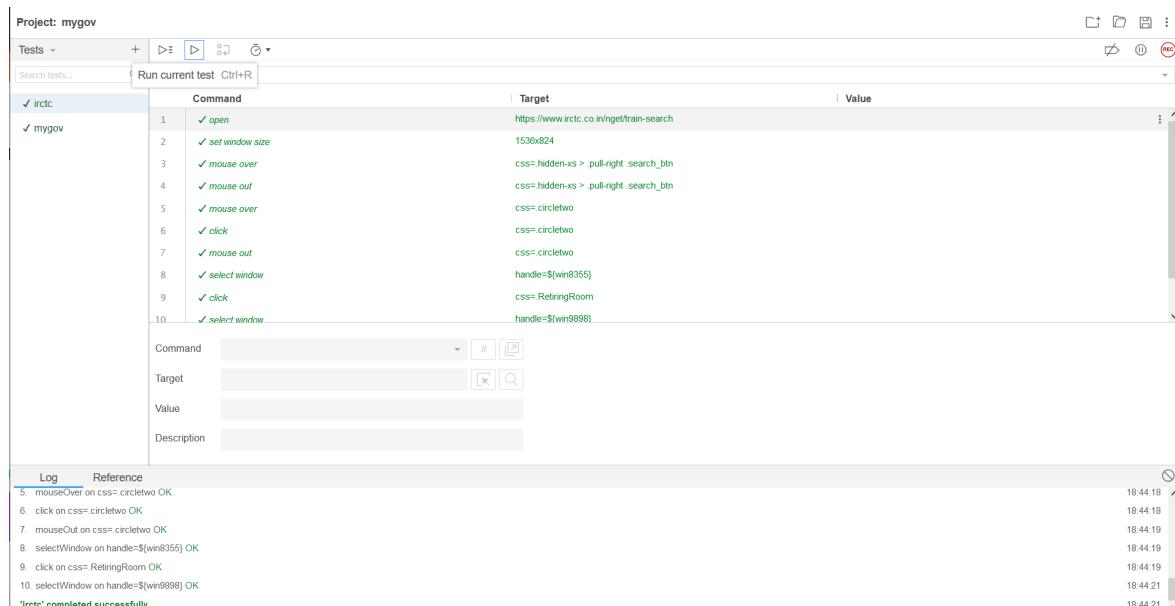


Figure 1: IRCTC Website

1.1.1 IRCTC pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver

```

```

6  from selenium.webdriver.common.by import By
7  from selenium.webdriver.common.action_chains import ActionChains
8  from selenium.webdriver.support import expected_conditions
9  from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
12     DesiredCapabilities
13
14 class TestIrctc():
15     def setup_method(self, method):
16         self.driver = webdriver.Firefox()
17         self.vars = {}
18
19     def teardown_method(self, method):
20         self.driver.quit()
21
22     def wait_for_window(self, timeout = 2):
23         time.sleep(round(timeout / 1000))
24         wh_now = self.driver.window_handles
25         wh_then = self.vars["window_handles"]
26         if len(wh_now) > len(wh_then):
27             return set(wh_now).difference(set(wh_then)).pop()
28
29     def test_irctc(self):
30         self.driver.get("https://www.irctc.co.in/nget/train-search")
31         self.driver.set_window_size(1536, 824)
32         element = self.driver.find_element(By.CSS_SELECTOR, ".hidden-
33             xs > .pull-right .search_btn")
34         actions = ActionChains(self.driver)
35         actions.move_to_element(element).perform()
36         element = self.driver.find_element(By.CSS_SELECTOR, "body")
37         actions = ActionChains(self.driver)
38         actions.move_to_element(element, 0, 0).perform()
39         element = self.driver.find_element(By.CSS_SELECTOR, "..
40             circletwo")
41         actions = ActionChains(self.driver)
42         actions.move_to_element(element).perform()
43         self.vars["window_handles"] = self.driver.window_handles
44         self.driver.find_element(By.CSS_SELECTOR, ".circletwo").click
45             ()
46         self.vars["win8355"] = self.wait_for_window(2000)
47         element = self.driver.find_element(By.CSS_SELECTOR, "body")
48         actions = ActionChains(self.driver)
49         actions.move_to_element(element, 0, 0).perform()
50         self.driver.switch_to.window(self.vars["win8355"])
51         self.vars["window_handles"] = self.driver.window_handles
52         self.driver.find_element(By.CSS_SELECTOR, ".RetiringRoom").
53             click()

```

```

49     self.vars["win9898"] = self.wait_for_window(2000)
50     self.driver.switch_to.window(self.vars["win9898"])

```

1.2 MyGOV

Selenium IDE Screenshot MyGov website.

| Log | Reference | Time |
|--|-----------|----------|
| 3. click on css= poll-icon > i OK | | 18:18:52 |
| 4. click on css= creative-list views-row nth-child(2) > .views-field nth-child(1) a OK | | 18:18:57 |
| 5. click on id=edit_search OK | | 18:18:57 |
| 6. type on id=edit_search with value republic day OK | | 18:18:59 |
| 7. click on id=edit_search_btn OK | | 18:18:59 |
| 8. click on id=edit_search_btn OK | | 18:18:59 |
| 'mygov' completed successfully | | 18:18:59 |

Figure 2: MyGov Website

1.2.1 MyGov pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
12     DesiredCapabilities
13
14 class TestMygov():
15     def setup_method(self, method):
16         self.driver = webdriver.Firefox()
17         self.vars = {}

```

```

18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_mygov(self):
22         self.driver.get("https://www.mygov.in/")
23         self.driver.set_window_size(1536, 824)
24         self.driver.find_element(By.CSS_SELECTOR, ".poll-icon > i").click()
25         self.driver.find_element(By.CSS_SELECTOR, ".creative-list .views-row:nth-child(2) > .views-field:nth-child(1) a").click()
26         self.driver.find_element(By.ID, "edit_search").click()
27         self.driver.find_element(By.ID, "edit_search").send_keys("republic day")
28         self.driver.find_element(By.ID, "edit_search_btn").click()
29         self.driver.find_element(By.ID, "edit_search_btn").click()

```

1.3 CoWin

Selenium IDE Screenshot CoWIN website.

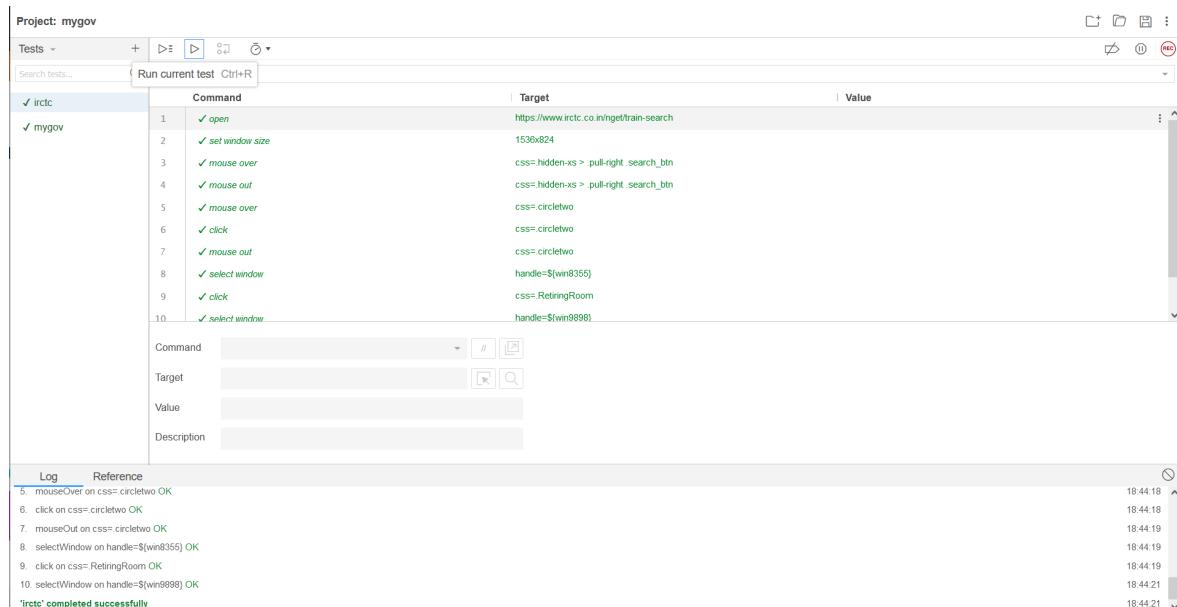


Figure 3: CoWIN Website

1.3.1 CoWIN pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json

```

```

5 from selenium import webdriver
6 from selenium.webdriver.common.by import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
    DesiredCapabilities
12
13 class TestCoWin():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_coWin(self):
22         self.driver.get("https://www.cowin.gov.in/")
23         self.driver.find_element(By.CSS_SELECTOR, ".accessibility-
            plugin-ac:nth-child(2) > .dropdownbtn").click()
24         assert self.driver.title == "CoWIN"

```

1.4 GFG

Selenium IDE Screenshot GFG website.

The screenshot shows the Selenium IDE interface with the following details:

- Project:** ANI
- Test Case:** X GFG
- Test Steps:**

| Index | Command | Target | Value |
|-------|---------------|--------------------------------|------------------|
| 1 | open | https://www.geeksforgeeks.org/ | |
| 2 | click | css=ant-input | |
| 3 | type | css=ant-input | Software Testing |
| 4 | click | css=ant-btn-lg > span | |
| 5 | X verify text | software | |
- Log Tab:**
 - Step 2: click on css=ant-input OK
 - Step 3: type on css= ant-input with value Software Testing OK
 - Step 4: click on css= ant-btn-lg > span OK
 - Step 5: Trying to find software Failed: Implicit Wait timed out after 30000ms
 - Warning: implicit locators are deprecated, please change the locator to id=software
 - 'GFG' ended with 1 error(s)

Figure 4: GFG Website

1.4.1 Failure

verify text failed because not able to verify the word software in the searched page.

1.5 Sarkariresult

Selenium IDE Screenshot of sarkariresult.com website.

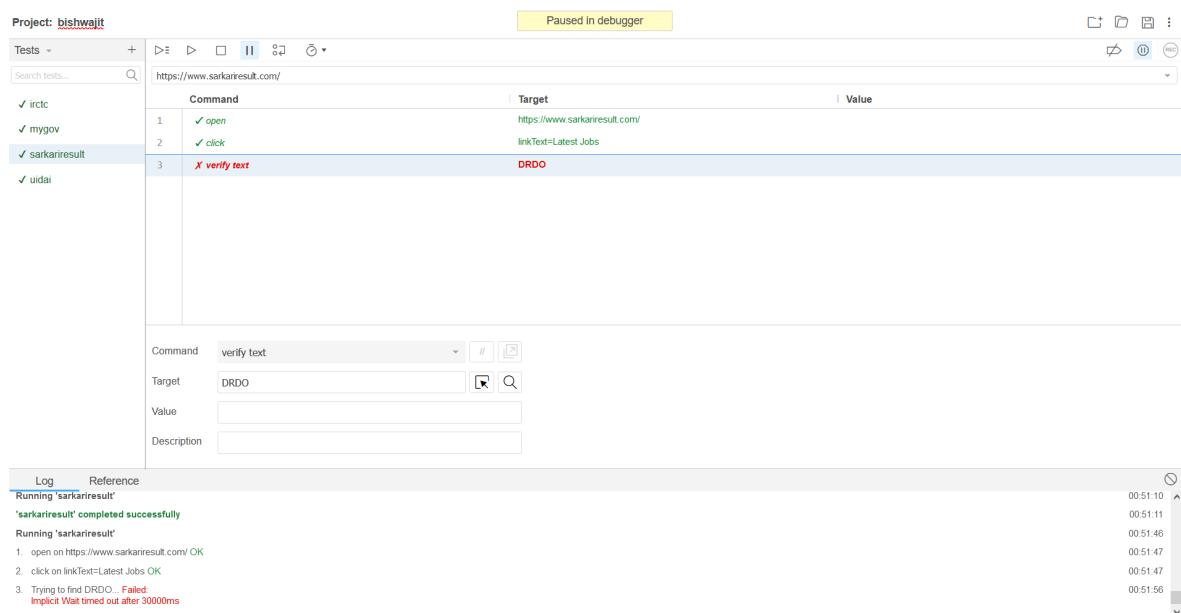


Figure 5: Sarkariresult Website

1.5.1 Failed Case

verify text failed because not able to verify the word "DRDO" in the searched page,

1.6 UIDAI

Selenium IDE Screenshot of website.

1.6.1 UIDAI pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common import By
7 from selenium.webdriver.common.action_chains import ActionChains

```

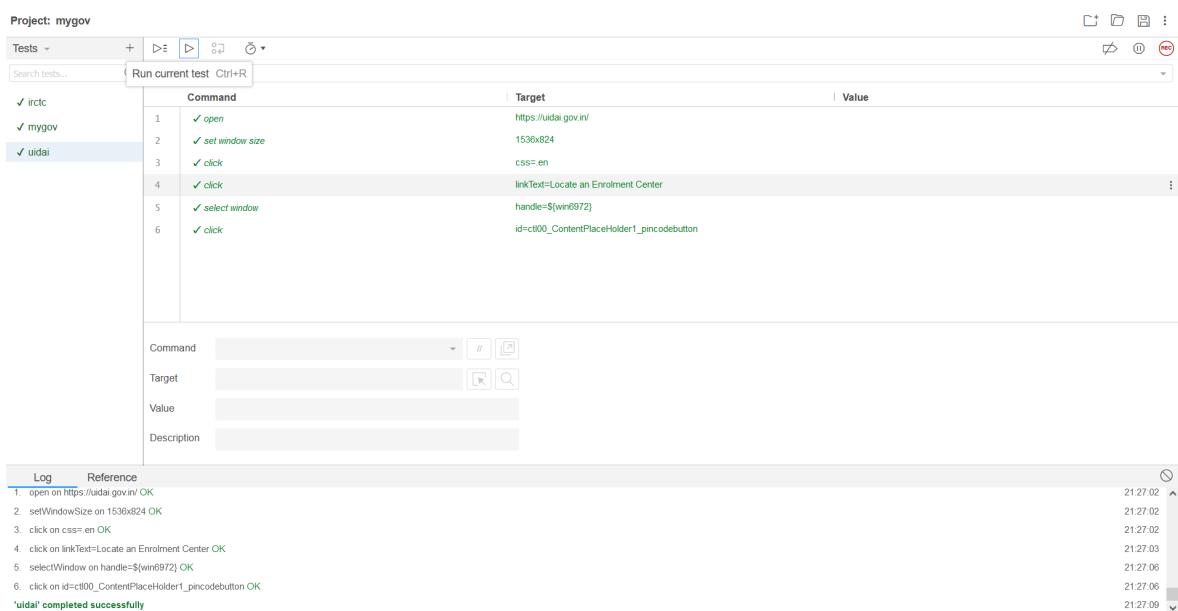


Figure 6: UIDAI Website

```

8  from selenium.webdriver.support import expected_conditions
9  from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
     DesiredCapabilities
12
13 class TestUidai():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def wait_for_window(self, timeout = 2):
22         time.sleep(round(timeout / 1000))
23         wh_now = self.driver.window_handles
24         wh_then = self.vars["window_handles"]
25         if len(wh_now) > len(wh_then):
26             return set(wh_now).difference(set(wh_then)).pop()
27
28     def test_uidai(self):
29         self.driver.get("https://uidai.gov.in/")
30         self.driver.set_window_size(1536, 824)
31         self.driver.find_element(By.CSS_SELECTOR, ".en").click()
32         self.vars["window_handles"] = self.driver.window_handles
33         self.driver.find_element(By.LINK_TEXT, "Locate an Enrolment
             Center").click()
34         self.vars["win6972"] = self.wait_for_window(2000)

```

```

35     self.driver.switch_to.window(self.vars["win6972"])
36     self.driver.find_element(By.ID, "ctl00_ContentPlaceHolder1_pincodebutton").click()

```

1.7 Nasa

Selenium IDE Screenshot of Nasa website.

The screenshot shows the Selenium IDE interface with a test case named 'nasa'. The test case contains the following steps:

| Command | Target | Value |
|----------------|---------------------------------|-------|
| 1 ✓ open | https://www.nasa.gov/ | |
| 2 ✓ click | css=dropdown:nth-child(4) span | |
| 3 ✓ mouse down | css=body | |
| 4 ✓ store text | css=nasa-tv-schedule__container | NASA |
| 5 ✓ echo | \$NASA | |

Below the test case, there are input fields for Command, Target, Value, and Description. The Log panel at the bottom shows the execution results:

```

Running 'nasa'
1. open on https://www.nasa.gov/ OK
2. click on css=dropdown:nth-child(4) span OK
3. mouseDown on css= body OK
4. storeText on css=nasa-tv-schedule__container with value NASA OK
echo: $NASA
'nasa' completed successfully

```

Figure 7: Nasa Website

1.7.1 Command Used

- echo
- store text
- mouse down

1.7.2 Nasa pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common.by import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys

```

```

11 from selenium.webdriver.common.desired_capabilities import
    DesiredCapabilities
12
13 class TestNASA():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_nasa(self):
22         self.driver.get("https://www.nasa.gov/")
23         self.driver.find_element(By.CSS_SELECTOR, ".dropdown:nth-
            child(4) span").click()
24         element = self.driver.find_element(By.CSS_SELECTOR, ".body")
25         actions = ActionChains(self.driver)
26         actions.move_to_element(element).click_and_hold().perform()
27         self.vars["NASA"] = self.driver.find_element(By.CSS_SELECTOR,
            ".nasa-tv-schedule__container").text
28         print("${NASA}")

```

1.8 Tutorialspoint

Selenium IDE Screenshot tutorialspoint.com website.

The screenshot shows the Selenium IDE interface with a recorded script for the tutorialspoint.com website. The script consists of seven commands:

| Command | Target | Value |
|---------------------|---|-------|
| 1 ✓ open | https://www.tutorialspoint.com/java/index.htm | |
| 2 ✓ set window size | 1192x649 | |
| 3 ✓ run script | window.scrollTo(0,528.6666870117188) | |
| 4 ✓ click | css=toc nth-child(3)>li:nth-child(3) | |
| 5 ✓ run script | window.scrollTo(0,888) | |
| 6 ✓ click | linkText=Java - Files and I/O | |
| 7 ✓ run script | window.scrollTo(0,1431.3333740234375) | |

Below the command table, there are input fields for Command, Target, Value, and Description. At the bottom, a log window displays the executed commands with their timestamps:

- 2. setWindowSize on 1192x649 OK 22:50:29
- 3. runScript on window.scrollTo(0,528.6666870117188) OK 22:50:29
- 4. click on css=toc nth-child(3)>li:nth-child(3) OK 22:50:35
- 5. runScript on window.scrollTo(0,888) OK 22:50:37
- 6. click on linkText=Java - Files and I/O OK 22:50:37
- 7. runScript on window.scrollTo(0,1431.3333740234375) OK 22:50:39

Figure 8: tutorialsoint Website

1.8.1 tutorialsoint pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common.by import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
    DesiredCapabilities
12
13 class TestTutorialsPoint():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_tutorialsPoint(self):
22         self.driver.get("https://www.tutorialspoint.com/java/index.
            htm")
23         self.driver.set_window_size(1192, 649)
24         self.driver.execute_script("window.scrollTo
            (0,528.6666870117188)")
25         self.driver.find_element(By.CSS_SELECTOR, ".toc:nth-child(3)
            > li:nth-child(3)").click()
26         self.driver.execute_script("window.scrollTo(0,898)")
27         self.driver.find_element(By.LINK_TEXT, "Java - Files and I/O"
            ).click()
28         self.driver.execute_script("window.scrollTo
            (0,1431.3333740234375)")

```

1.9 Passort Seva Kendra

Selenium IDE Screenshot IRCTC website.

1.9.1 Passort Seva Kendra pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver

```

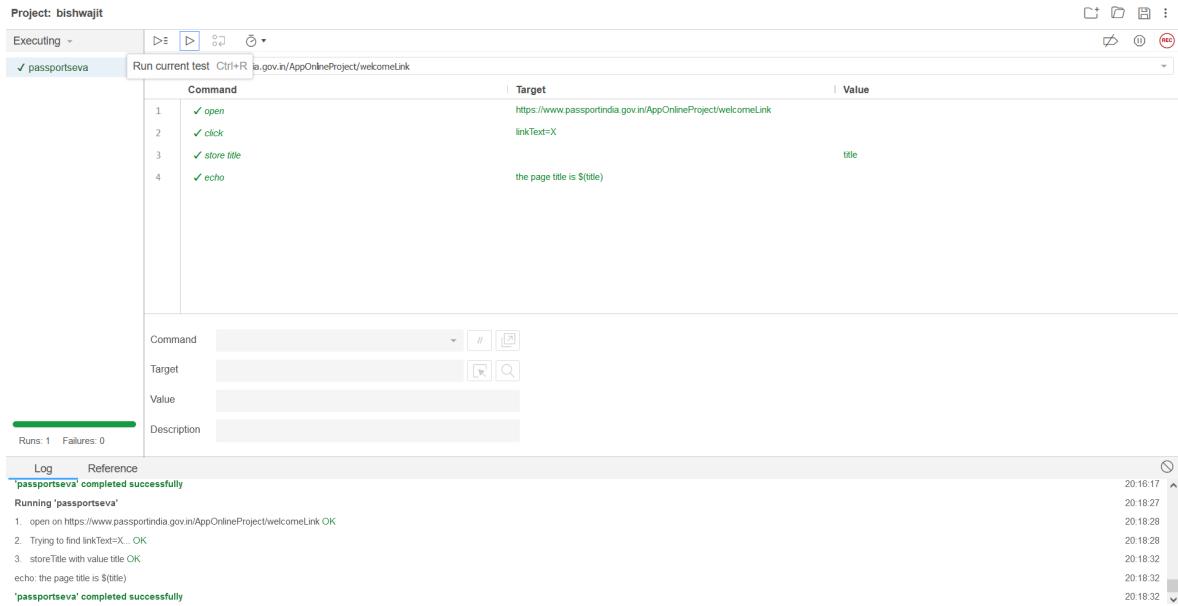


Figure 9: Passort Seva Kendra Website

```

6 from selenium.webdriver.common import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
     DesiredCapabilities
12
13 class TestPassportseva():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_passportseva(self):
22         self.driver.get("https://www.passportindia.gov.in/
              AppOnlineProject/welcomeLink")
23         self.driver.find_element(By.LINK_TEXT, "X").click()
24         self.vars["title"] = self.driver.title
25         print("the page title is $(title)")

```

1.10 Wikipedia

Selenium IDE Screenshot of Wikipedia website.

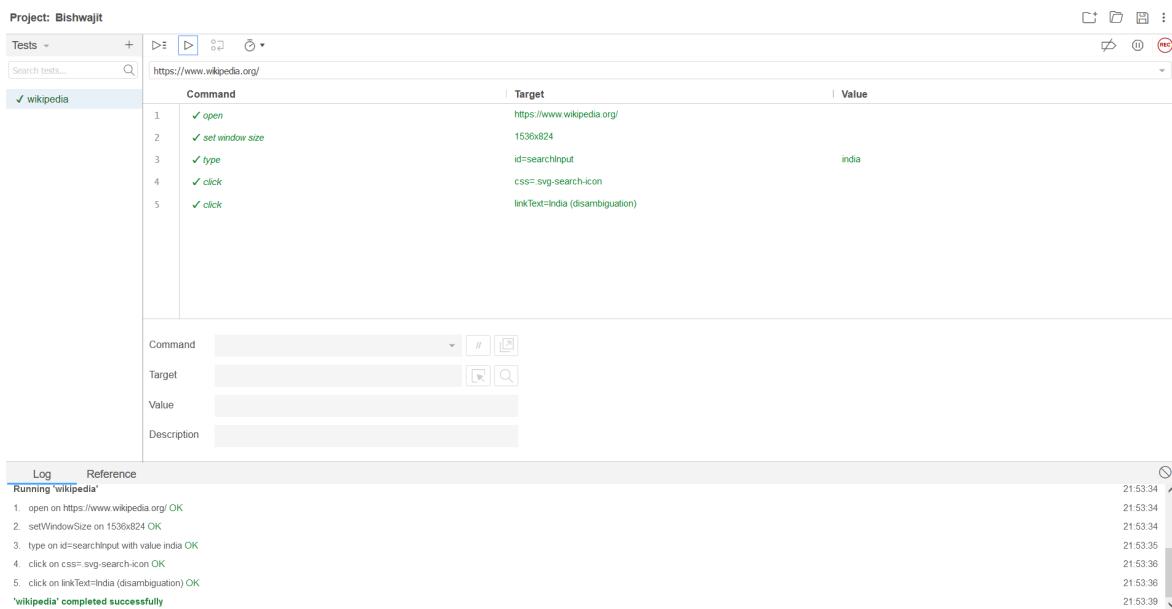


Figure 10: Wikipedia Website

1.10.1 Wikipedia pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common.by import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
    DesiredCapabilities
12
13 class TestWikipedia():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_wikipedia(self):
22         self.driver.get("https://www.wikipedia.org/")
23         self.driver.set_window_size(1536, 824)
24         self.driver.find_element(By.ID, "searchInput").send_keys(
            "india")

```

```

25     self.driver.find_element(By.CSS_SELECTOR, ".svg-search-icon")
         .click()
26     self.driver.find_element(By.LINK_TEXT, "India (disambiguation"
         ).click()

```

1.11 Zimbra

Selenium IDE Screenshot of Zimbra mail.

The screenshot shows the Selenium IDE interface with a project named 'bishwajit'. A test named 'zimbra' is selected. The test steps are:

| Command | Target | Value |
|----------|----------------------------|-----------|
| 1. open | https://mail.nittek.ac.in/ | |
| 2. click | id=username | 222CS3113 |
| 3. click | id=password | S2FEB4536 |
| 4. click | css=ZLoginButton | |

Below the table, there are fields for Command, Target, Value, and Description. At the bottom, the Log tab shows the test results:

```

'coWin' completed successfully
Running 'zimbra'
1. open on https://mail.nittek.ac.in/ OK
2. click on id=username with value 222CS3113 OK
3. click on id=password with value S2FEB4536 OK
4. click on css=ZLoginButton OK
'zimbra' completed successfully

```

The log also includes a timestamp column.

Figure 11: Zimbra mail

1.11.1 Zimbra pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common.by import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
     DesiredCapabilities
12
13 class TestZimbra():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()

```

```

16     self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_zimbra(self):
22         self.driver.get("https://mail.nitrkl.ac.in/")
23         self.driver.find_element(By.ID, "username").click()
24         self.driver.find_element(By.ID, "password").click()
25         self.driver.find_element(By.CSS_SELECTOR, ".ZLoginButton") .
26             click()

```

1.12 EDX

Selenium IDE Screenshot of edX website.

The screenshot shows the Selenium IDE interface with a project named 'Bishwajit'. A test named 'edx' is selected. The test steps are listed in the 'Command' column:

| Command | Target | Value |
|---------------------|--|--------------------|
| 1 ✓ open | https://www.edx.org/ | |
| 2 ✓ set window size | 1536x824 | |
| 3 ✓ click | css=product-card-sizing-wrapper:nth-child(3) span:nth-child(1) > span:nth-child(1) > span:nth-child(3) | id=nav-certificate |
| 4 ✓ click | id=nav-certificate | |
| 5 ✓ mouse over | id=nav-certificate | |
| 6 ✓ mouse out | id=nav-certificate | |
| 7 ✓ click | linkText=Blog | |

The 'Log' section at the bottom shows the command history:

```

2. setWindowSize on 1536x824 OK
3. click on css=product-card-sizing-wrapper:nth-child(3) span:nth-child(1) > span:nth-child(1) > span:nth-child(3) OK
4. click on id=nav-certificate OK
5. mouseOver on id=nav-certificate OK
6. mouseOut on id=nav-certificate OK
7. click on linkText=Blog OK
'dx' completed successfully

```

Figure 12: EDX Website

1.12.1 EDX pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait

```

```

10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
12     DesiredCapabilities
13
14 class TestEdx():
15     def setup_method(self, method):
16         self.driver = webdriver.Firefox()
17         self.vars = {}
18
19     def teardown_method(self, method):
20         self.driver.quit()
21
22     def test_edx(self):
23         self.driver.get("https://www.edx.org/")
24         self.driver.set_window_size(1536, 824)
25         self.driver.find_element(By.CSS_SELECTOR, ".product-card-
26             sizing-wrapper:nth-child(3) span:nth-child(1) > span:nth-
27             child(1) > span:nth-child(3)").click()
28         self.driver.find_element(By.ID, "nav-certificate").click()
29         element = self.driver.find_element(By.ID, "nav-certificate")
30         actions = ActionChains(self.driver)
31         actions.move_to_element(element).perform()
32         element = self.driver.find_element(By.CSS_SELECTOR, "body")
33         actions = ActionChains(self.driver)
34         actions.move_to_element(element, 0, 0).perform()
35         self.driver.find_element(By.LINK_TEXT, "Blog").click()

```

1.13 LeetCode

Selenium IDE Screenshot of LeetCode website.

1.13.1 LeetCode pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common.by import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
12     DesiredCapabilities

```

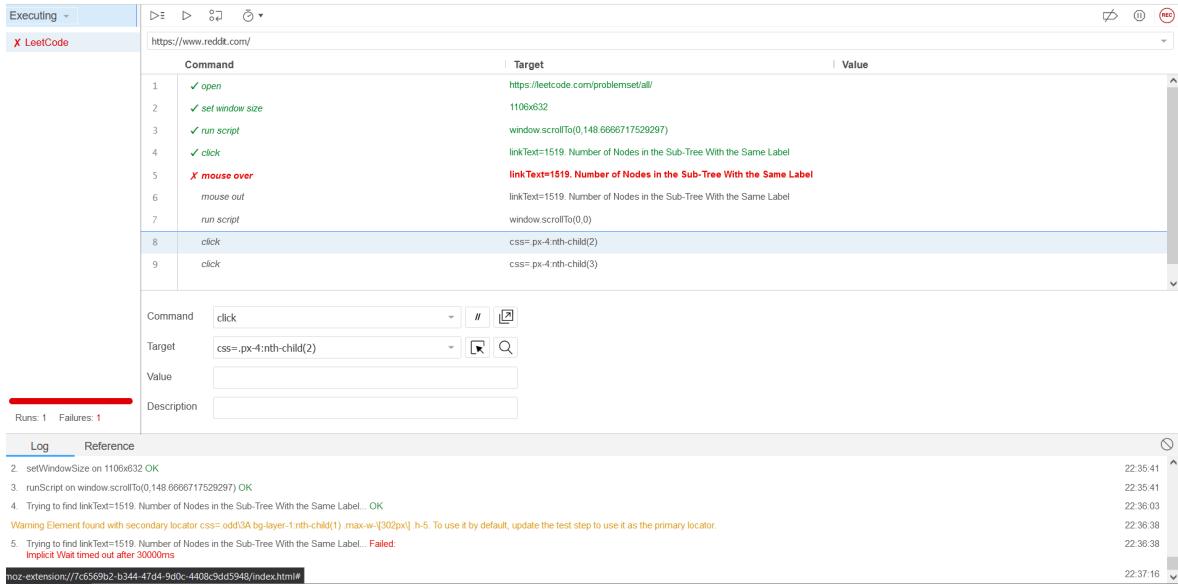


Figure 13: LeetCode Website

```

13 class TestLeetCode():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_leetCode(self):
22         self.driver.get("https://leetcode.com/problemset/all/")
23         self.driver.set_window_size(1106, 632)
24         self.driver.execute_script("window.scrollTo
25             (0,148.6666717529297)")
26         self.driver.find_element(By.LINK_TEXT, "1519. Number of Nodes
27             in the Sub-Tree With the Same Label").click()
28         element = self.driver.find_element(By.LINK_TEXT, "1519.
29             Number of Nodes in the Sub-Tree With the Same Label")
30         actions = ActionChains(self.driver)
31         actions.move_to_element(element).perform()
32         element = self.driver.find_element(By.CSS_SELECTOR, "body")
33         actions = ActionChains(self.driver)
34         actions.move_to_element(element, 0, 0).perform()

```

1.14 Allnovel

Selenium IDE Screenshot IRCTC website.

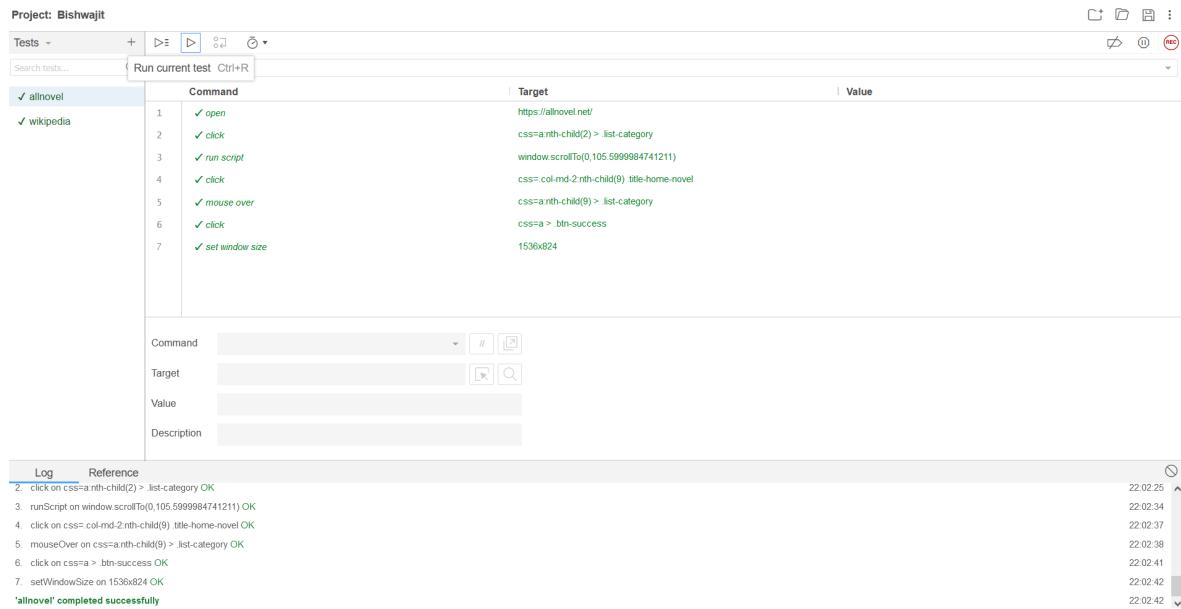


Figure 14: Allnovel Website

1.14.1 Allnovel pytest code

```

1 # Generated by Selenium IDE
2 import pytest
3 import time
4 import json
5 from selenium import webdriver
6 from selenium.webdriver.common import By
7 from selenium.webdriver.common.action_chains import ActionChains
8 from selenium.webdriver.support import expected_conditions
9 from selenium.webdriver.support.wait import WebDriverWait
10 from selenium.webdriver.common.keys import Keys
11 from selenium.webdriver.common.desired_capabilities import
    DesiredCapabilities
12
13 class TestAllnovel():
14     def setup_method(self, method):
15         self.driver = webdriver.Firefox()
16         self.vars = {}
17
18     def teardown_method(self, method):
19         self.driver.quit()
20
21     def test_allnovel(self):
22         self.driver.get("https://allnovel.net/")

```

```

23     self.driver.find_element(By.CSS_SELECTOR, "a:nth-child(2) > .list-category").click()
24     self.driver.execute_script("window.scrollTo(0,105.5999984741211)")
25     self.driver.find_element(By.CSS_SELECTOR, ".col-md-2:nth-child(9) .title-home-novel").click()
26     element = self.driver.find_element(By.CSS_SELECTOR, "a:nth-child(9) > .list-category")
27     actions = ActionChains(self.driver)
28     actions.move_to_element(element).perform()
29     self.driver.find_element(By.CSS_SELECTOR, "a > .btn-success")
30         .click()
30     self.driver.set_window_size(1536, 824)

```

1.15 Coursera

Selenium IDE Screenshot of Coursera website.

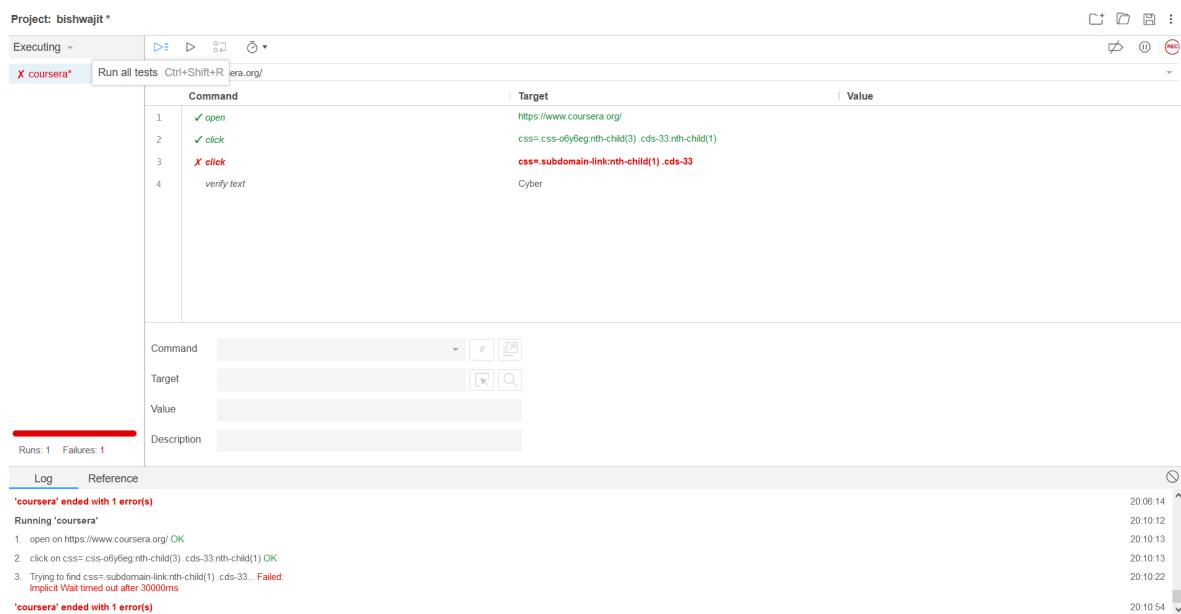


Figure 15: Coursera Website

1.15.1 Failed

Implicit Timed out

CS6474: Software Testing Laboratory 2023

SELENIUM RC

Prepared by
BISHWAJIT PRASAD GOND
222CS3113



2 Selenium RC

Selenium RC is a key part in Selenium. It is a framework for testing that allows testers and developers to design test scripts in multiple languages to automate frontend UI test cases. It has a client library and a server that starts and quits the browser sessions by default.

Server injects Selenium core (a program in JavaScript) to the browser. The Selenium Core gets the commands from the RC server. Selenium Core executes the commands in JavaScript. Then the JavaScript commands provide instructions to the browser. Finally, the browser runs the instructions given by the Selenium Core and sends a complete status of the execution to the server. This final result is the output received by the user.

Selenium RC is deprecated because of the reasons listed below

Command related usage is present in Selenium RC.

- Selenium RC comprises an additional layer of JavaScript known as the core which makes it slower.
- Selenium RC has complicated and redundant APIs.
- Selenium RC is not compatible with the HTMLUnit browser (required for headless execution).
- Selenium RC has in-built HTML report generation features for test results.
- Selenium RC has selenium.typeKeys and selenium.type APIs which have similar tasks. While Selenium webdriver has only one method sendKeys which takes care of all inputting tasks.
- Selenium RC cannot be used for testing mobile applications like android phones, iphone, iPad, and so on.
- Maintaining a large regression suite is difficult in Selenium RC.
- Additional software and third-party APIs are not supported in Selenium RC.
- Not capable of executing Selenium webdriver scripts from Selenium RC.
- Has in-built report generation features but it is not upto to the mark.
- Installation of Remote Control Server is required prior to running of scripts in Selenium RC.

2.1 Calculator.net

Selenium RC Screenshot of Calculator.net website.

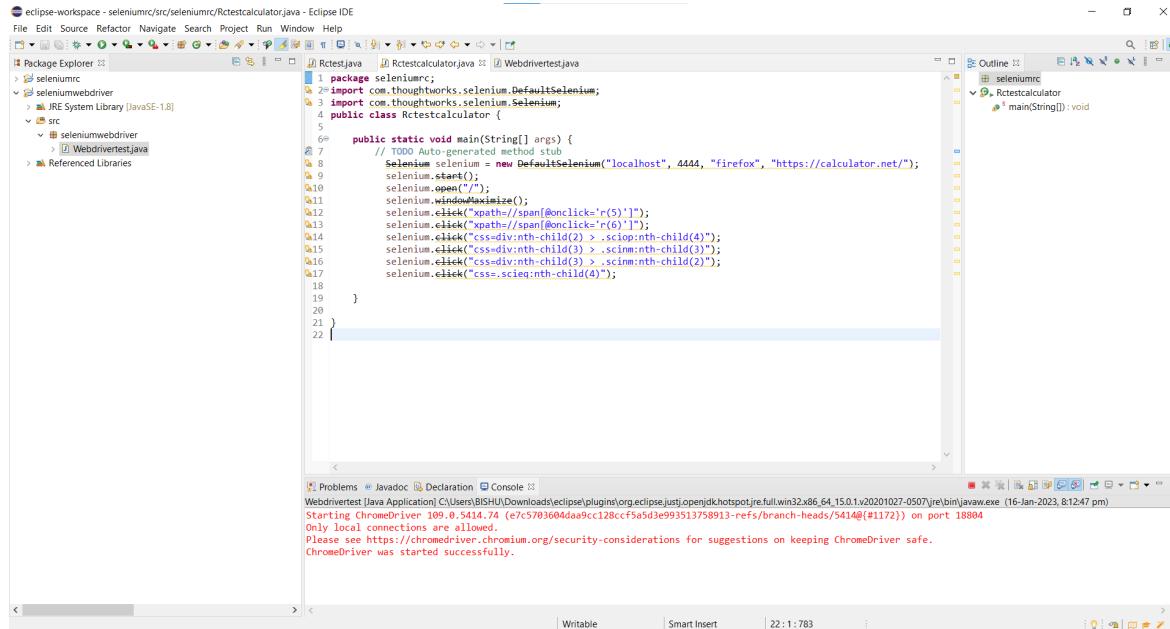


Figure 16: Selenium RC for Calculator.net Website

2.1.1 Selenium RC calculator

```

1 package seleniumrc;
2 import com.thoughtworks.selenium.DefaultSelenium;
3 import com.thoughtworks.selenium.Selenium;
4 public class Rctestcalculator {
5
6     public static void main(String[] args) {
7         // TODO Auto-generated method stub
8         Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://calculator.net/");
9         selenium.start();
10        selenium.open("/");
11        selenium.windowMaximize();
12        selenium.click("xpath=//span[@onclick='r(5)']");
13        selenium.click("xpath=//span[@onclick='r(6)']");
14        selenium.click("css=div:nth-child(2) > .sciop:nth-child(4)");
15        selenium.click("css=div:nth-child(3) > .scinm:nth-child(3)");
16        selenium.click("css=div:nth-child(3) > .scinm:nth-child(2)");
17        selenium.click("css=.scieq:nth-child(4)");
18    }
19 }

```

2.2 Coursera

Selenium RC Screenshot of Coursera website.

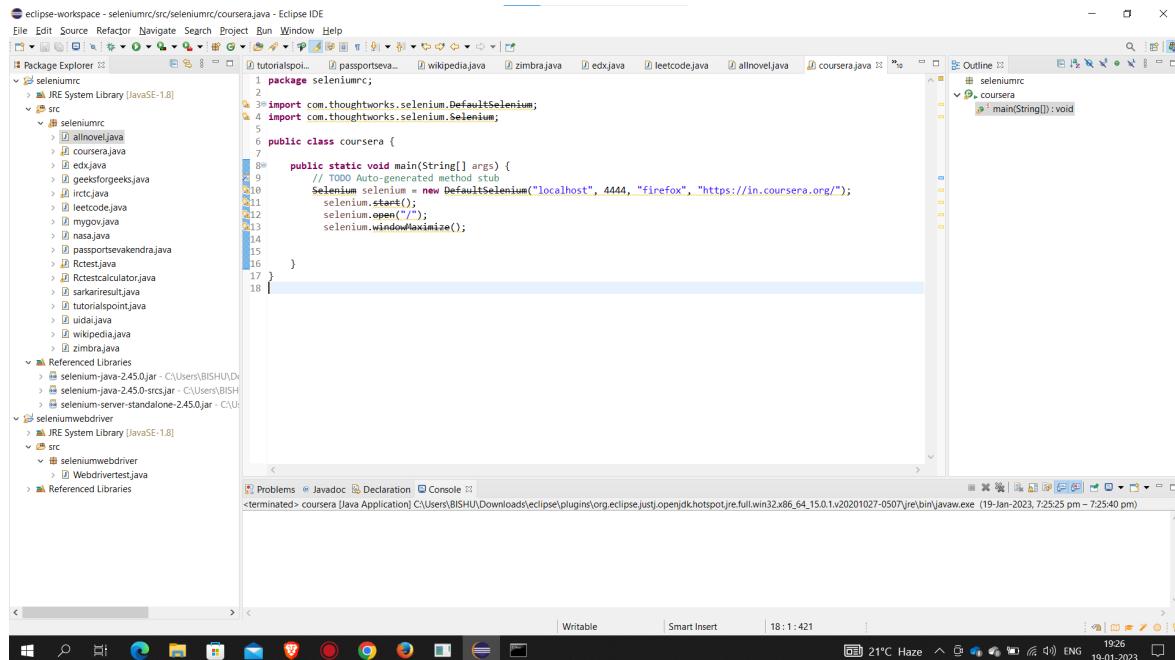


Figure 17: Selenium RC for Coursera Website

2.2.1 Selenium RC Coursera

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class coursera {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://in.coursera.org/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15    }
16 }
17 }
```

2.3 IRCTC

Selenium RC Screenshot of IRCTC website.

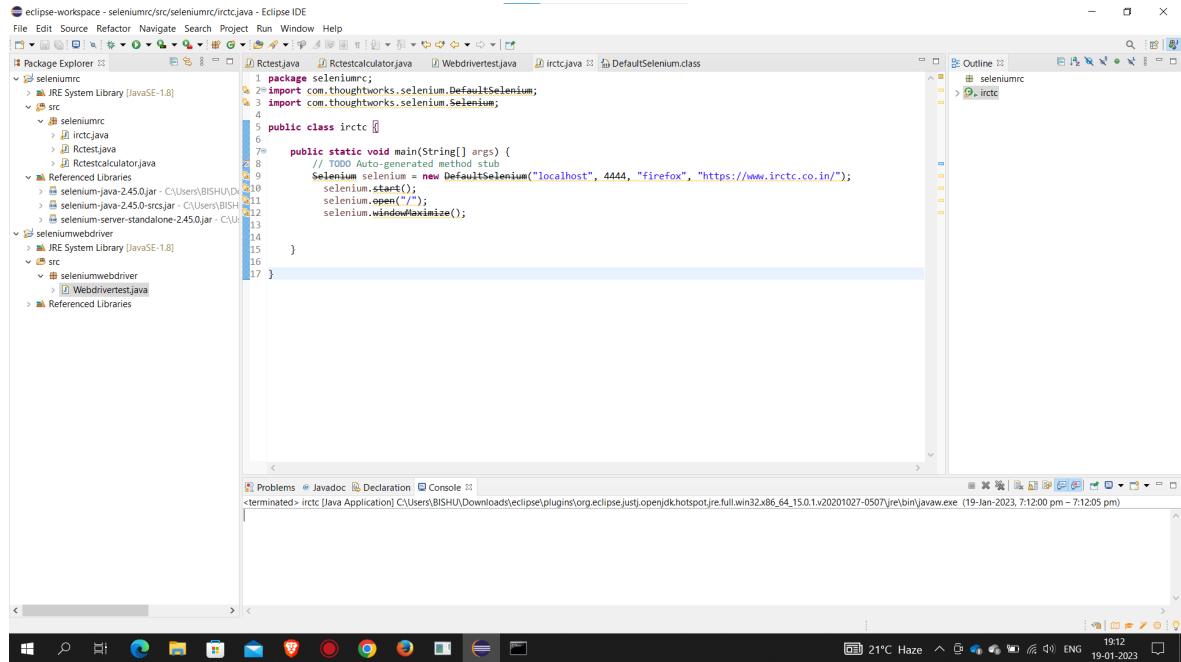


Figure 18: Selenium RC for IRCTC Website

2.3.1 Selenium RC IRCTC

```

1 package seleniumrc;
2 import com.thoughtworks.selenium.DefaultSelenium;
3 import com.thoughtworks.selenium.Selenium;
4
5 public class irctc {
6
7     public static void main(String[] args) {
8         // TODO Auto-generated method stub
9         Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.irctc.co.in/");
10        selenium.start();
11        selenium.open("/");
12        selenium.windowMaximize();
13
14    }
15}
16
17 }
```

2.4 Allnovel

Selenium RC Screenshot of Allnovel website.

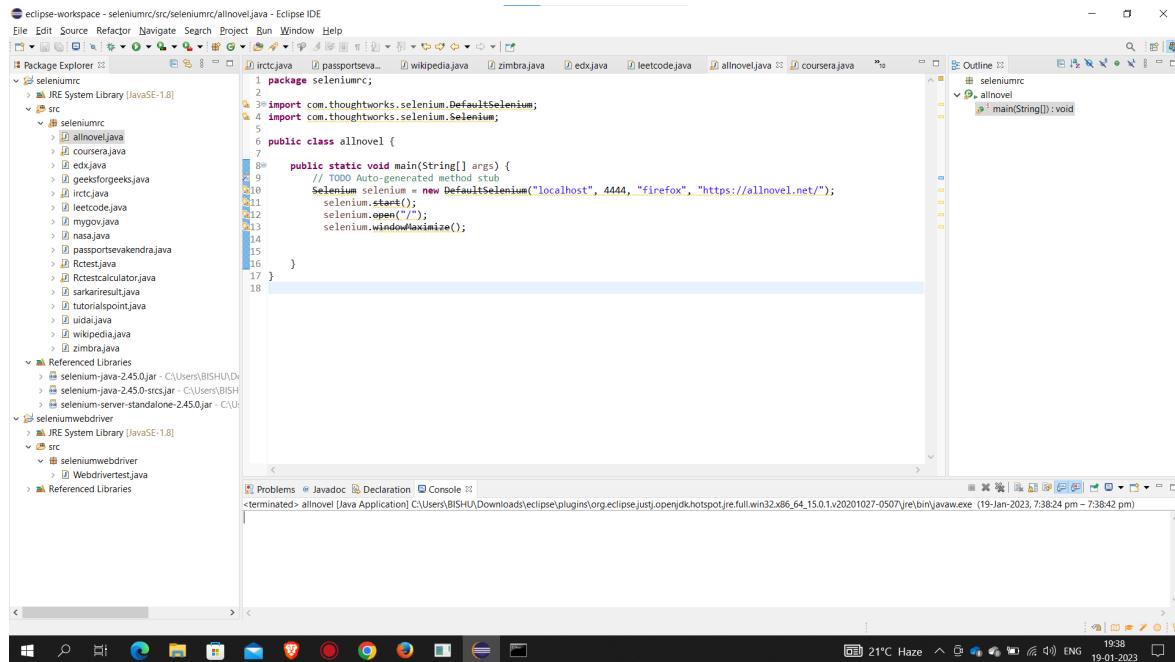


Figure 19: Selenium RC for Allnovel Website

2.4.1 Selenium RC Allnovel

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class allnovel {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://allnovel.net/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15
16    }
17 }
```

2.5 EDX

Selenium RC Screenshot of EDX website.

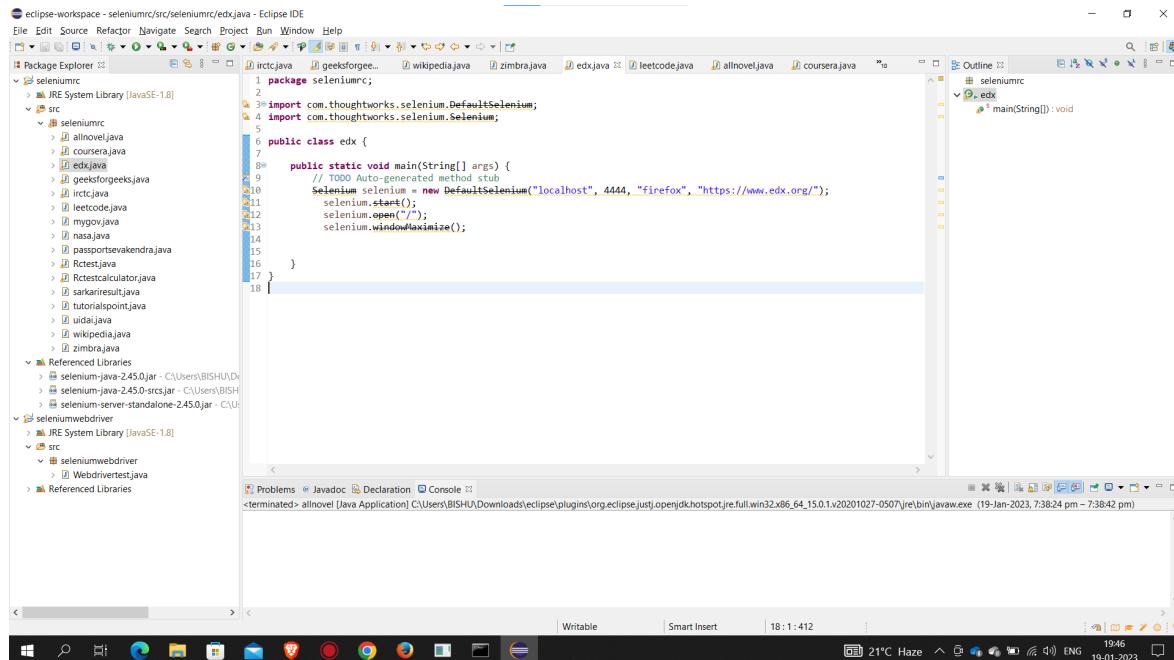


Figure 20: Selenium RC for EDX Website

2.5.1 Selenium RC EDX

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class edx {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.edx.org/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15    }
16 }
17 }
```

2.6 Geeksforgeeks

Selenium RC Screenshot of Geeksforgeeks website.

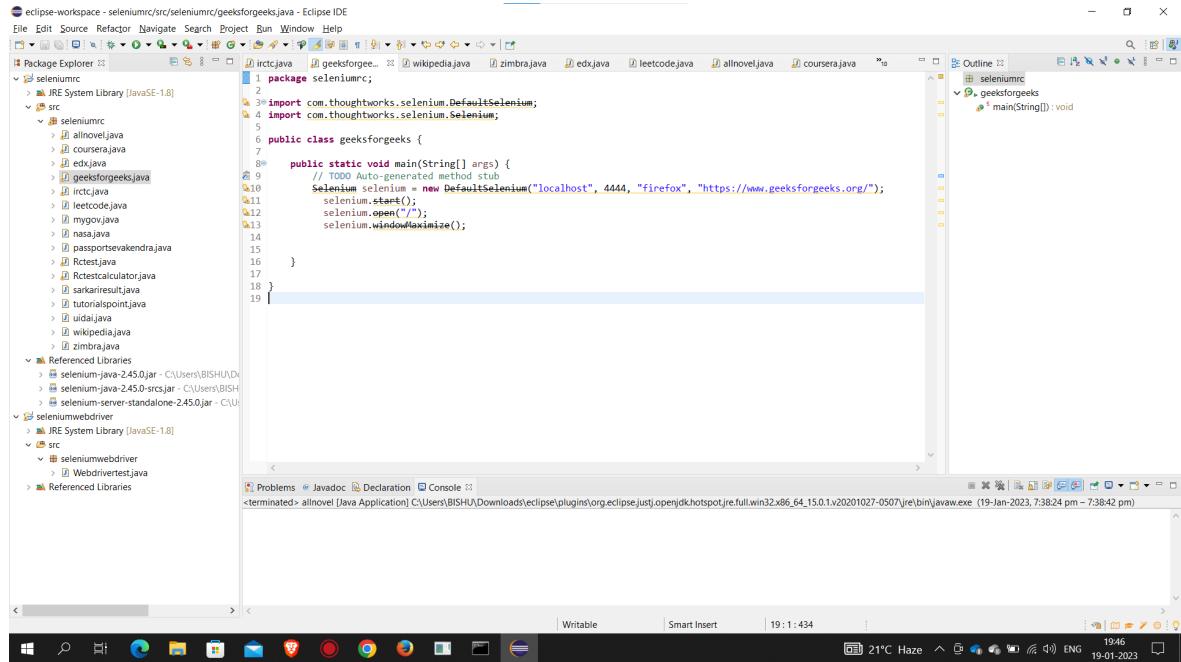


Figure 21: Selenium RC for Geeksforgeeks Website

2.6.1 Selenium RC Geeksforgeeks

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class geeksforgeeks {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.geeksforgeeks.org/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15    }
16
17 }
18

```

2.7 Leetcode

Selenium RC Screenshot of Leetcode website.

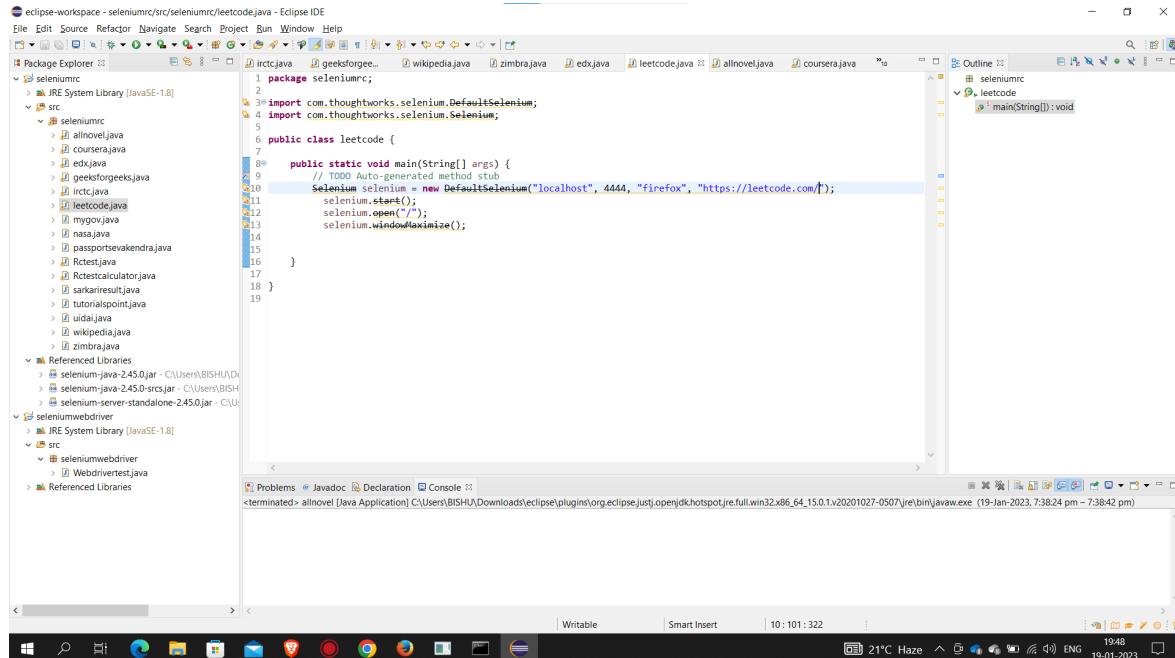


Figure 22: Selenium RC for Leetcode Website

2.7.1 Selenium RC Leetcode

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class leetcode {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://leetcode.com/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14    }
15
16 }
17
18 }
```

2.8 NASA

Selenium RC Screenshot of NASA website.

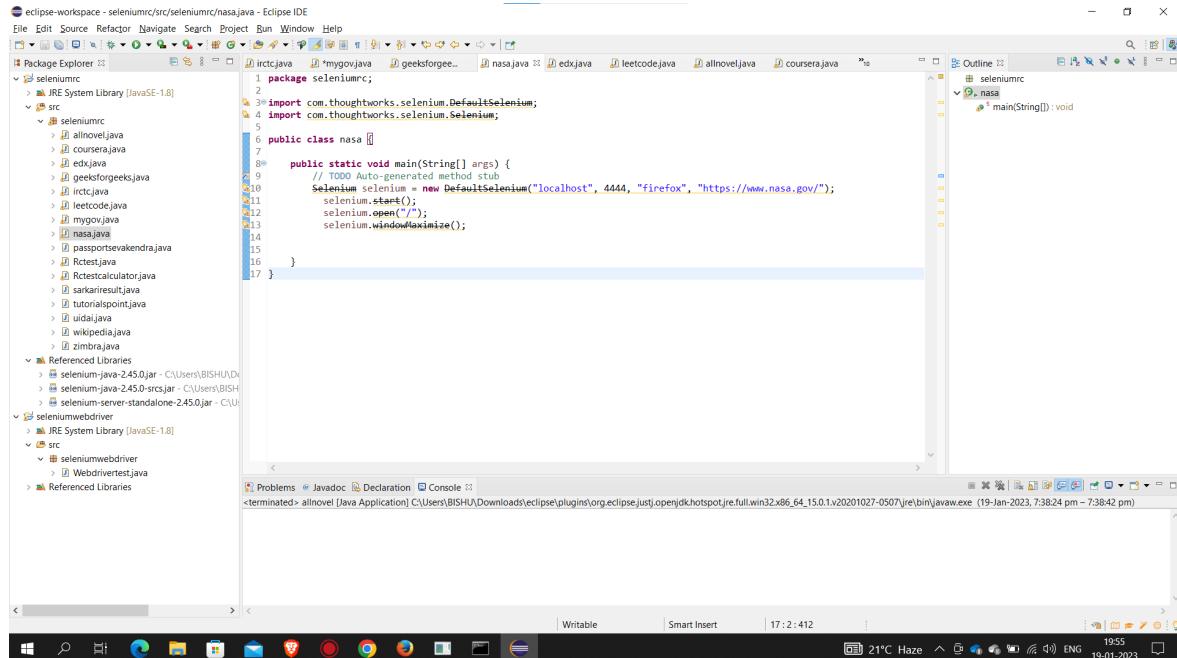


Figure 23: Selenium RC for NASA Website

2.8.1 Selenium RC NASA

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class nasa {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.nasa.gov/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14    }
15
16 }
17 }
```

2.9 MyGov

Selenium RC Screenshot of MyGov website.

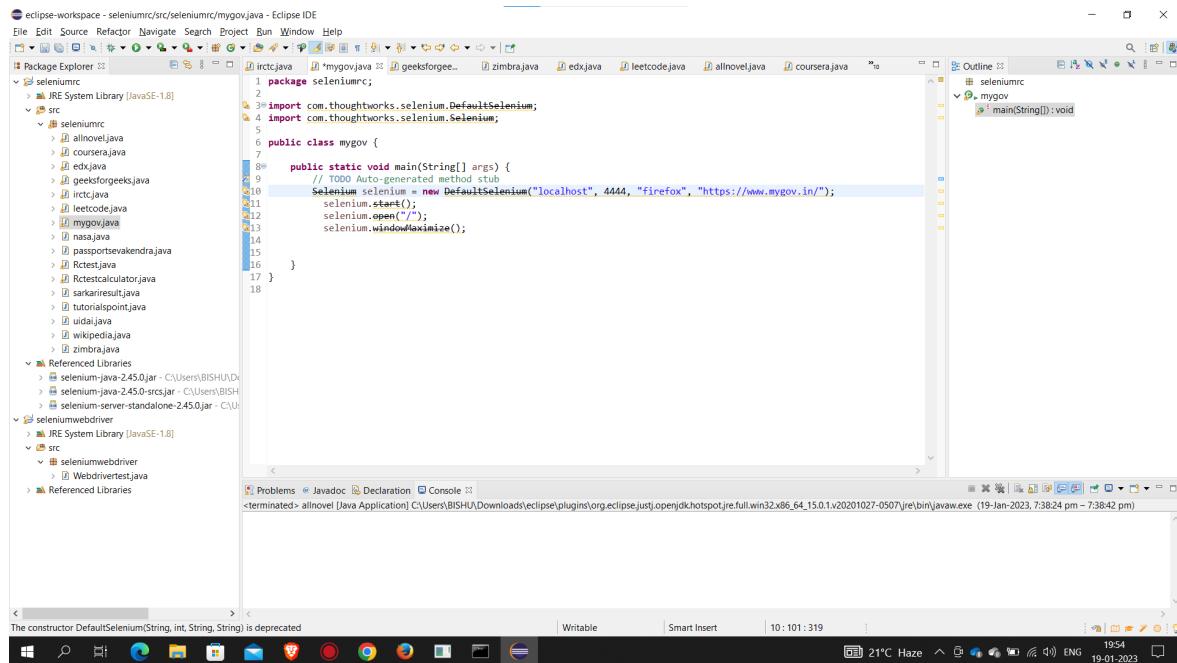


Figure 24: Selenium RC for MyGov Website

2.9.1 Selenium RC MyGov

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class mygov {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.mygov.in/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15
16    }
17 } 
```

2.10 PassportIndia

Selenium RC Screenshot of PassportIndia website.

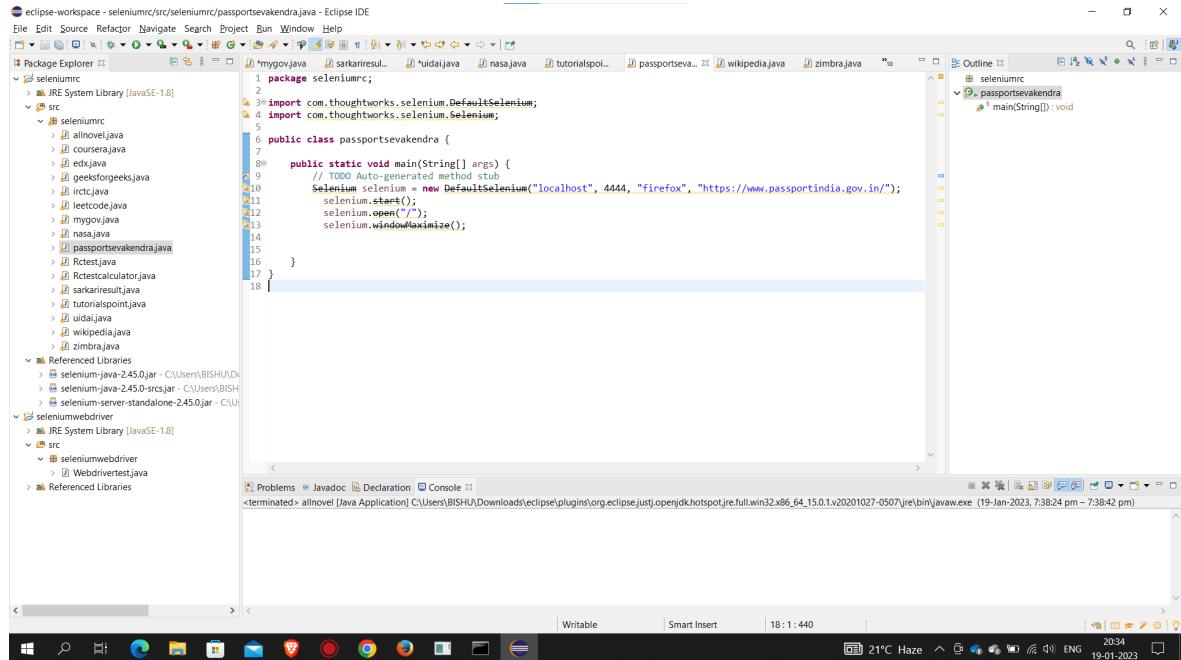


Figure 25: Selenium RC for PassportIndia Website

2.10.1 Selenium RC PassportIndia

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class passportevakendra {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.passportindia.gov.in/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15    }
16
17 }

```

2.11 Sarkariresult

Selenium RC Screenshot of Sarkariresult website.

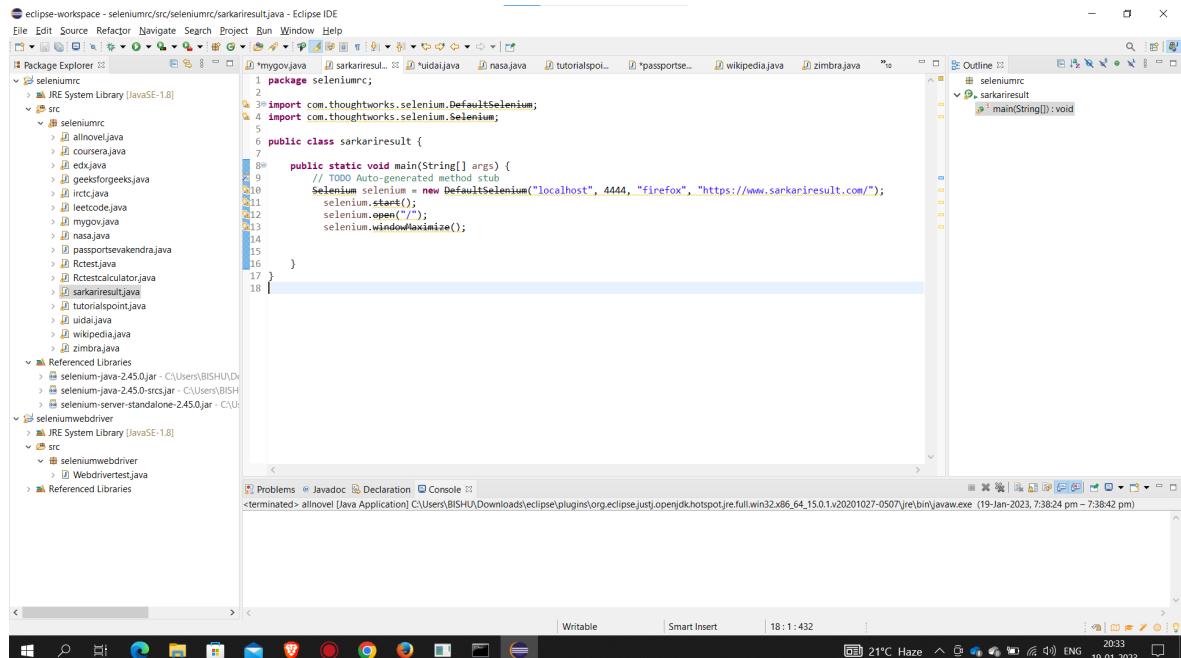


Figure 26: Selenium RC for Sarkariresult Website

2.11.1 Selenium RC Sarkariresult

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class sarkariresult {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.sarkariresult.com/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14    }
15
16 }
17

```

2.12 Tutorialspoint

Selenium RC Screenshot of Tutorialspoint website.

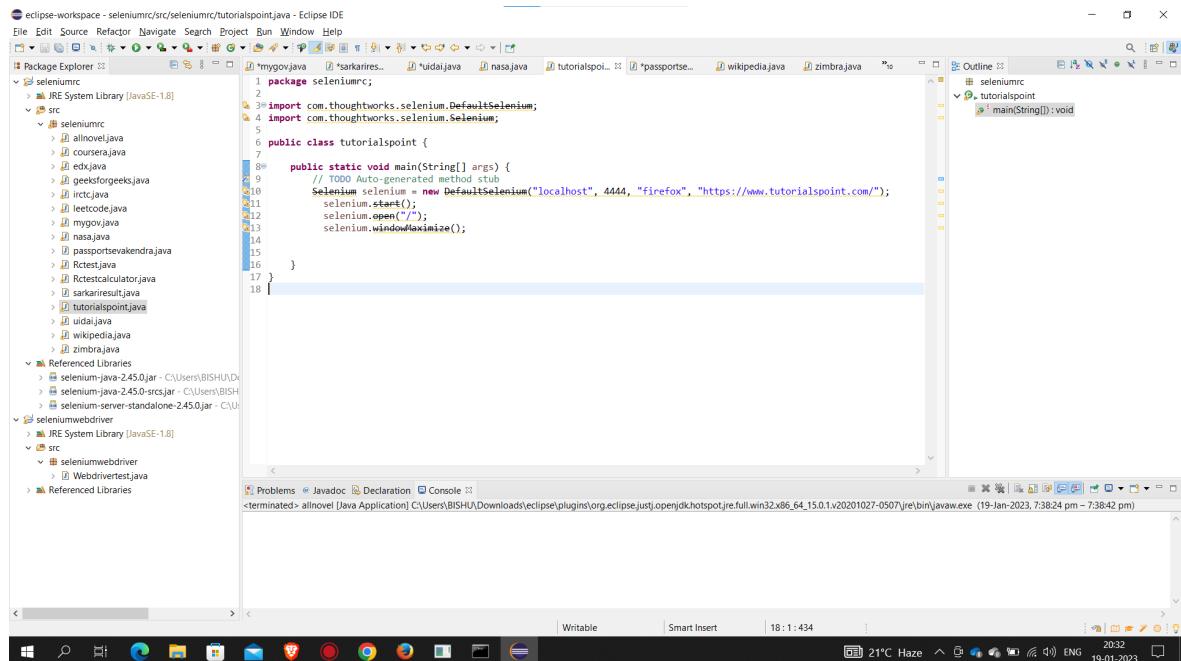


Figure 27: Selenium RC for Tutorialspoint Website

2.12.1 Selenium RC Tutorialspoint

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class tutorialspoint {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.tutorialspoint.com/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15
16    }
17 } 
```

2.13 Wikipedia

Selenium RC Screenshot of wikipedia website.

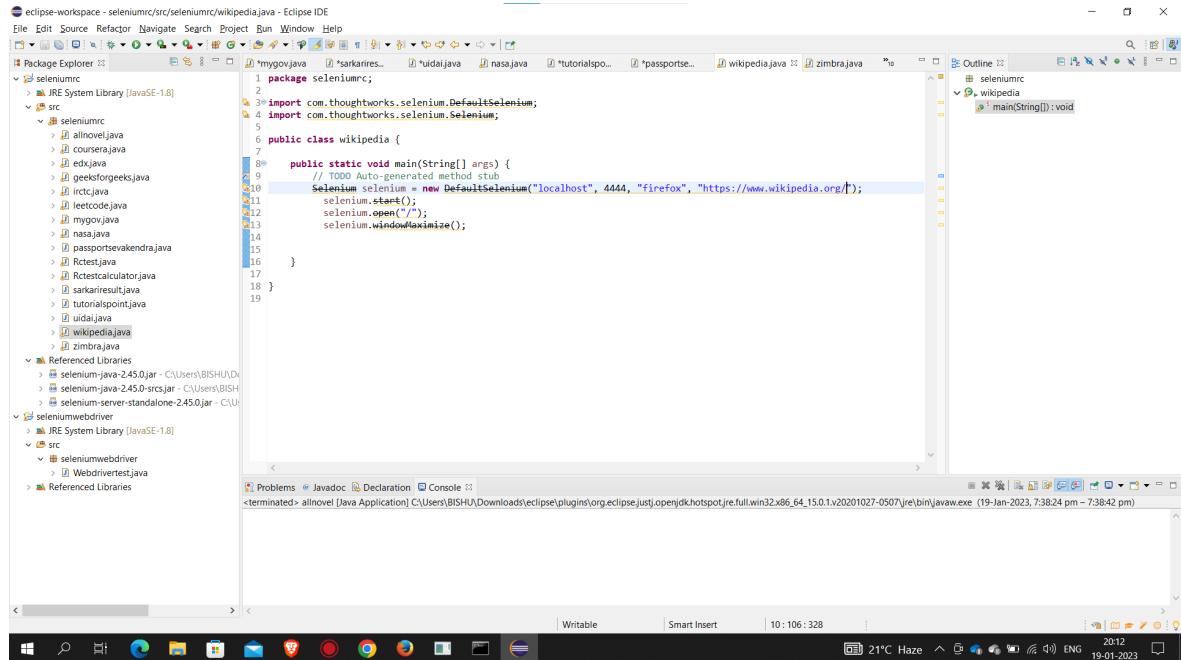


Figure 28: Selenium RC for wikipedia Website

2.13.1 Selenium RC wikipedia

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class wikipedia {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.wikipedia.org/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14
15
16    }
17
18 }
```

2.14 UIDAI

Selenium RC Screenshot of UIDAI website.

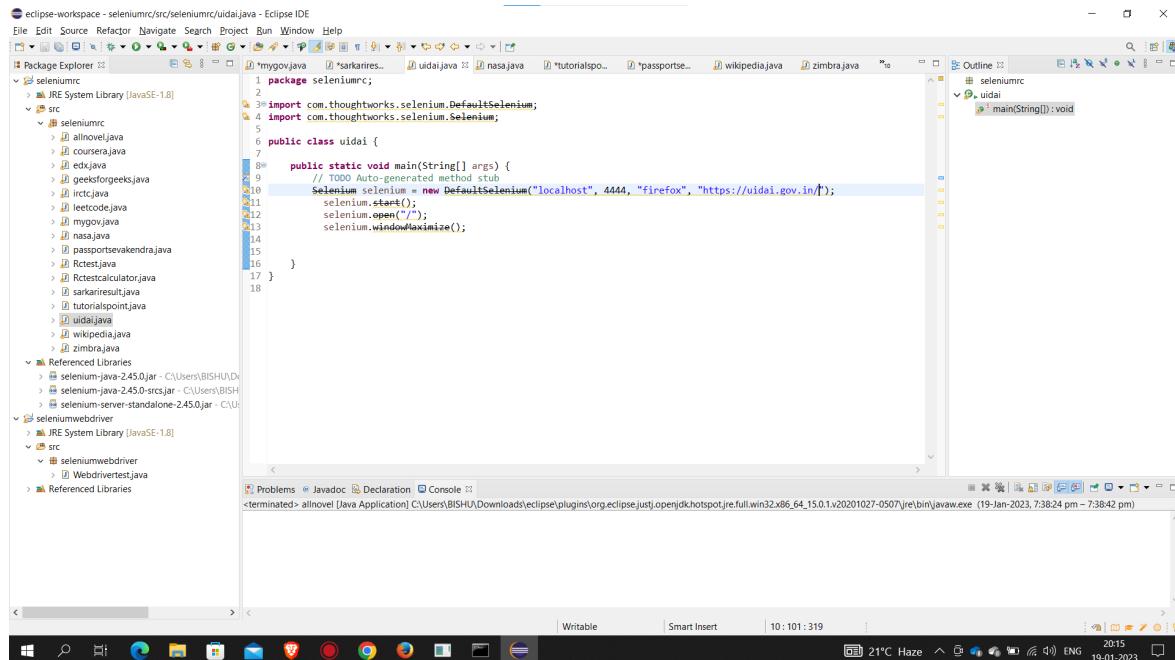


Figure 29: Selenium RC for UIDAI Website

2.14.1 Selenium RC UIDAI

```

1 package seleniumrc;
2 import com.thoughtworks.selenium.DefaultSelenium;
3 import com.thoughtworks.selenium.Selenium;
4
5 public class irctc {
6
7     public static void main(String[] args) {
8         // TODO Auto-generated method stub
9         Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://www.irctc.co.in/");
10        selenium.start();
11        selenium.open("/");
12        selenium.windowMaximize();
13
14    }
15}
16
17}
```

2.15 Zimbra

Selenium RC Screenshot of Zimbra website.

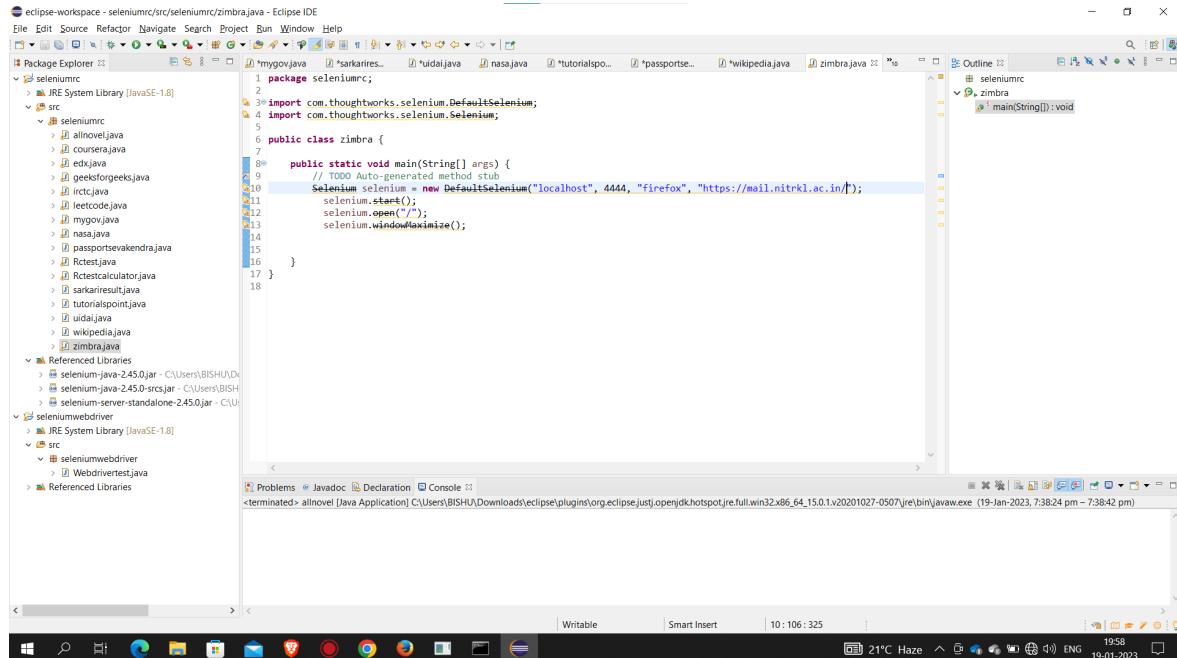


Figure 30: Selenium RC for Zimbra Website

2.15.1 Selenium RC Zimbra

```

1 package seleniumrc;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class zimbra {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        Selenium selenium = new DefaultSelenium("localhost", 4444, "firefox", "https://mail.nitrkl.ac.in/");
11        selenium.start();
12        selenium.open("/");
13        selenium.windowMaximize();
14    }
15
16 }
17 
```

CS6474: Software Testing Laboratory 2023

SELENIUM WEBDRIVER

Prepared by
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3 Selenium WebDriver

Selenium WebDriver is the most important component of Selenium Tool's Suite. The latest release "Selenium 2.0" is integrated with WebDriver API which provides a simpler and more concise programming interface.

The following image will give you a fair understanding of Selenium components and the Test Automation Tools.

Selenium WebDriver was first introduced as a part of Selenium v2.0. The initial version of Selenium i.e Selenium v1 consisted of only IDE, WebDriver and Grid. However, with the release of Selenium v3, WebDriver has been deprecated and moved to legacy package.

In WebDriver, test scripts can be developed using any of the supported programming languages and can be run directly in most modern web browsers. Languages supported by WebDriver include C#, Java, Perl, PHP, Python and Ruby.

3.1 Google Search

Selenium WebDriver Screenshot of Calculator.net website.

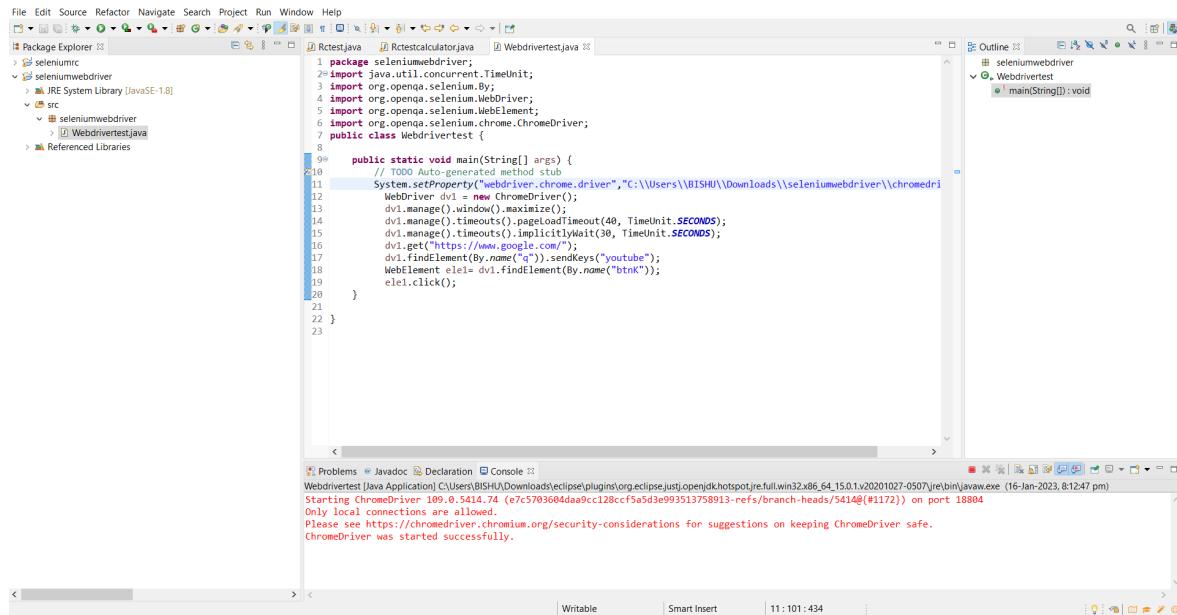


Figure 31: Google search WebDrive

3.1.1 Selenium WebDriver google search

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class Webdrivertest {
8
9     public static void main(String[] args) {
10         // TODO Auto-generated method stub
11         System.setProperty("webdriver.chrome.driver","C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
12         WebDriver dv1 = new ChromeDriver();
13         dv1.manage().window().maximize();
14         dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
15             ;
16         dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
17         dv1.get("https://www.google.com/");
18         dv1.findElement(By.name("q")).sendKeys("youtube");
19         WebElement ele1= dv1.findElement(By.name("btnK"));
20         ele1.click();
21 }

```

3.2 Calculator.net

Selenium WebDriver Screenshot of Calculator.net website.

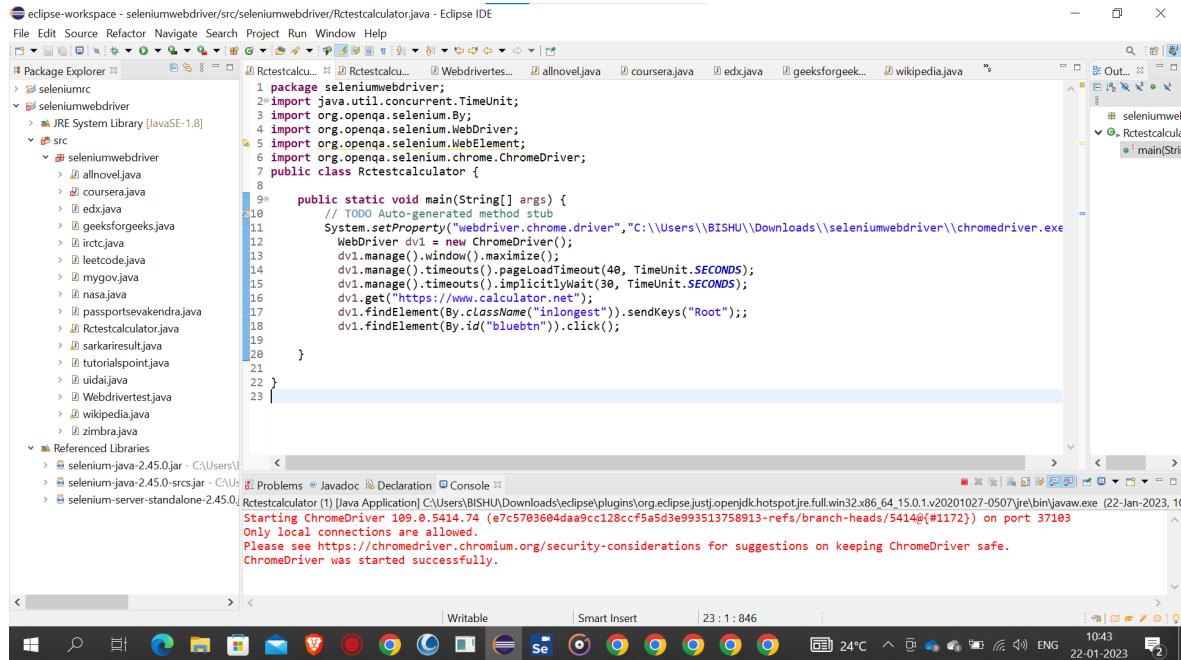


Figure 32: Selenium WebDriver for Calculator.net Website

3.2.1 Selenium WebDriver calculator

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class calculator {
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
11        WebDriver dv1 = new ChromeDriver();
12        dv1.manage().window().maximize();
13        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
14            ;
15        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
16        dv1.get("https://www.calculator.net");
17        dv1.findElement(By.className("inlongest")).sendKeys("Root");
18        dv1.findElement(By.id("bluebtn")).click();
19    }
20 }

```

3.3 Coursera

Selenium WebDriver Screenshot of Coursera website.

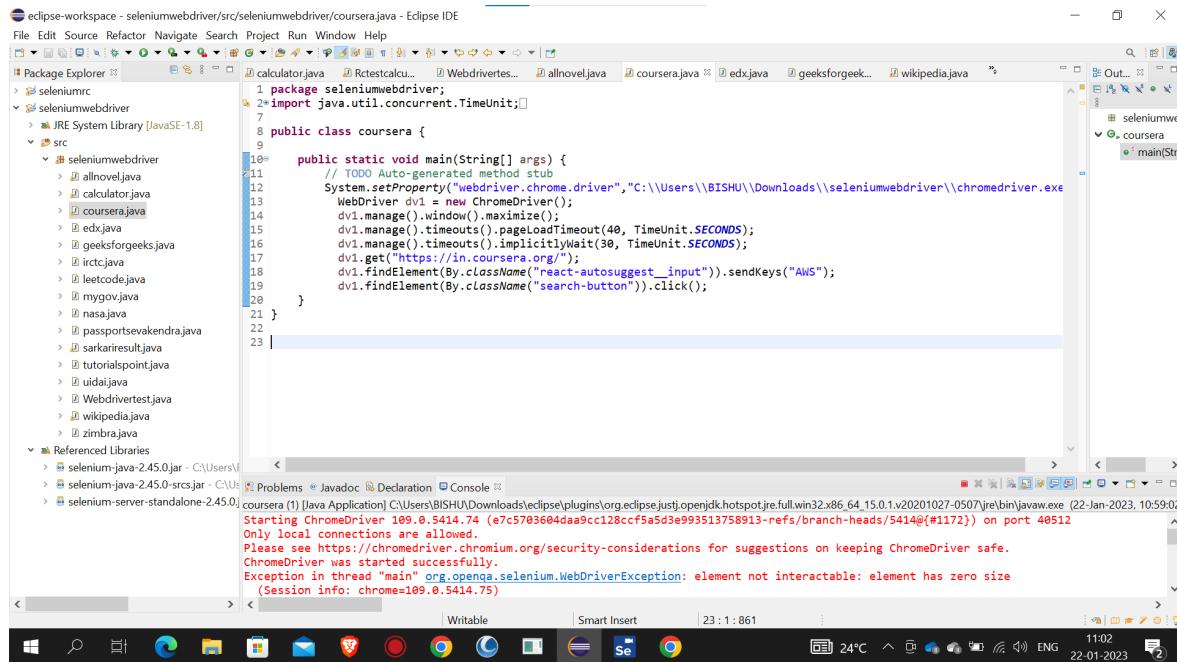


Figure 33: Selenium WebDriver for Coursera Website

3.3.1 Selenium WebDriver Coursera

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class coursera {
8     public static void main(String[] args) {
9         System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\
10          Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
11         WebDriver dv1 = new ChromeDriver();
12         dv1.manage().window().maximize();
13         dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
14             ;
15         dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
16         dv1.get("https://in.coursera.org/");
17         dv1.findElement(By.className("react-autosuggest__input"))
18             .sendKeys("AWS");
19         dv1.findElement(By.className("search-button")).click();
20     }
21 }

```

3.4 IRCTC

Selenium WebDriver Screenshot of IRCTC website.

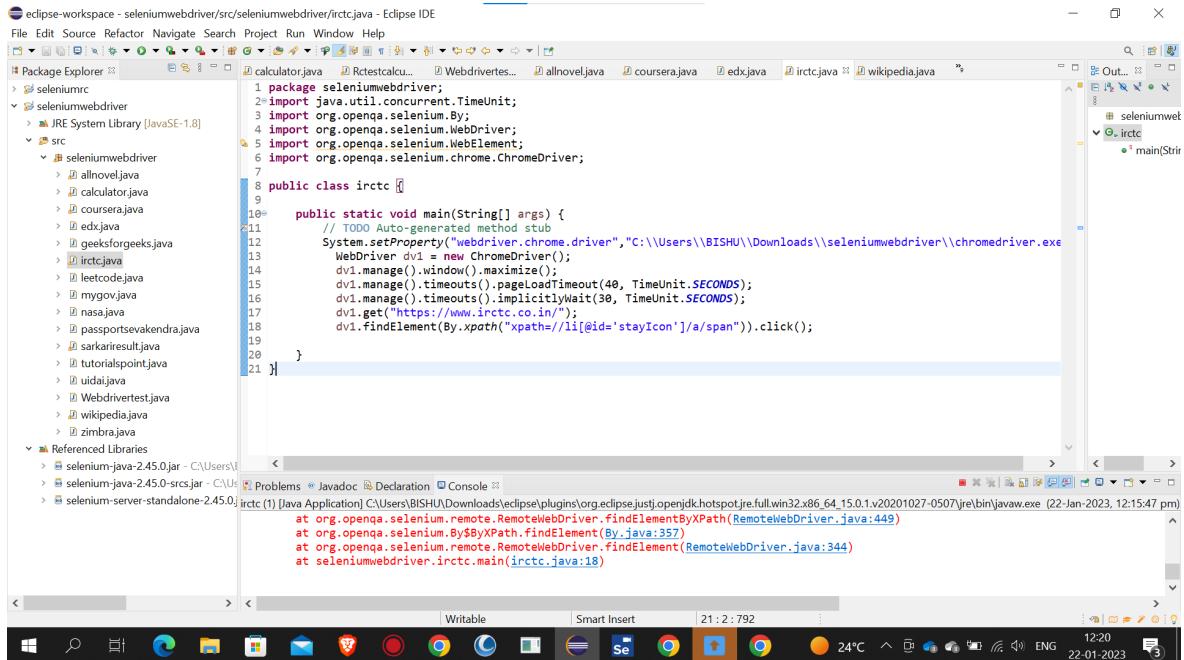


Figure 34: Selenium WebDriver for IRCTC Website

3.4.1 Selenium WebDriver IRCTC

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7
8 public class irctc {
9
10    public static void main(String[] args) {
11        // TODO Auto-generated method stub
12        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
13        WebDriver dv1 = new ChromeDriver();
14        dv1.manage().window().maximize();
15        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
16        ;
17        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
18        dv1.get("https://www.irctc.co.in/");
19        dv1.findElement(By.xpath("//li[@id='stayIcon']/a/span"))
20            .click();
21}

```

```

19 }
20 }
21 }
```

3.5 Allnovel

Selenium WebDriver Screenshot of Allnovel website.

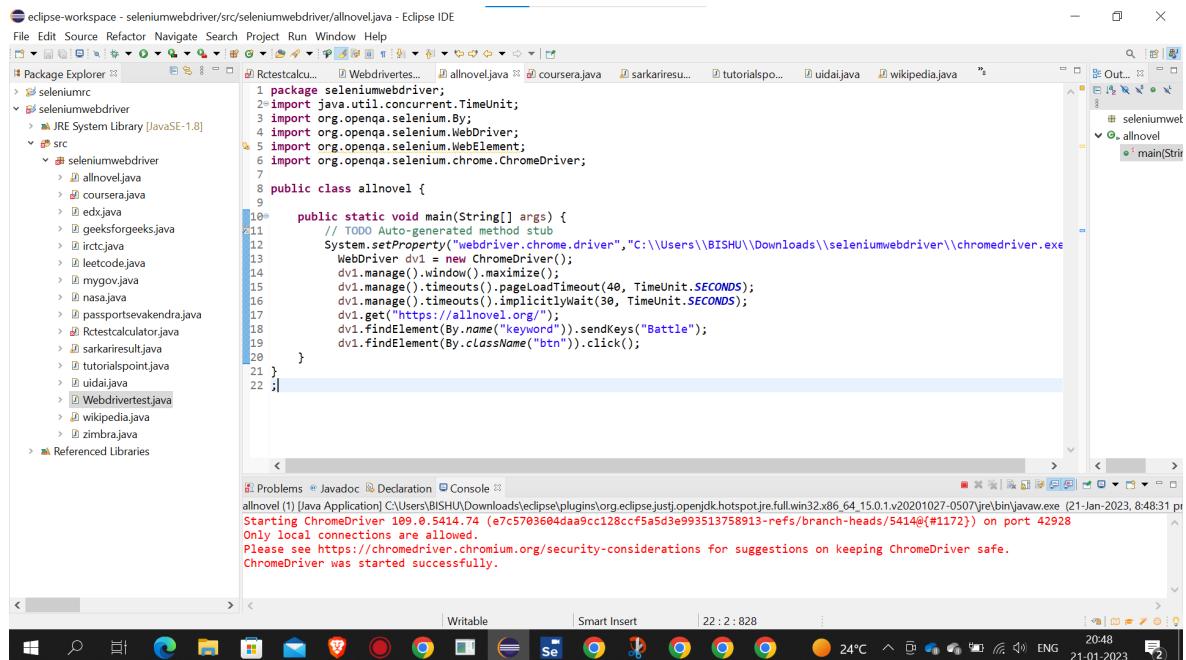


Figure 35: Selenium WebDriver for Allnovel Website

3.5.1 Selenium WebDriver Allnovel

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class allnovel {
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub System.setProperty("webdriver.chrome.driver","C:\\Users\\BISHU\\Downloads\\seleniumwebdriver\\chromedriver.exe");
10        WebDriver dv1 = new ChromeDriver();
11        dv1.manage().window().maximize();
12        dv1.manage().pageLoadTimeout(40, TimeUnit.SECONDS);
13        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
```

```

14     dv1.get("https://allnovel.org/");
15     dv1.findElement(By.name("keyword")).sendKeys("Battle");
16     dv1.findElement(By.className("btn")).click();
17 }
18 }
19 ;

```

3.6 EDX

Selenium WebDriver Screenshot of EDX website.

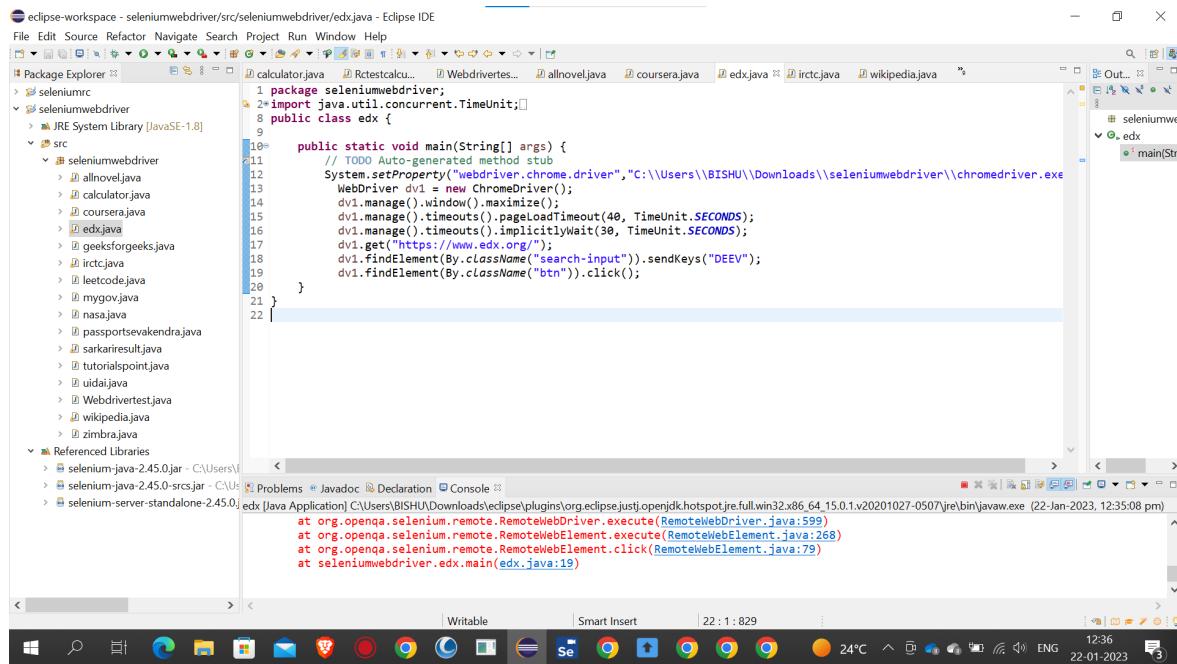


Figure 36: Selenium WebDriver for EDX Website

3.6.1 Selenium WebDriver EDX

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3
4 import org.openqa.selenium.By;
5 import org.openqa.selenium.WebDriver;
6 import org.openqa.selenium.WebElement;
7 import org.openqa.selenium.chrome.ChromeDriver;
8 public class edx {
9
10    public static void main(String[] args) {
11        // TODO Auto-generated method stub
12        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU
13                                     \\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
14        WebDriver dv1 = new ChromeDriver();
15        dv1.manage().window().maximize();
16        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS);
17        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
18        dv1.get("https://www.edx.org/");
19        dv1.findElement(By.className("search-input")).sendKeys("DEEV");
20        dv1.findElement(By.className("btn")).click();
21    }
22 }

```

```

13     WebDriver dv1 = new ChromeDriver();
14     dv1.manage().window().maximize();
15     dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
16         ;
16     dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
17     dv1.get("https://www.edx.org/");
18     dv1.findElement(By.className("search-input")).sendKeys("DEEV"
19         );
20     dv1.findElement(By.className("btn")).click();
21 }
}

```

3.7 Geeksforgeeks

Selenium WebDriver Screenshot of Geeksforgeeks website.

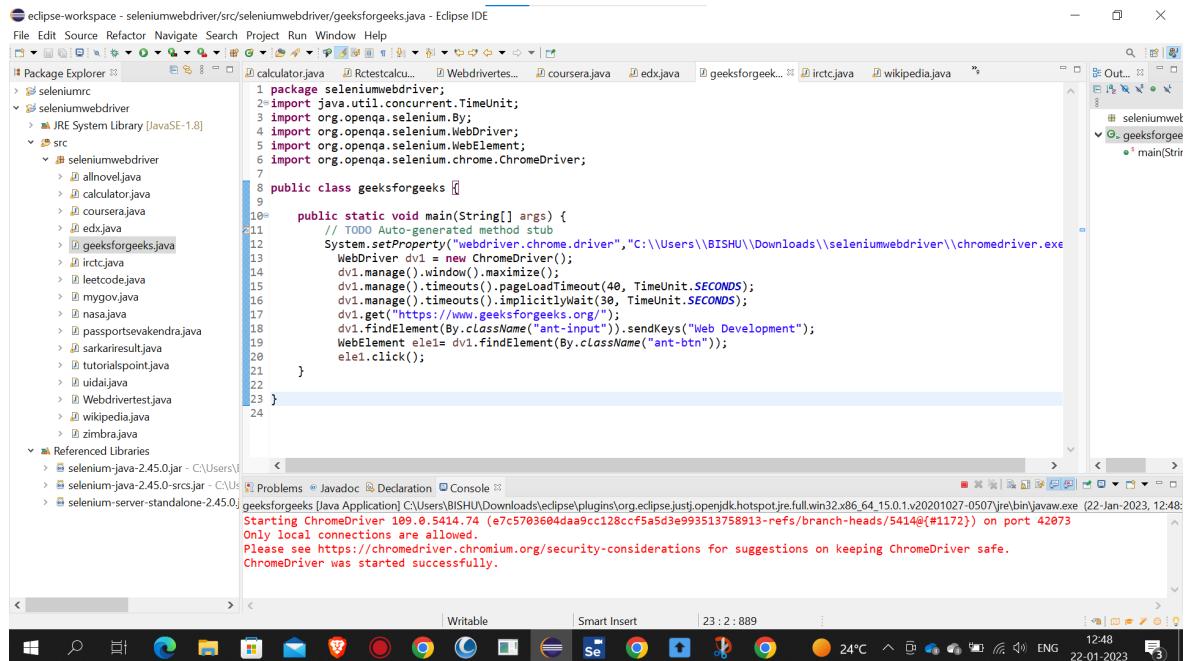


Figure 37: Selenium WebDriver for Geeksforgeeks Website

3.7.1 Selenium WebDriver Geeksforgeeks

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7
8 public class geeksforgeeks {

```

```

9
10 public static void main(String[] args) {
11     // TODO Auto-generated method stub
12     System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU
13         \\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
14     WebDriver dv1 = new ChromeDriver();
15     dv1.manage().window().maximize();
16     dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
17         ;
18     dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
19     dv1.get("https://www.geeksforgeeks.org/");
20     dv1.findElement(By.className("ant-input")).sendKeys("Web
21         Development");
22     WebElement ele1= dv1.findElement(By.className("ant-btn"));
23     ele1.click();
}

```

3.8 Youtube

Selenium WebDriver Screenshot of Youtube website.

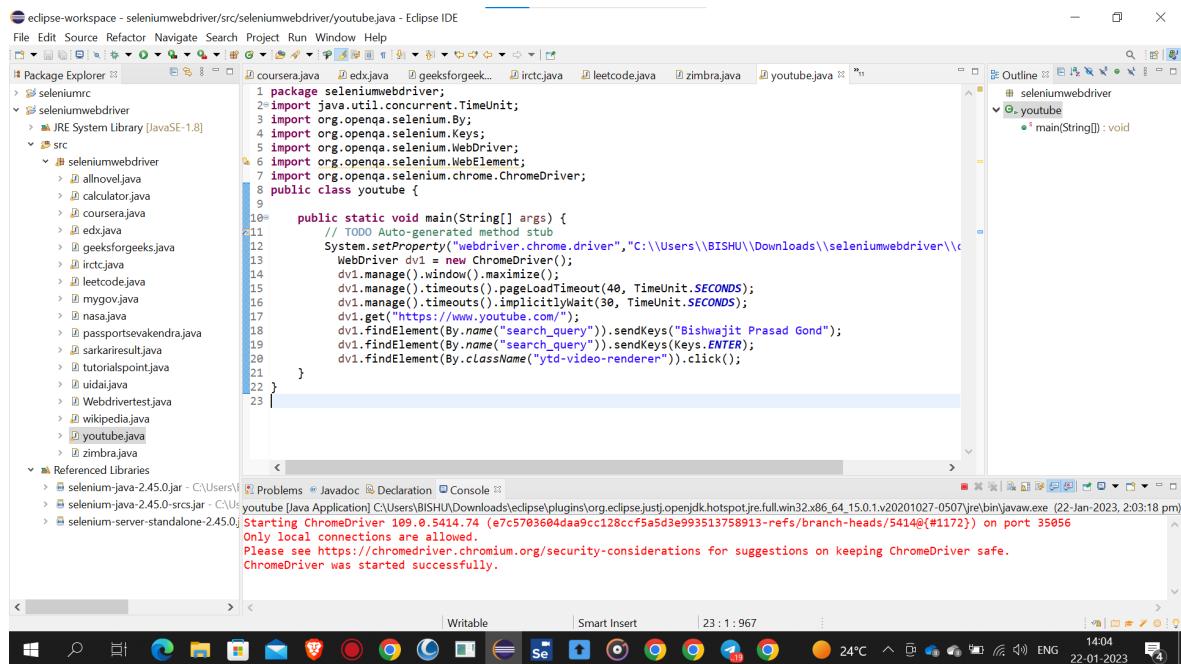


Figure 38: Selenium WebDriver for Youtube Website

3.8.1 Selenium WebDriver Youtube

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.Keys;
5 import org.openqa.selenium.WebDriver;
6 import org.openqa.selenium.WebElement;
7 import org.openqa.selenium.chrome.ChromeDriver;
8 public class youtube {
9
10    public static void main(String[] args) {
11        // TODO Auto-generated method stub
12        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU
13            \\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
14        WebDriver dv1 = new ChromeDriver();
15        dv1.manage().window().maximize();
16        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
17            ;
18        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
19        dv1.get("https://www.youtube.com/");
20        dv1.findElement(By.name("search_query")).sendKeys("Bishwajit
21            Prasad Gond");
22        dv1.findElement(By.name("search_query")).sendKeys(Keys.ENTER)
23            ;
24        dv1.findElement(By.className("ytd-video-renderer")).click
25            ();
26    }
27 }

```

3.9 Indgovtjobs

Selenium WebDriver Screenshot of indgovtjobs website.

3.9.1 Selenium WebDriver indgovtjobs

```

1 package seleniumwebdriver;
2
3 import java.util.concurrent.TimeUnit;
4 import org.openqa.selenium.By;
5 import org.openqa.selenium.WebDriver;
6 import org.openqa.selenium.chrome.ChromeDriver;
7
8 public class indgovtjobs {
9
10    public static void main(String[] args) {
11        // TODO Auto-generated method stub

```

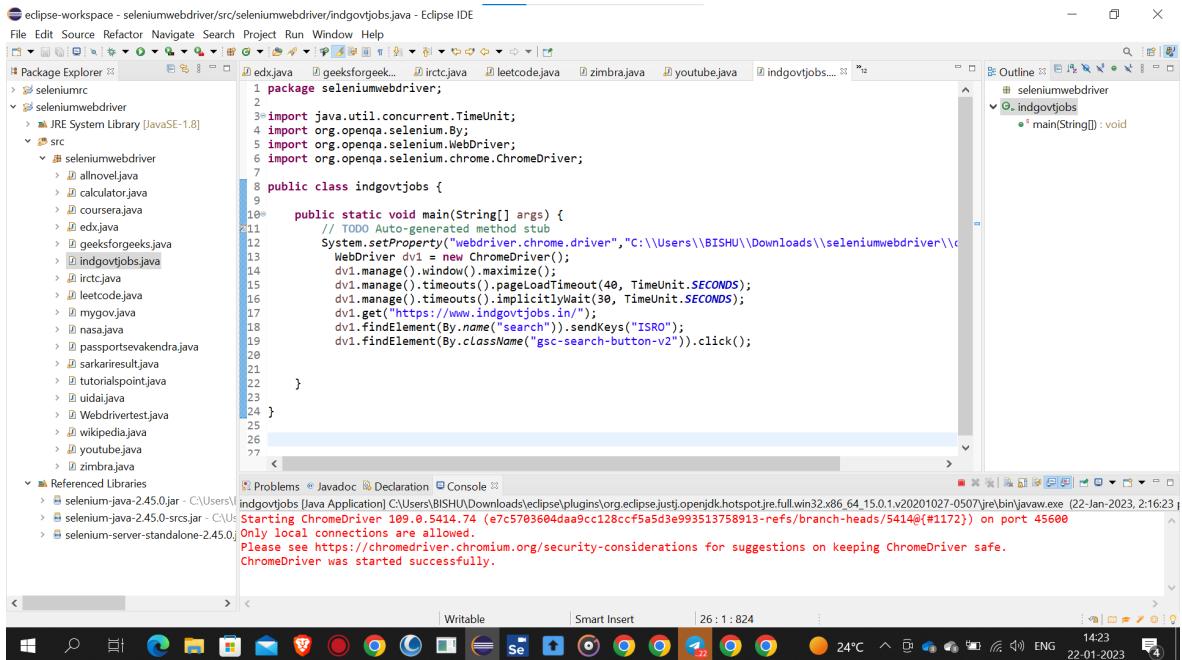


Figure 39: Selenium WebDriver for indgovtjobs Website

```

12 System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU
13 \\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
14 WebDriver dv1 = new ChromeDriver();
15 dv1.manage().window().maximize();
16 dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
17 ;
18 dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
19 dv1.get("https://www.indgovtjobs.in/");
20 dv1.findElement(By.name("search")).sendKeys("ISRO");
21 dv1.findElement(By.className("gsc-search-button-v2")).click()
22 ;
23
24 }

```

3.10 MyGov

Selenium WebDriver Screenshot of MyGov website.

3.10.1 Selenium WebDriver MyGov

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;

```

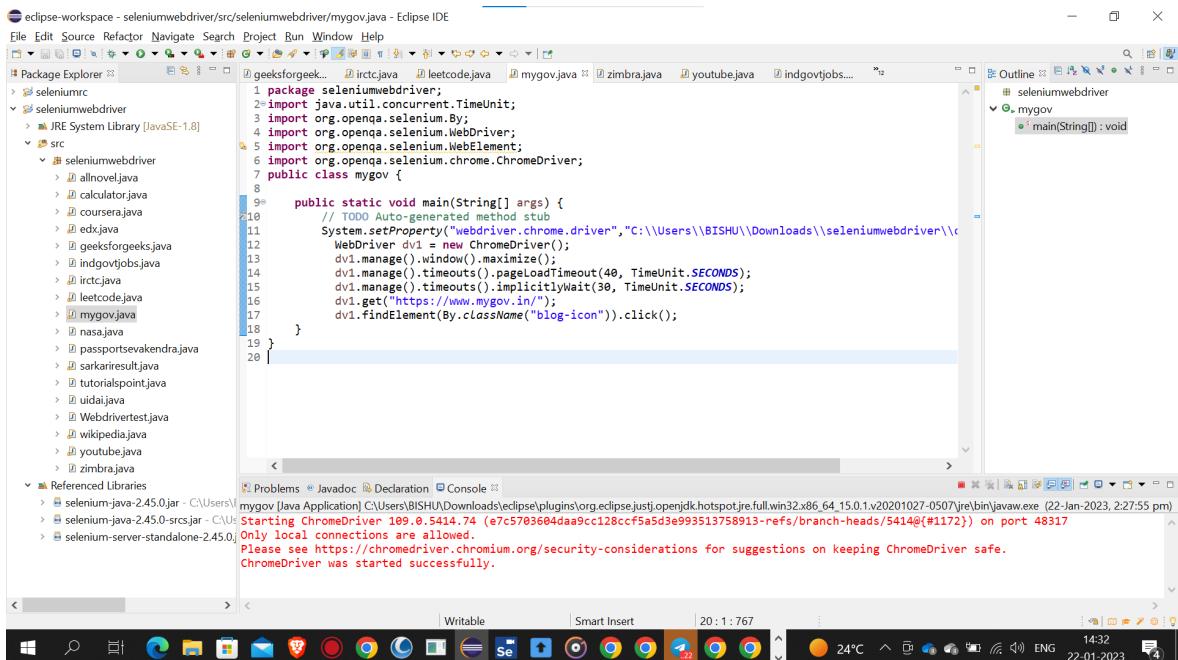


Figure 40: Selenium WebDriver for MyGov Website

```

4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class mygov {
8
9     public static void main(String[] args) {
10        // TODO Auto-generated method stub
11        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
12        WebDriver dv1 = new ChromeDriver();
13        dv1.manage().window().maximize();
14        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
15        ;
16        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
17        dv1.get("https://www.mygov.in/");
18        dv1.findElement(By.className("blog-icon")).click();
19    }
}

```

3.11 PassportIndia

Selenium WebDriver Screenshot of PassportIndia website.

3.11.1 Selenium WebDriver PassportIndia

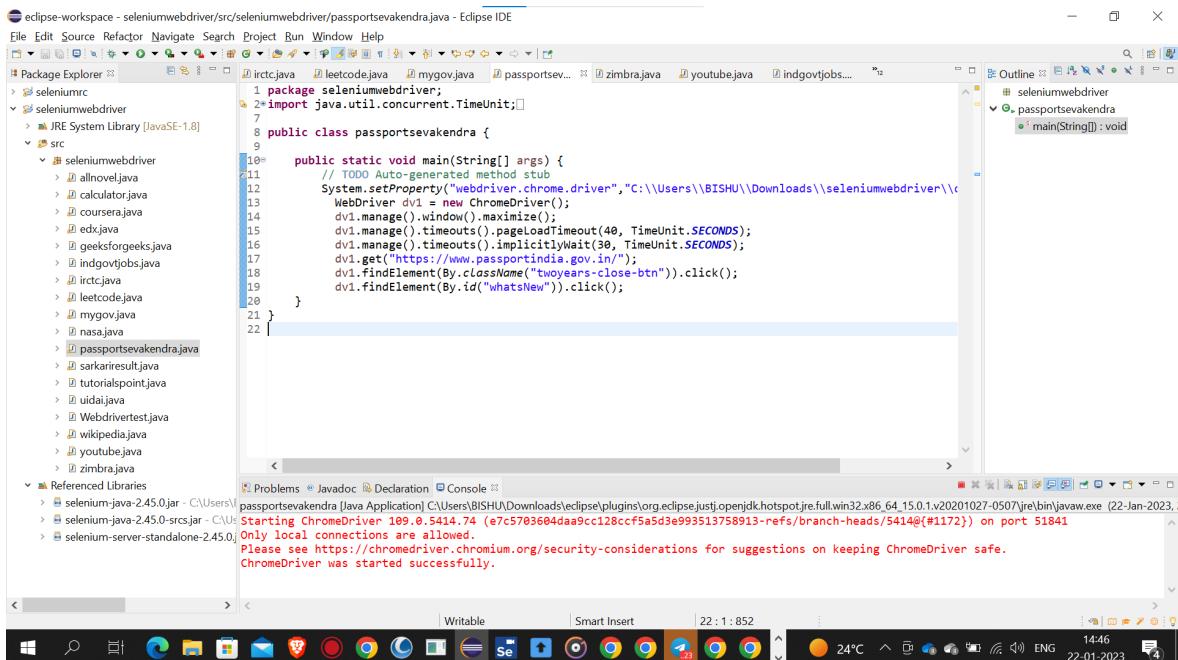


Figure 41: Selenium WebDriver for PassportIndia Website

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7
8 public class passportsevakendra {
9
10    public static void main(String[] args) {
11        // TODO Auto-generated method stub
12        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU
13          \\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
14        WebDriver dv1 = new ChromeDriver();
15        dv1.manage().window().maximize();
16        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
17            ;
18        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
19        dv1.get("https://www.passportindia.gov.in/");
20        dv1.findElement(By.className("twoyears-close-btn")).click();
21        dv1.findElement(By.id("whatsNew")).click();
22    }
}

```

3.12 Wikipedia

Selenium WebDriver Screenshot of wikipedia website.

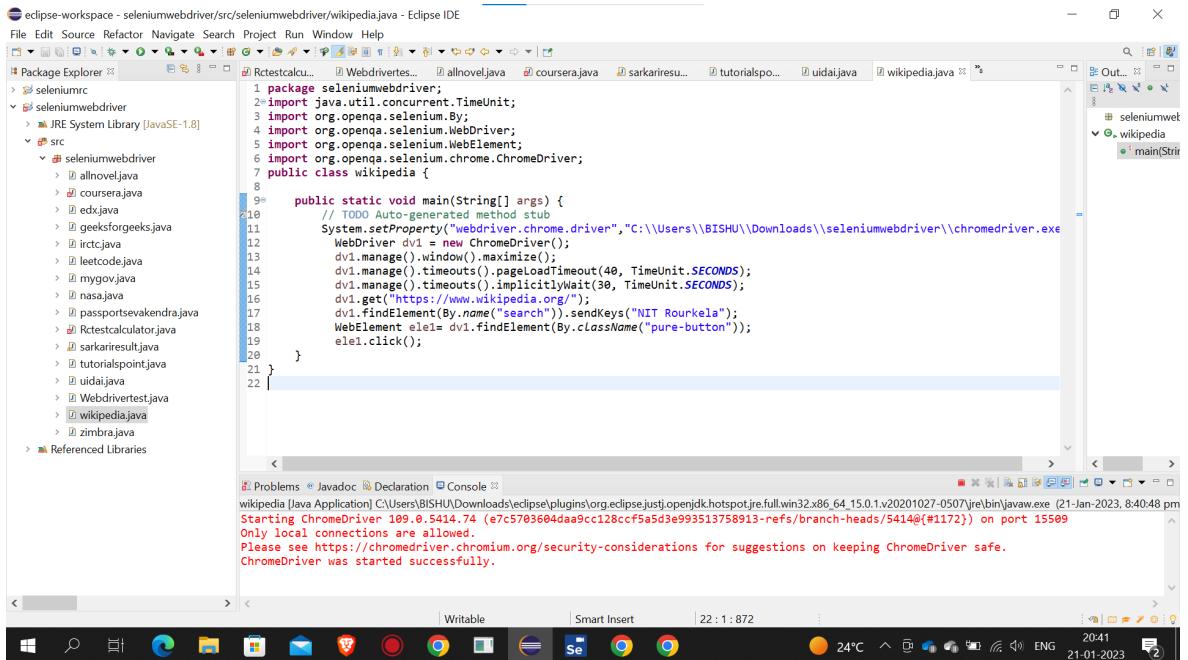


Figure 42: Selenium WebDriver for wikipedia Website

3.12.1 Selenium WebDriver wikipedia

```

1 package seleniumWebDriver;
2
3 import com.thoughtworks.selenium.DefaultSelenium;
4 import com.thoughtworks.selenium.Selenium;
5
6 public class wikipedia {
7
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
11        WebDriver dv1 = new ChromeDriver();
12        dv1.manage().window().maximize();
13        dv1.manage().pageLoadTimeout(40, TimeUnit.SECONDS);
14        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
15        dv1.get("https://www.wikipedia.org/");
16        dv1.findElement(By.name("search")).sendKeys("NIT Rourkela");
17        dv1.findElement(By.className("pure-button")).click();
18    }
19
20 }
```

3.13 UIDAI

Selenium WebDriver Screenshot of UIDAI website.

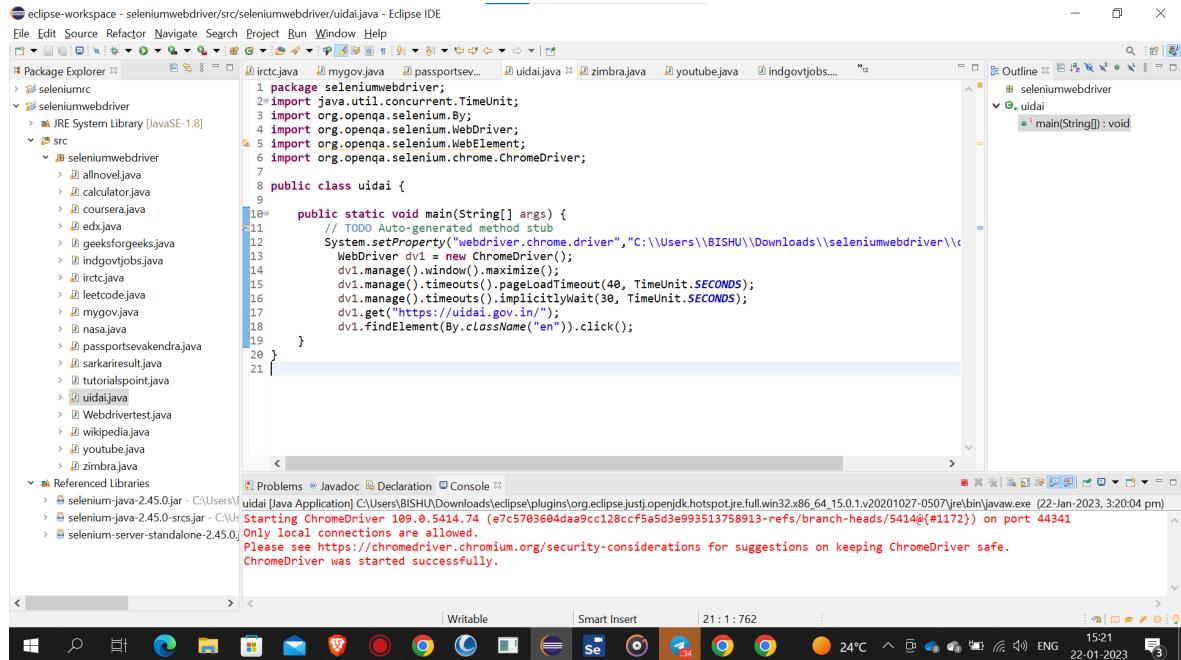


Figure 43: Selenium WebDriver for UIDAI Website

3.13.1 Selenium WebDriver UIDAI

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class uidai {
8     public static void main(String[] args) {
9         // TODO Auto-generated method stub
10        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
11        WebDriver dv1 = new ChromeDriver();
12        dv1.manage().window().maximize();
13        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
14            ;
15        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
16        dv1.get("https://uidai.gov.in/");
17        dv1.findElement(By.className("en")).click();
18    }
19 }
```

3.14 Zimbra

Selenium WebDriver Screenshot of Zimbra website.

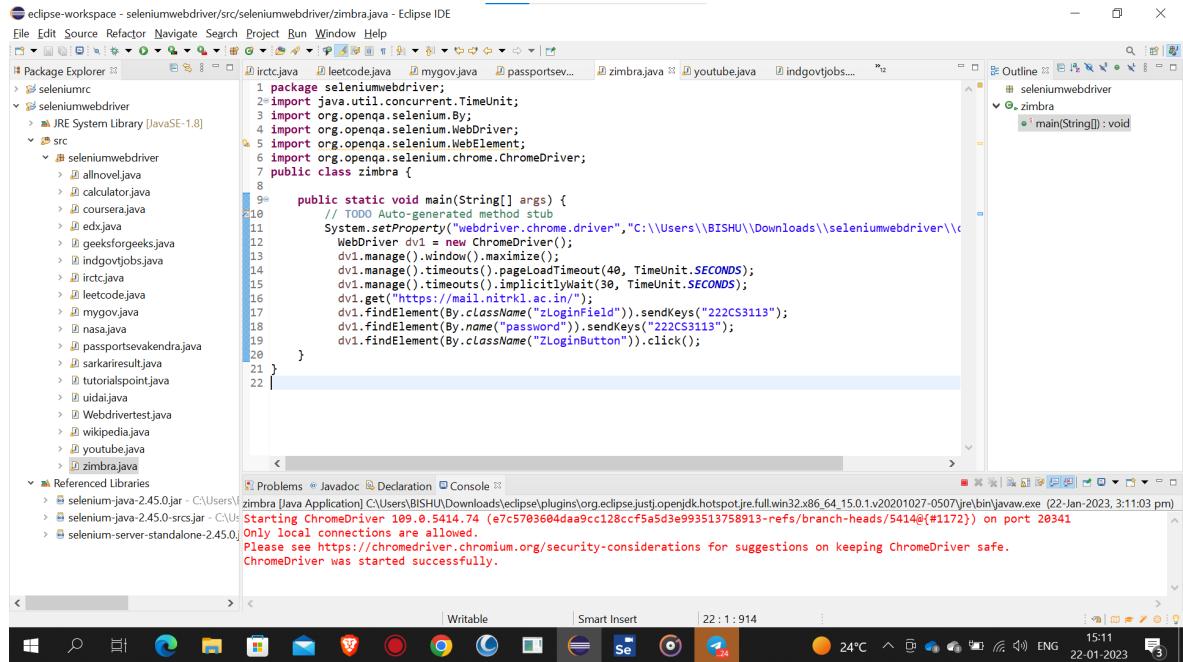


Figure 44: Selenium WebDriver for Zimbra Website

3.14.1 Selenium WebDriver Zimbra

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.WebDriver;
5 import org.openqa.selenium.WebElement;
6 import org.openqa.selenium.chrome.ChromeDriver;
7 public class zimbra {
8
9     public static void main(String[] args) {
10         // TODO Auto-generated method stub
11         System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
12         WebDriver dv1 = new ChromeDriver();
13         dv1.manage().window().maximize();
14         dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
15             ;
16         dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
17         dv1.get("https://mail.nitrkl.ac.in/");
18         dv1.findElement(By.className("zLoginField")).sendKeys("222
19             CS3113");
20         dv1.findElement(By.name("password")).sendKeys("222CS3113");

```

```

19     dv1.findElement(By.className("ZLoginButton")).click();
20 }
21 }

```

3.15 Maxdroid

Selenium WebDriver Screenshot of Maxdroid website.

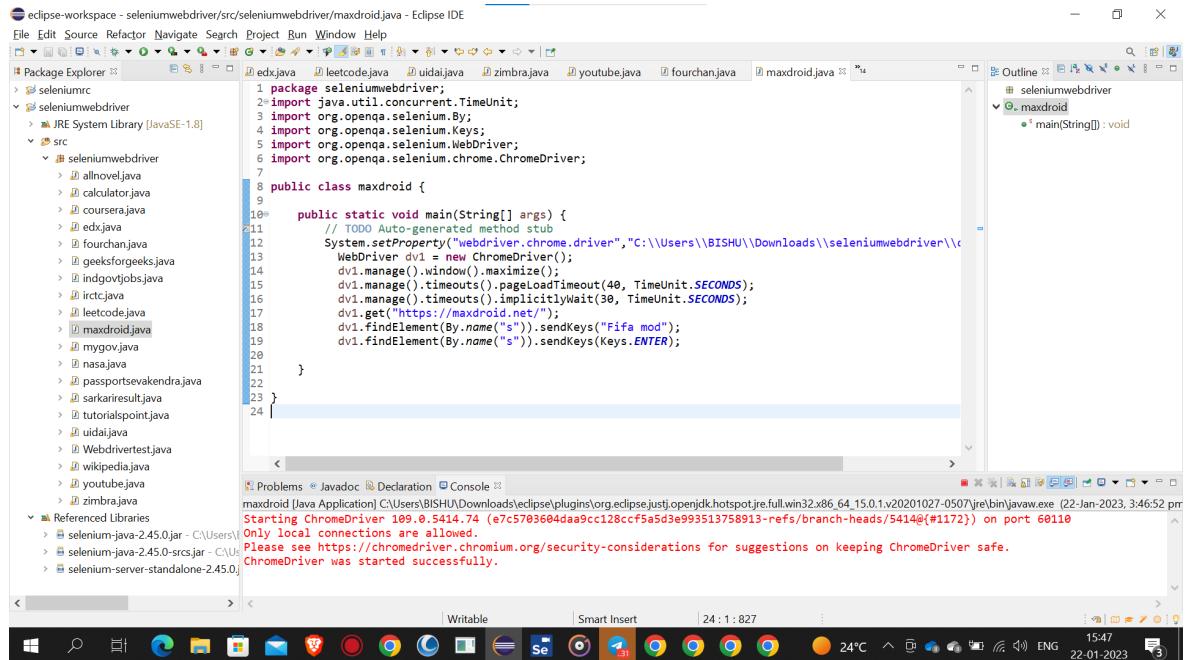


Figure 45: Selenium WebDriver for Maxdroid Website

3.15.1 Selenium WebDriver Maxdroid

```

1 package seleniumwebdriver;
2 import java.util.concurrent.TimeUnit;
3 import org.openqa.selenium.By;
4 import org.openqa.selenium.Keys;
5 import org.openqa.selenium.WebDriver;
6 import org.openqa.selenium.chrome.ChromeDriver;
7
8 public class maxdroid {
9
10    public static void main(String[] args) {
11        // TODO Auto-generated method stub
12        System.setProperty("webdriver.chrome.driver", "C:\\\\Users\\\\BISHU\\\\Downloads\\\\seleniumwebdriver\\\\chromedriver.exe");
13        WebDriver dv1 = new ChromeDriver();
14        dv1.manage().window().maximize();
15        dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS);
16        dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
17        dv1.get("https://maxdroid.net/");
18        dv1.findElement(By.name("s")).sendKeys("Fifa mod");
19        dv1.findElement(By.name("s")).sendKeys(Keys.ENTER);
20    }
21 }
22
23 }
24

```

```
15     dv1.manage().timeouts().pageLoadTimeout(40, TimeUnit.SECONDS)
16     ;
17     dv1.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
18     dv1.get("https://maxdroid.net/");
19     dv1.findElement(By.name("s")).sendKeys("Fifa mod");
20     dv1.findElement(By.name("s")).sendKeys(Keys.ENTER);
21 }
22
23 }
```

CS6474 : Software Testing Laboratory 2023

CUCKOO SANDBOX

Prepared by
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4 Cuckoo Sandbox

A Cuckoo Sandbox is a tool that is used to launch malware in a secure and isolated environment, the idea is the sandbox fools the malware into thinking it has infected a genuine host.

The sandbox will then record the activity of the malware and then generate a report on what the malware has attempted to do while in this secure environment.

These are great for security teams and malware analysts as they can be used to quickly gather IOC's which may be required for a security incident or a starting point for a piece of intel, it gives you quick and detailed information on how the malware is likely to behave.

Most commercial malware sandboxes are expensive, such as McAfee's enterprise version called Artemis. However Cuckoo is open source and free to download, and from my experience, the resulting output is almost identical.

Even though Cuckoo is free to download it can be quite complicated and time-consuming to set up for the first time, this is due to the Cuckoo requiring a number of dependencies, however once in place, it is an incredibly useful tool.

Once set up, Cuckoo is able to analyze many different malicious files (executables, office documents, pdf files, emails, malicious scripts) as well as malicious websites.

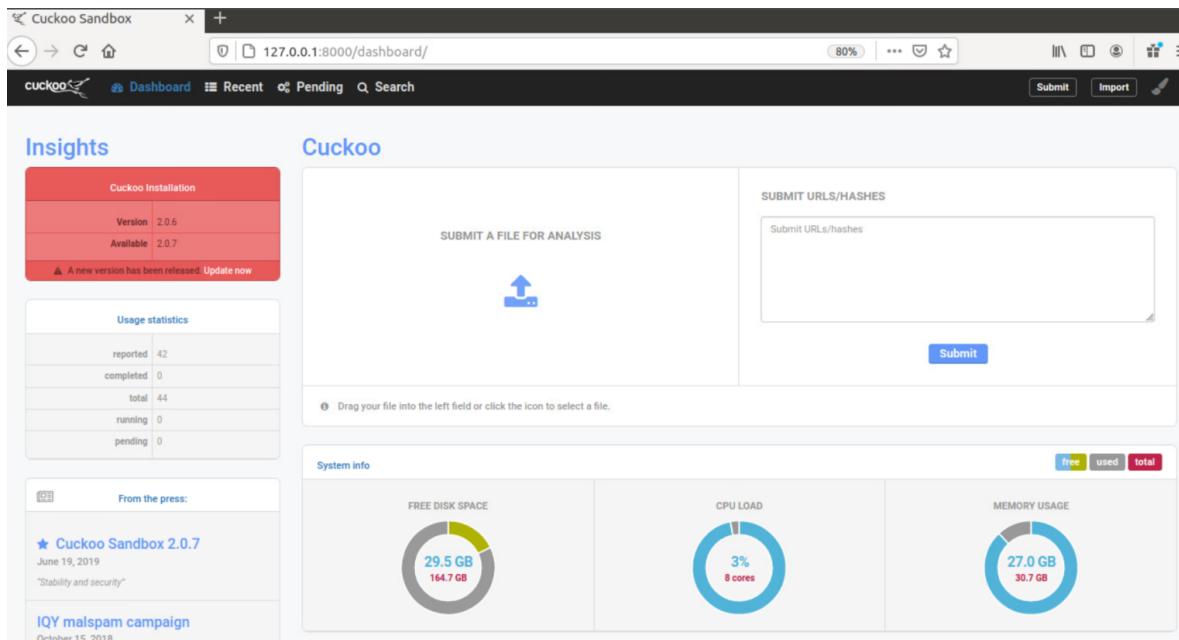


Figure 46: Cuckoo Sandbox Dashboard

4.0.1 Tcases CMD command

```

1 Sudo apt update
2 Sudo apt upgrade
3 sudo apt-get install python python-pip python-dev libffi-dev
    libssl-dev

```

```

4 sudo apt-get install python-virtualenv python-setuptools
5 sudo apt-get install libjpeg-dev zlib1g-dev swig
6 sudo apt-get install mongodb
7 sudo apt-get install postgresql libpq-dev
8 sudo apt install virtualbox
9 open virtualbox
10 create vboxnet0
11 sudo apt-get install tcpdump apparmor-utils
12 sudo groupadd pcap
13 sudo usermod -a -G pcap cuckoo
14 sudo chgrp pcap /usr/sbin/tcpdump
15 sudo setcap cap_net_raw,cap_net_admin=eip /usr/sbin/tcpdump
16 getcap /usr/sbin/tcpdump
17 sudo aa-disable /usr/sbin/tcpdump
18 sudo pip install m2crypto
19 sudo usermod -a -G vboxusers cuckoo
20 go to https://gist.github.com/jstrosch/
    de20131dda2aac5cd1116dd44b8f2474
21 chmod +x cuckoo-setup-virtualenv.sh
22 sudo -u cuckoo ./cuckoo-setup-virtualenv.sh
23 source ~/.bashrc
24 mkvirtualenv -p python2.7 cuckoo-test
25 pip install -U pip setuptools
26 pip install -U cuckoo
27 wget https://cuckoo.sh/win7ultimate.iso
28 ls -lah
29 sudo mkdir /mnt/win7
30 sudo chown cuckoo:cuckoo /mnt/win7
31 sudo mount -o ro,loop win7ultimate.iso /mnt/win7
32 sudo apt-get -y install build-essential libssl-dev libffi-dev
33 python-dev genisoimage
34 sudo apt-get -y install zlib1g-dev libjpeg-dev
35 sudo apt-get -y install python-pip python-virtualenv python-
    setuptools swig
36 pip install -U vmcloak
37 vmcloak
38 ** delete vboxnet from virtualbox **
39 vmcloak-vboxnet0
40 vmcloak init --verbose --win7x64 win7x64base --cpus 2 --ramsize
    2048
41 vmcloak clone win7x64base win7x64cuckoo
42 vmcloak install win7x64cuckoo ie11
43 vmcloak snapshot --count 1 win7x64cuckoo 192.168.56.101
44 vmcloak list vms
45 cuckoo init
46 cd ~/.cuckoo/
47 ls
48 cd conf/

```

```

49 ls
50 cuckoo community
51 nano virtualbox.conf
52 make mode = gui
53 while read -r vm ip; do cuckoo machine --add $vm $ip; done < <<
    vmcloak list vms)
54 nano virtualbox.conf
55 delete cuckoo and its data
56 open new terminal
57 ip a
58 sudo sysctl -w net.ipv4.conf.vboxnet0.forwarding=1
59     sudo sysctl -w net.ipv4.conf.eth0.forwarding=1
60 open new terminal
61 workon cuckoo-test
62 cuckoo rooter --sudo --group cuckoo
63
64 nano routing.conf
65 change internet = eth0
66 nano reporting.conf
67 change mongodb enabled = yes
68 open new terminal
69 workon cuckoo-test
70 cuckoo
71
72 open new terminal
73 workon cuckoo-test
74 cuckoo web --host 127.0.0.1 --port 8080

```

open new terminal

4.1 Command Explanation

4.1.1 Sudo apt update

The sudo apt-get update command is used to download package information from all configured sources. The sources often defined in the /etc/apt/sources.list file and other files located in /etc/apt/sources.

4.1.2 Sudo apt upgrade

apt-get upgrade actually installs newer versions of the packages you have. After updating the lists, the package manager knows about available updates for the software you have installed.

4.1.3 sudo apt-get install python python-pip python-dev libffi-dev libssl-dev

python python-pip python-dev libffi-dev libssl-dev software packages from the apt repositories are required to get Cuckoo to install and run properly.

4.1.4 sudo apt-get install python-virtualenv python-setuptools

python-virtualenv python-setuptools are required to get cuckoo to install and run properly.

4.1.5 sudo apt-get install libjpeg-dev zlib1g-dev swig

libjpeg-dev zlib1g-dev swig are required to get cuckoo to install and run properly.

4.1.6 sudo apt-get install mongodb

Django-based Web Interface, MongoDB is required.

4.1.7 sudo apt-get install postgresql libpq-dev

libpq is a set of library functions that allow client programs to pass queries to the PostgreSQL backend server and to receive the results of these queries.

4.1.8 sudo apt install virtualbox

This command downloads and install virtual box with the newest version.

4.1.9 virtualbox

This command is used to open the virtualbox.

4.1.10 Create vboxnet0

This command is create a new host that is a gateway between host and guest.

4.1.11 sudo apt-get install tcpdump apparmor-utils

This command installs the apparmor-utils. You need to install tcpdump in order to dump network traffic which occurs during analysis.

4.1.12 sudo usermod -a -G pcap cuckoo

The usermod command modifies the system account files to reflect the changes that are specified on the command line.

4.1.13 sudo setcap cap_net_raw,cap_net_admin=eip /usr/sbin/tcpdump

setcap sets the capabilities of each specified filename to the capabilities specified.

4.1.14 getcap /usr/sbin/tcpdump

getcap displays the name and capabilities of each specified file

4.1.15 sudo aa-disable /usr/sbin/tcpdump

aa-disable is used to disable one or more profiles. This command will unload the profile from the kernel and prevent the profile from being loaded on AppArmor startup

4.1.16 sudo pip install m2crypto

This command is used to install m2crypto.

4.1.17 sudo usermod -a -G vboxusers cuckoo

The usermod command modifies the system account files.

4.1.18 cuckoo-setup-virtualenv.sh

we are downloading sh file <https://gist.github.com/jstrosch/de20131dda2aac5cd1116dd44b8f2474>

4.1.19 sudo -u cuckoo ./cuckoo-setup-virtualenv.sh

The -u option allows you to run a command as the specified user name or user ID. So, you can run the command as a user other than the root.

4.1.20 source /.bashrc

For the changes to be applied, run the source command with the .bashrc file as an argument.

4.1.21 mkvirtualenv -p python2.7 cuckoo-test

This command is used for create new python environment for cuckoo.

4.1.22 pip install -U pip setuptools

Upgrade all packages to the newest available version of pip setuptools.

4.1.23 pip install -U cuckoo

Although the above, a global installation of Cuckoo in your OS works mostly fine, we highly recommend installing Cuckoo in a virtualenv.

4.1.24 wget https://cuckoo.sh/win7ultimate.iso

We are downloading virtaulbox win7ultimate.iso

4.1.25 ls -lah

List information about the FILES (the current directory by default).

4.1.26 sudo mkdir /mnt/win7

Create the DIRECTORY, if they do not already exist.

4.1.27 sudo chown cuckoo:cuckoo /mnt/win7

These system calls change the owner and group of a file

4.1.28 sudo mount -o ro,loop win7ultimate.iso /mnt/win7

The mount options from command line will be appended to the list of op etc/fstab.tions from /
The usual behavior is that the last option wins if there are more duplicated options.

4.1.29 sudo apt-get -y install build-essential libssl-dev libffi-dev python-dev genisoimage

Before we install Cuckoo and VMCloak, the installation of multiple packages is required. These are dependencies VMCloak or Cuckoo require to function

4.1.30 sudo apt-get -y install zlib1g-dev libjpeg-dev

For the jpeg supports we want run above command.

4.1.31 sudo apt-get -y install python-pip python-virtualenv python-setuptools swig

Above command used for create the dependency between cuckoo and vmcloak.

4.1.32 pip install -U vmcloak

VMCloak only supports VirtualBox. Using this command install the vmcloak.

4.1.33 vmcloak

VMCloak is a utility for automatically creating Virtual Machines with Windows as guest Operating System. It has been tailored to generate Virtual Machines directly usable from within Cuckoo Sandbox, but it can also be used for other purposes as Cuckoo's components can be omitted through the configuration.

4.1.34 vmcloak-vboxnet0

This command create and start the vboxnet0 network.

4.1.35 vmcloak init --verbose --win7x64 win7x64base --cpus 2 --ramsize 2048

Create the VM and automatically install Windows. A Cuckoo analysis VM should have at least 2GB of memory and preferably two or more CPU cores.

4.1.36 vmcloak clone win7x64base win7x64cuckoo

This commands Creating cuckoo clone image form base file.

4.1.37 vmcloak install win7x64cuckoo ie11

This command is used for install internet explorer.

4.1.38 vmcloak snapshot --count 1 win7x64cuckoo 192.168.56.101

This command creating the snapshots of vms with ip address

4.1.39 vmcloak list vms

Listed the vm using above command.

4.1.40 cuckoo init

Creating the directory before use the cuckoo.

4.1.41 cd /.cuckoo/

This command is used to move to the cuckoo directory.

4.1.42 ls

After run above command it shows the list of directory content.

4.1.43 cd conf/

Here we can do some configurations the files.

4.1.44 ls

After run above command it shows the list of directory content.

4.1.45 cuckoo community

Install cuckoo community, which has useful signatures that will be useful while in analysis.

4.1.46 nano virtualbox.conf

We are using nano text editor to edit virtualbox.conf

4.1.47 make mode = gui

We are enabling GUI render for user friendly dashboard

4.1.48 while read -r vm ip; do cuckoo machine –add \$vm \$ip; done <<(vmcloak list vms)

Time to add the created VMs to Cuckoo. We will use the cuckoo machine $--add <vmname><ip>$ to tell Cuckoo to add the machine to its configuration. This has to be done for each machine, so let's make life easier and use vmcloak list vms.

4.1.49 nano virtualbox.conf

We are using nano text editor to edit virtualbox.conf

4.1.50 sudo sysctl -w net.ipv4.conf.vboxnet0.forwarding=1

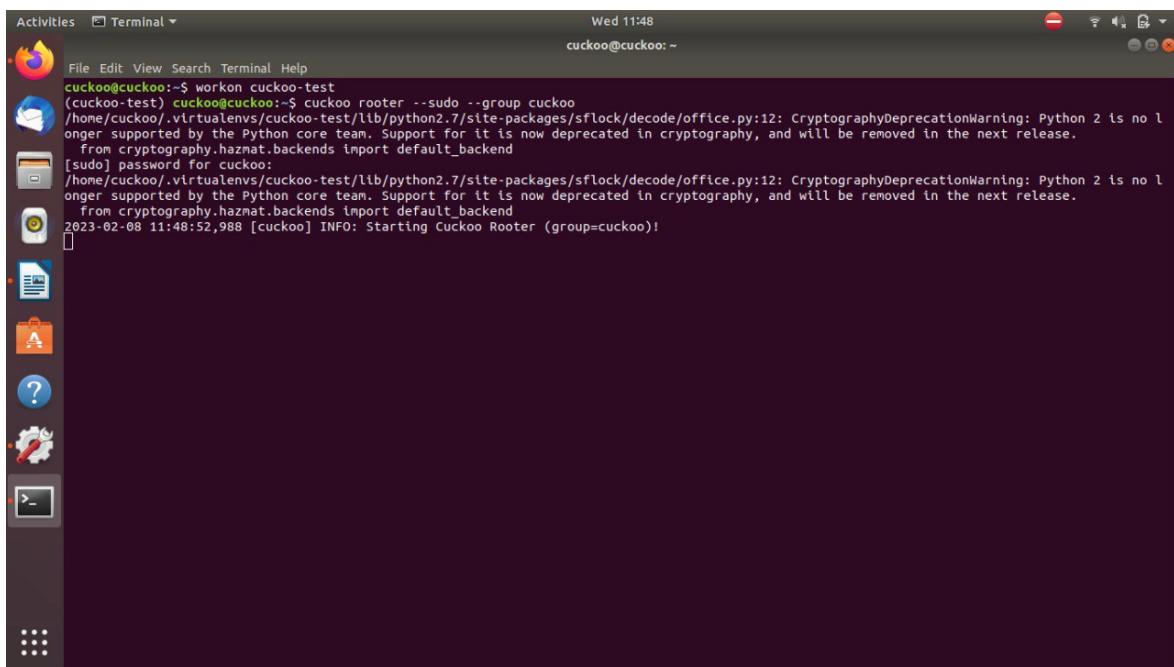
We are configuring virtualbox to allow ip forwarding.

4.1.51 sudo sysctl -w net.ipv4.conf.eth0.forwarding=1

We are configuring eth0 to allow ip forwarding.

4.1.52 workon cuckoo-test

This command is use to switch to cuckoo in virtual environment any further command in this environment will be executed in cuckoo-test.



```

Activities Terminal Wed 11:48
cuckoo@cuckoo:~$ workon cuckoo-test
(cuckoo-test) cuckoo@cuckoo:~$ cuckoo rooter --sudo --group cuckoo
/home/cuckoo/.virtualenvs/cuckoo-test/lib/python2.7/site-packages/sflock/decode/office.py:12: CryptographyDeprecationWarning: Python 2 is no longer supported by the Python core team. Support for it is now deprecated in cryptography, and will be removed in the next release.
    from cryptography.hazmat.backends import default_backend
[sudo] password for cuckoo:
/home/cuckoo/.virtualenvs/cuckoo-test/lib/python2.7/site-packages/sflock/decode/office.py:12: CryptographyDeprecationWarning: Python 2 is no longer supported by the Python core team. Support for it is now deprecated in cryptography, and will be removed in the next release.
    from cryptography.hazmat.backends import default_backend
2023-02-08 11:48:52,988 [cuckoo] INFO: Starting Cuckoo Rooter (group=cuckoo)

```

Figure 47: Screenshot of workon cuckoo-test

4.1.53 cuckoo rooter –sudo –group cuckoo

Since Cuckoo is installed in a virtualenv, and the Cuckoo user should not have root privileges, we can do the following from a root privileged user.

4.1.54 nano routing.conf

We are using nano text editor to edit routing.conf

change internet = eth0

nano reporting.conf

change mongodb enabled = yes

Again we are opening new terminal for running the below command.

4.1.55 workon cuckoo-test

This command is use to switch to cuckoo in virtual environment any further command in this environment will be executed in cuckoo-test.

```

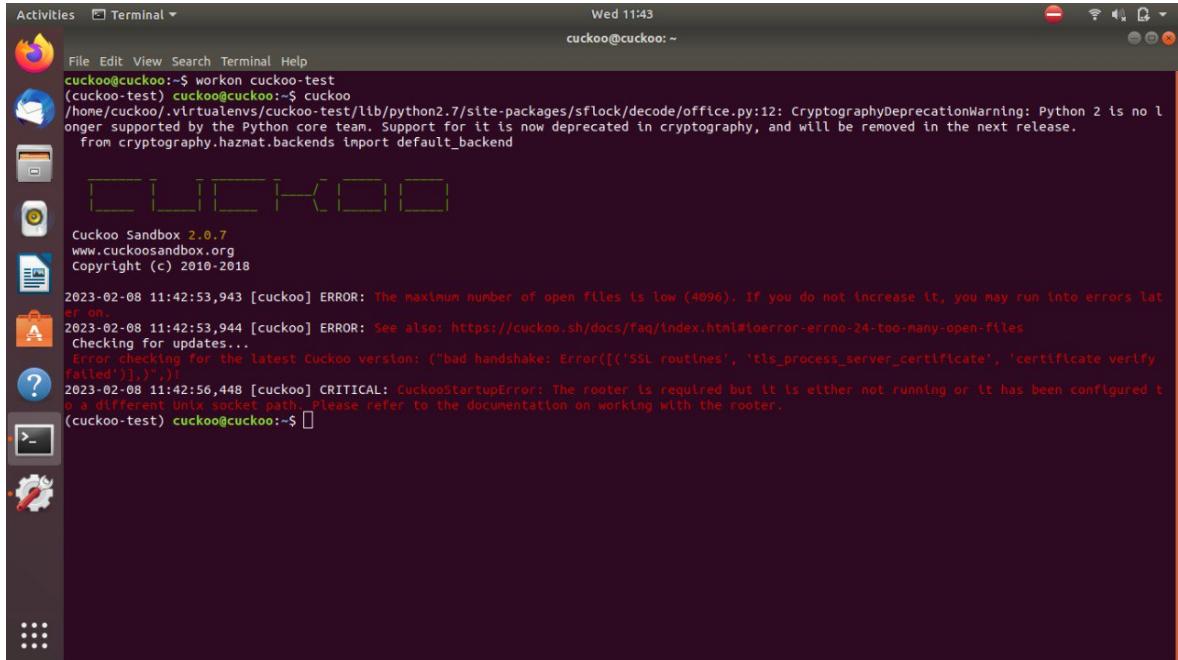
Activities Terminal ▾
Wed 11:43
cuckoo@cuckoo: ~
File Edit View Search Terminal Help
cuckoo@cuckoo:~$ workon cuckoo-test
(cuckoo-test) cuckoo@cuckoo:~$ cuckoo
/home/cuckoo/.virtualenvs/cuckoo-test/lib/python2.7/site-packages/sflock/decode/office.py:12: CryptographyDeprecationWarning: Python 2 is no longer supported by the Python core team. Support for it is now deprecated in cryptography, and will be removed in the next release.
  from cryptography.hazmat.backends import default_backend
Cuckoo Sandbox 2.0.7
www.cuckoosandbox.org
Copyright (c) 2010-2018
2023-02-08 11:42:53,943 [cuckoo] ERROR: The maximum number of open files is low (4096). If you do not increase it, you may run into errors later on.
2023-02-08 11:42:53,944 [cuckoo] ERROR: See also: https://cuckoo.sh/docs/faq/index.html#ioerror-errno-24-too-many-open-files
Checking for updates...
Error checking for the latest Cuckoo version: ("bad handshake: Error([('SSL routines', 'tls_process_server_certificate', 'certificate verify failed')])")
2023-02-08 11:42:56,448 [cuckoo] CRITICAL: CuckooStartupError: The rooter is required but it is either not running or it has been configured to a different Unix socket path. Please refer to the documentation on working with the rooter.
(cuckoo-test) cuckoo@cuckoo:~$ 

```

Figure 48: Screenshot of cuckoo

4.1.56 cuckoo

This Command is Used to start cuckoo program.



The screenshot shows a terminal window titled 'Terminal' with the command 'workon cuckoo-test' being run. The output indicates that the command is switching to the 'cuckoo-test' environment. It also shows several error messages related to cryptography and SSL/TLS configurations, and a critical error message about the rooter being required. The terminal window is part of a desktop environment with a dock containing icons for various applications like a file manager, browser, and terminal.

```
cuckoo@cuckoo:~$ workon cuckoo-test
(cuckoo-test) cuckoo@cuckoo:~$ cuckoo
/home/cuckoo/.virtualenvs/cuckoo-test/lib/python2.7/site-packages/sflock/decode/office.py:12: CryptographyDeprecationWarning: Python 2 is no longer supported by the Python core team. Support for it is now deprecated in cryptography, and will be removed in the next release.
  from cryptography.hazmat.backends import default_backend

Cuckoo Sandbox 2.0.7
www.cuckoosandbox.org
Copyright (c) 2010-2018

2023-02-08 11:42:53,943 [cuckoo] ERROR: The maximum number of open files is low (4096). If you do not increase it, you may run into errors later on.
2023-02-08 11:42:53,944 [cuckoo] ERROR: See also: https://cuckoo.sh/docs/faq/index.html#error-errno-24-too-many-open-files
Checking for updates...
Error checking for the latest Cuckoo version: ('bad handshake: Error([('SSL routines', 'tls_process_server_certificate', 'certificate verify failed')])')
2023-02-08 11:42:56,448 [cuckoo] CRITICAL: CuckooStartupError: The rooter is required but it is either not running or it has been configured to a different Unix socket path. Please refer to the documentation on working with the rooter.
(cuckoo-test) cuckoo@cuckoo:~$ 
```

Figure 49: Screenshot of workon cuckoo-test

4.1.57 workon cuckoo-test

This command is use to switch to cuckoo in virtual environment any further command in this environment will be executed in cuckoo-test.

4.1.58 cuckoo web –host 127.0.0.1 –port 8080

We are opening GUI based cuckoo dashboard on Internet Explorer on IP 127.0.0.1 port: 8080

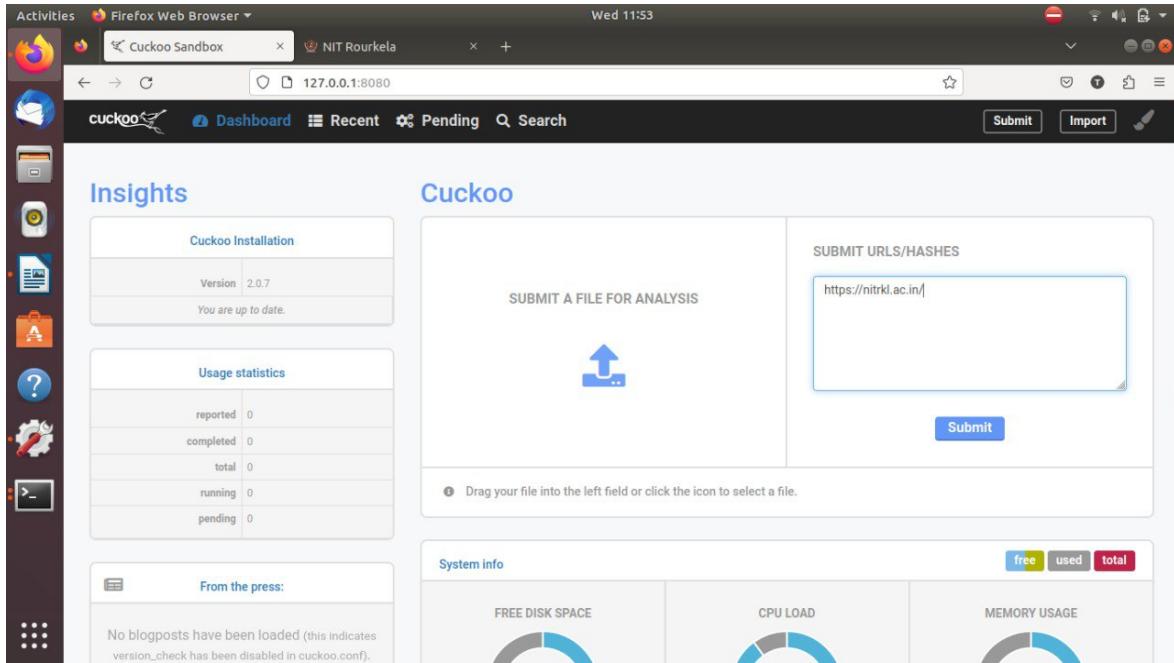


Figure 50: Screenshot of cuckoo dashboard

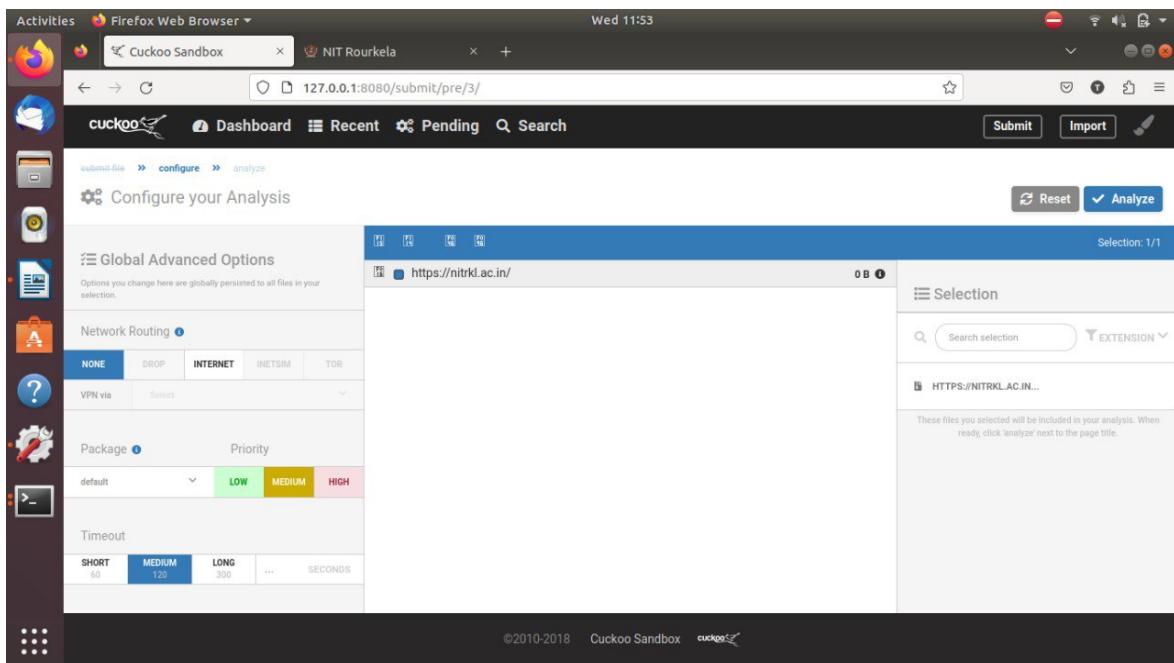


Figure 51: Screenshot of url injection using cuckoo

CS6474: Software Testing Laboratory 2023

TCASES

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5 Tcases

Tcases is a tool for designing tests. It doesn't matter what kind of system you are testing. Nor does it matter what level of the system you are testing — unit, subsystem, or full system. You can use Tcases to design your tests in any of these situations. With Tcases, you define the input space for your system-under-test and the level of coverage that you want. Then Tcases generates a minimal set of test cases that meets your requirements.

Tcases is primarily a tool for black-box test design. For such tests, the concept of "coverage" is different from structural testing criteria such as line coverage, branch coverage, etc. Instead, Tcases is guided by coverage of the input space of your system.

5.0.1 Tcases CMD command

```

1 D:\Tcase\tcases-3.7.1\docs\examples\xml\icecream3>tcases Ice-
  Cream-Input.xml
2 D:\Tcase\tcases-3.7.1\docs\examples\xml\icecream3>tcases -J Ice-
  Cream-Input.xml
3 D:\Tcase\tcases-3.7.1\docs\examples\xml\icecream3>tcases -H Ice-
  Cream-Input.xml
4 D:\Tcase\tcases-3.7.1\docs\examples\xml\icecream3>tcases-reducer
  Ice-Cream-Input.xml
5 D:\Tcase\tcases-3.7.1\docs\examples\xml\icecream3>

```

5.1 Annotations-Test

5.1.1 Specification

Usage: Check different geometrical shape

We can add shape by using addShape function by passing parameter to

- 1) Type: CIRCLE, RECTANGLE, LINE etc
- 2) Size: In cm
- 3) Colour: RED, GREEN etc

5.1.2 XML Code

```

1 <!--
2 Usage: ADD or Create different geometrical shape
3
4 We can add shape by using addShape function
5 by passing parameter to
6 1) Type: CIRCLE, RECTANGLE, LINE etc
7 2) Size: In cm
8 3) Colour: RED, GREEN etc

```

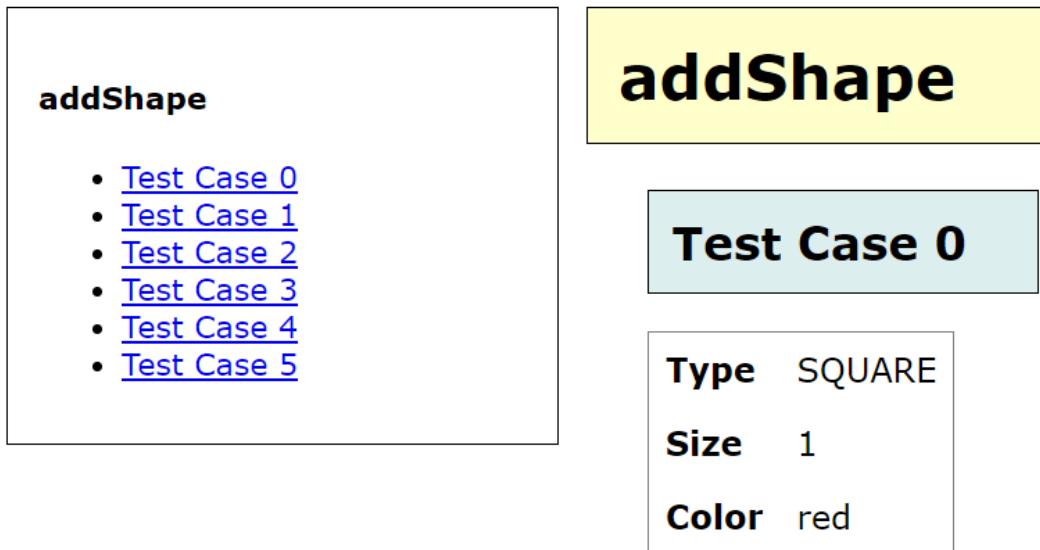


Figure 52: Annotations-Test HTML View

```

9
10  -->
11 <System name="Examples">
12   <Function name="addShape">
13     <!-- Test case annotations -->
14     <Has name="pageType" value="Page"/>
15     <Has name="pageName" value="page"/>
16     <Has name="pageValue" value="new Page()"/>
17
18   <Input>
19
20     <Var name="Type">
21       <!-- Variable binding annotations -->
22       <Has name="varType" value="Shape"/>
23       <Has name="varName" value="shape"/>
24       <Has name="varEval" value="new Shape()"/>
25
26       <Value name="SQUARE"/>
27       <Value name="CIRCLE"/>
28       <Value name="LINE" property="1D"/>
29     </Var>
30
31     <Var name="Size">
32       <!-- Variable binding annotations -->
33       <Has name="varType" value="int"/>
34       <Has name="varName" value="size"/>
35       <Has name="varApply" value="setSize"/>
36
37     <Value name="1"/>

```

```

38         <Value name="10"/>
39         <Value name="100" property="Large"/>
40     </Var>
41
42     <Var name="Color">
43         <!-- Variable binding annotations -->
44         <Has name="varType" value="String"/>
45         <Has name="varName" value="color"/>
46         <Has name="varApply" value="setColor"/>
47
48         <Value name="red"/>
49         <Value name="green"/>
50         <Value name="blue"/>
51     </Var>
52   </Input>
53 </Function>
54 </System>

```

5.2 Ice-Cream Input

5.2.1 Specification

Usage: Checking different Scoop level & toppings of ice-cream

We can add different levels of scoops in different condition of cone functions for example

- 1) If cone is not there then we will not add any scoop of ice-cream.
- 2) If cone is there and customer want Plain ice-cream then we can add maximum of 1 scoop and 1 topping in ice-cream.
- 3) If cone is there and customer want Plenty ice-cream then we can add min of 1 and maximum of 2 scoop and 2 topping in ice-cream.
- 4) If cone is there and customer want Grande ice-cream then we can add maximum of 4 scoop and 3 maximum and 1 minimum topping in ice-cream.
- 5) If cone is there and customer want Too-much ice-cream then we can add maximum of 3 scoop and 4 minimum topping in ice-cream.
- 6) If cone is there and customer want Too-much ice-cream then we can add maximum of 4 scoop and 5 minimum topping in ice-cream.

5.2.2 XML Code

```

1 <System name="Ice-Cream">
2   <Function name="Cones">
3     <Input>
4       <Var name="Cone">

```

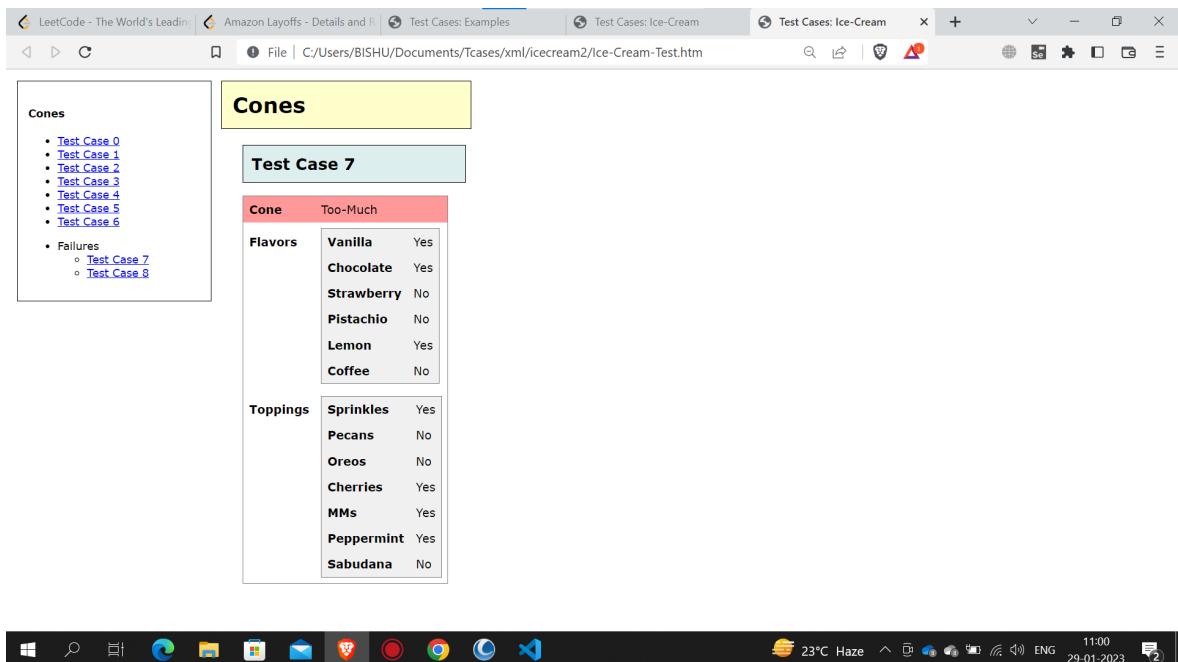


Figure 53: Ice-Cream HTML Test cases View

```

5   <Value name="Empty" failure="false">
6     <When>
7       <LessThan property="scoop" max="1"/>
8     </When>
9   </Value>
10  <Value name="Plain">
11    <When>
12      <AllOf>
13        <Equals property="scoop" count="1"/>
14        <NotMoreThan property="topping" max=
15          1/>
16      </AllOf>
17    </When>
18  </Value>
19  <Value name="Plenty">
20    <When>
21      <AllOf>
22        <Between property="scoop" min="1" max
23          = "2"/>
24        <NotMoreThan property="topping" max="2"/>
25      </AllOf>
26    </When>
27  </Value>
28  <Value name="Grande">

```

```
29             <Between property="scoop"
30                 exclusiveMin="0" exclusiveMax="4" />
31         >
32         <Between property="topping" min="1"
33             max="3" />
34     </AllOf>
35     </When>
36 </Value>
37 <Value name="Too-Much" failure="true">
38     <When>
39         <AnyOf>
40             <MoreThan property="scoop" min="3" />
41             <NotLessThan property="topping" min="4" />
42         </AnyOf>
43     </When>
44 </Value>
45 <Value name="Too-too-Much" failure="true">
46     <When>
47         <AnyOf>
48             <MoreThan property="scoop" min="4" />
49             <NotLessThan property="topping" min="5" />
50         </AnyOf>
51     </When>
52 </Value>
53 </Var>
54
55 <VarSet name="Flavors">
56     <Var name="Vanilla">
57         <Value name="Yes" property="scoop"/>
58         <Value name="No" />
59     </Var>
60     <Var name="Chocolate">
61         <Value name="Yes" property="scoop"/>
62         <Value name="No" />
63     </Var>
64     <Var name="Strawberry">
65         <Value name="Yes" property="scoop"/>
66         <Value name="No" />
67     </Var>
68     <Var name="Pistachio">
69         <Value name="Yes" property="scoop"/>
70         <Value name="No" />
71     </Var>
72     <Var name="Lemon">
73         <Value name="Yes" property="scoop"/>
74         <Value name="No" />
```

```

72      </Var>
73      <Var name="Coffee">
74          <Value name="Yes" property="scoop"/>
75          <Value name="No"/>
76      </Var>
77  </VarSet>
78
79  <VarSet name="Toppings" when="scoop">
80      <Var name="Sprinkles">
81          <Value name="Yes" property="topping"/>
82          <Value name="No"/>
83      </Var>
84      <Var name="Pecans">
85          <Value name="Yes" property="topping"/>
86          <Value name="No"/>
87      </Var>
88      <Var name="Oreos">
89          <Value name="Yes" property="topping"/>
90          <Value name="No"/>
91      </Var>
92      <Var name="Cherries">
93          <Value name="Yes" property="topping"/>
94          <Value name="No"/>
95      </Var>
96      <Var name="MMs">
97          <Value name="Yes" property="topping"/>
98          <Value name="No"/>
99      </Var>
100     <Var name="Peppermint">
101         <Value name="Yes" property="topping"/>
102         <Value name="No"/>
103     </Var>
104     <Var name="Sabudana">
105         <Value name="Yes" property="topping"/>
106         <Value name="No"/>
107     </Var>
108  </VarSet>
109 </Input>
110 </Function>
111 </System>

```

5.3 Tcases-Input

5.3.1 Specification

Usage: Represents a set of command line options. Command line arguments have the following form. [-c tupleSize] [-f outFile] [-g genDef] [-n] [-I] [-o outDir] [-p name=value] [-r seed] [-R]

`[-t testDef] [-T contentType] [-v] [-x transformDef — -J — -H] [inputDef]`

where:

`-c tupleSize` If `-c` is defined, use the given default tupleSize for all generators. This updates the generator definitions specified by the genDef file.

`-f outFile` If `-f` is defined, test definition output is written to the specified outFile, relative to the given outDir. If omitted, test definitions are written to the file specified by the `-t` option. If an output path cannot be derived, output is written to standard output.

`-g genDef` If `-g` is defined, test definitions are created using the generator(s) specified by the given genDef file. If omitted, the default generator definition is used. The default generator definition is read from the corresponding `*-Generators` file in the same directory as the inputDef, if it exists. Otherwise, the default TupleGenerator is used for all functions.

`-H` If `-H` is defined, test definition output is transformed into an HTML report. The resulting HTML file is written to the specified outDir.

`-J` If `-J` is defined, test definition output is transformed into Java source code for a JUnit test class. The resulting Java source file is written to the specified outDir. The following parameters (see the `-p` option) affect the results of this transform.

`class`: The name of the class under test. If omitted, the default is defined by the system parameter.

`system`: The name of the system under test. If omitted, the default is defined by the inputDef.

`throws`: A boolean value (true/false, yes/no). If true, generated test methods are declared to throw Exception. If omitted, the default is false.

`values`: A boolean value (true/false, yes/no). If true, comments listing all input variable assignments are included in the body of each test method. If omitted, the default is true.

`-n` If `-n` is defined, any previous contents of the testDef are ignored. If omitted, new test definitions are based on the previous testDef.

`-I` If `-I` is defined, no test definitions are produced. Instead, a JSON document containing the effective system input definition is written to the outDir. The effective system input definition, which is used to generate test definitions, is the result of normalizing all input schemas and adding any schema-derived value definitions.

`-o outDir` If `-o` is defined, test definition output is written to the specified directory. If omitted, the default outDir is the directory containing the inputDef or, if reading from standard input, the current working directory. If an output path cannot be derived, output is written to standard output.

`-p name=value` Defines the value of a transform parameter. Any number of `-p` options may

be specified. This option is meaningful only if the -x or -J option is given.

-r seed If -r is defined, use the given random number seed for all generators. This updates the generator definitions specified by the genDef file. -R Choose a new random number seed for all generators. This updates the generator definitions specified by the genDef file.

-x transformDef If -x is defined, test definition output is transformed according to the XSLT transform defined by the transformDef file. If relative, the transformDef path is assumed to be relative to the directory containing the inputDef.

-t testDef If -t is defined, new test definitions are based on the contents of the specified testDef file, relative to the directory containing the inputDef. Also, unless the -f option is given, new test definition output is written to the specified testDef path, relative to the outDir. If omitted, the default testDef name is derived from the inputDef name.

-T contentType Defines the default content type for the files read and produced. The content-Type must be one of "json" or "xml". The default content type is assumed for any file that is not specified explicitly or that does not have a recognized extension. If omitted, the default content type is derived from the inputDef name.

-v Prints the current Tcases version identifier to standard output.

inputDef The system input definition is read from the given inputDef. If omitted, the system input definition is read from standard input. Otherwise, the system input definition is read from the first one of the following files that can be located.

inputDef
inputDef-Input.xml
inputDef.xml
inputDef-Input.json
inputDef.json

5.3.2 Tcases XML Code

```

1 <System name="Tcases">
2   <Function name="run">
3     <Input>
4
5       <!-- Option: -c -->
6       <VarSet name="defaultTupleSize">
7         <Var name="defined">
8           <Value name="Yes" property="defaultTupleSize"/>
9           <Value name="No"/>
10        </Var>
11
12        <Var name="isNumber" when="defaultTupleSize">
```

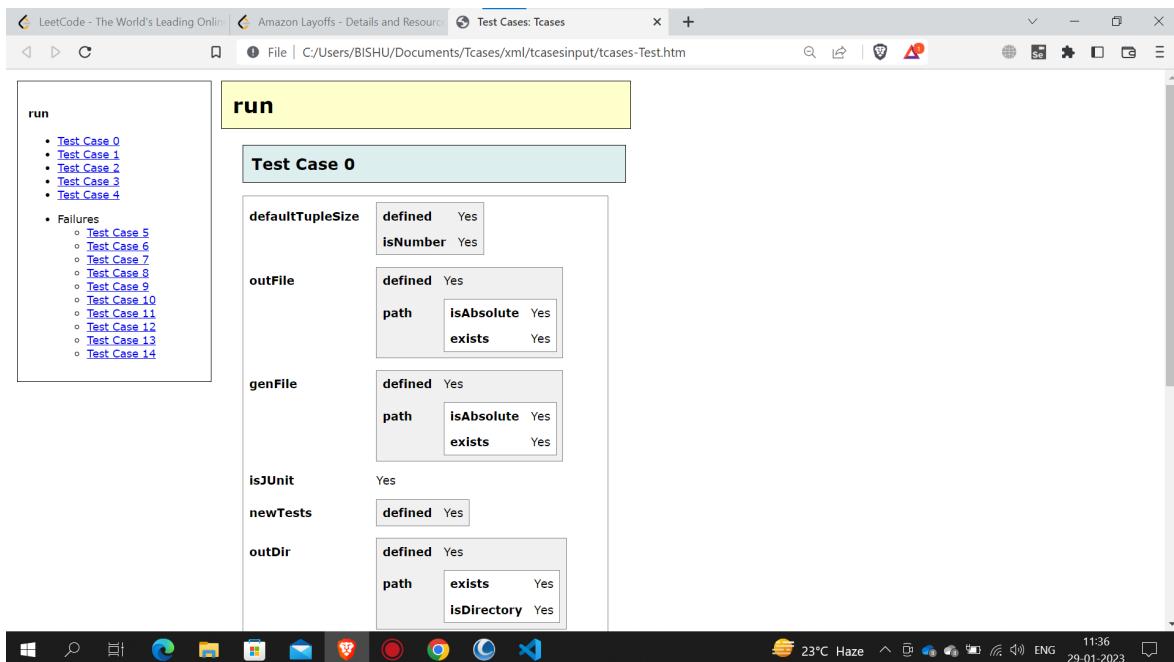


Figure 54: TCases Html View

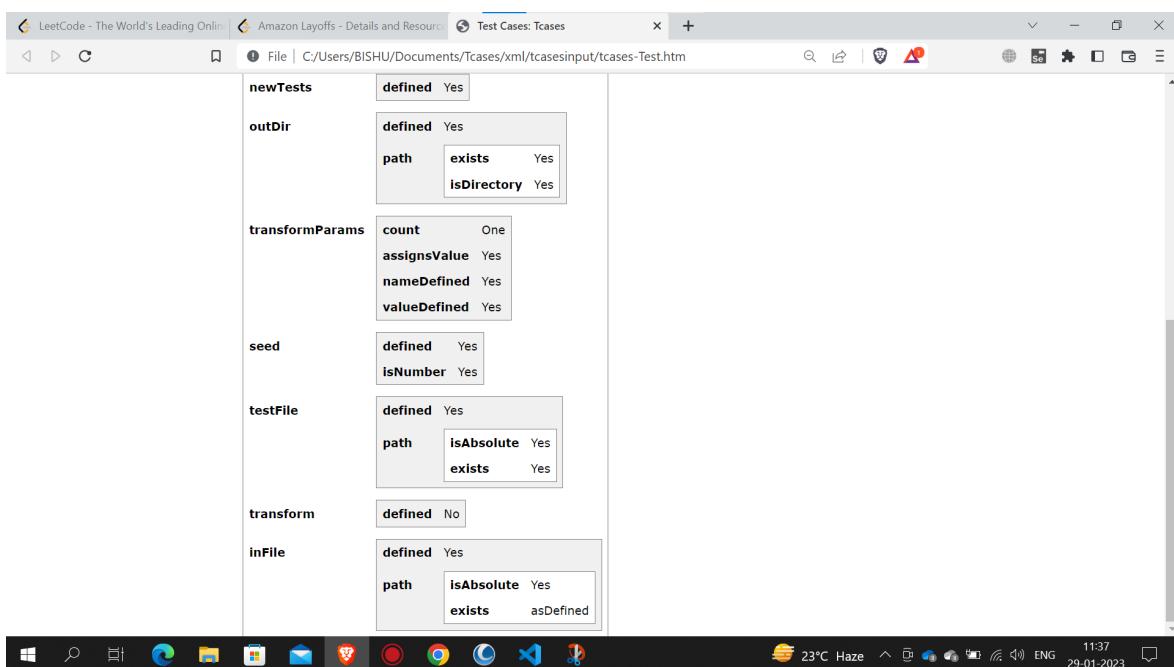


Figure 55: TCases Html View

```

13      <Value name="Yes"/>
14      <Value name="No" failure="true"/>
15    </Var>
16  </VarSet>
17
18  <!-- Option: -f -->
19  <VarSet name="outFile">
20    <Var name="defined">
```

```

21      <Value name="Yes" property="outFile"/>
22      <Value name="No"/>
23      <Value name="TransformOutputUndefined" failure="true"
24          when="transformedOut, testFileExists"/>
25    </Var>
26
27    <VarSet name="path" when="outFile">
28      <Var name="isAbsolute">
29        <Value name="Yes"/>
30        <Value name="No"/>
31      </Var>
32      <Var name="exists">
33        <Value name="Yes" property="outFileExists"/>
34        <Value name="No"/>
35      </Var>
36    </VarSet>
37  </VarSet>
38
39  <!-- Option: -g -->
40  <VarSet name="genFile">
41    <Var name="defined">
42      <Value name="Yes" property="genFile"/>
43      <Value name="No"/>
44    </Var>
45
46    <VarSet name="path" when="genFile">
47      <Var name="isAbsolute">
48        <Value name="Yes"/>
49        <Value name="No"/>
50      </Var>
51      <Var name="exists">
52        <Value name="Yes"/>
53        <Value name="No" failure="true"/>
54      </Var>
55    </VarSet>
56
57    <Var name="default" whenNot="genFile">
58      <Value name="ForInputExists" when="inFile"/>
59      <Value name="ForInputNone" when="inFile"/>
60      <Value name="Standard" whenNot="inFile"/>
61    </Var>
62  </VarSet>
63
64  <!-- Option: -J -->
65  <Var name="isJUnit">
66    <Value name="Yes" property="isJUnit, transformedOut"
        whenNot="transform"/>
    <Value name="No" when="transform"/>

```

```

67      <Value name="NotAllowed" when="transform" failure="true" />
68    </Var>
69
70    <!-- Option: -n -->
71    <VarSet name="newTests">
72      <Var name="defined" when="testFileExists">
73        <Value name="Yes"/>
74        <Value name="No"/>
75      </Var>
76    </VarSet>
77
78    <!-- Option: -o -->
79    <VarSet name="outDir">
80      <Var name="defined">
81        <Value name="Yes" property="outDir"/>
82        <Value name="No"/>
83      </Var>
84
85      <VarSet name="path" when="outDir">
86        <Var name="exists">
87          <Value name="Yes" property="outDirExists"/>
88          <Value name="No"/>
89        </Var>
90        <Var name="isDirectory" when="outDirExists">
91          <Value name="Yes"/>
92          <Value name="No" failure="true"/>
93        </Var>
94      </VarSet>
95    </VarSet>
96
97    <!-- Option: -p -->
98    <VarSet name="transformParams">
99      <When>
100        <AnyOf property="transform, isJUnit"/>
101      </When>
102      <Var name="count">
103        <Value name="One" property="params"/>
104        <Value name="Many" property="params"/>
105        <Value name="None"/>
106      </Var>
107      <Var name="assignsValue" when="params">
108        <Value name="Yes"/>
109        <Value name="No" failure="true"/>
110      </Var>
111      <Var name="nameDefined" when="params">
112        <Value name="Yes"/>
113        <Value name="No" failure="true"/>

```

```

114     </Var>
115     <Var name="valueDefined" when="params">
116         <Value name="Yes"/>
117         <Value name="No"/>
118     </Var>
119   </VarSet>
120
121   <!-- Option: -r -->
122   <VarSet name="seed">
123     <Var name="defined">
124         <Value name="Yes" property="random"/>
125         <Value name="No"/>
126     </Var>
127
128     <Var name="isNumber" when="random">
129         <Value name="Yes"/>
130         <Value name="No" failure="true"/>
131     </Var>
132   </VarSet>
133
134   <!-- Option: -t -->
135   <VarSet name="testFile">
136     <Var name="defined">
137         <Value name="Yes" property="testFile"/>
138         <Value name="No"/>
139     </Var>
140
141     <VarSet name="path" when="testFile">
142       <Var name="isAbsolute">
143         <Value name="Yes"/>
144         <Value name="No"/>
145       </Var>
146       <Var name="exists">
147         <Value name="Yes" property="testFileExists"/>
148         <Value name="No"/>
149       </Var>
150     </VarSet>
151
152     <VarSet name="default" whenNot="testFile">
153       <Var name="exists">
154         <Value name="Yes" property="testFileExists"/>
155         <Value name="No"/>
156       </Var>
157     </VarSet>
158   </VarSet>
159
160   <!-- Option: -x -->
161   <VarSet name="transform">

```

```

162     <Var name="defined">
163         <Value name="Yes" property="transform, transformedOut"/>
164         <Value name="No"/>
165     </Var>
166     <VarSet name="path" when="transform">
167         <Var name="isAbsolute">
168             <Value name="Yes"/>
169             <Value name="No"/>
170         </Var>
171         <Var name="exists">
172             <Value name="Yes"/>
173             <Value name="No" failure="true"/>
174         </Var>
175     </VarSet>
176 </VarSet>
177
178     <!-- Input definition file -->
179     <VarSet name="inFile">
180         <Var name="defined">
181             <Value name="Yes" property="inFile"/>
182             <Value name="No"/>
183         </Var>
184         <VarSet name="path" when="inFile">
185             <Var name="isAbsolute">
186                 <Value name="Yes"/>
187                 <Value name="No"/>
188             </Var>
189             <Var name="exists">
190                 <Value name="asDefined"/>
191                 <Value name="withInputXml"/>
192                 <Value name="withXml"/>
193                 <Value name="No" failure="true"/>
194             </Var>
195         </VarSet>
196     </VarSet>
197
198     </Input>
199 </Function>
200 </System>

```

5.4 Find-Input

5.4.1 Specification

Usage: find pattern file

Locates one or more instances of a given pattern in a text file.

All lines in the file that contain the pattern are written to standard output. A line containing the pattern is written only once, regardless of the number of times the pattern occurs in it.

The pattern is any sequence of characters whose length does not exceed the maximum length of a line in the file. To include a blank in the pattern, the entire pattern must be enclosed in quotes (""). To include a quotation mark in the pattern, two quotes in a row ("""") must be used.

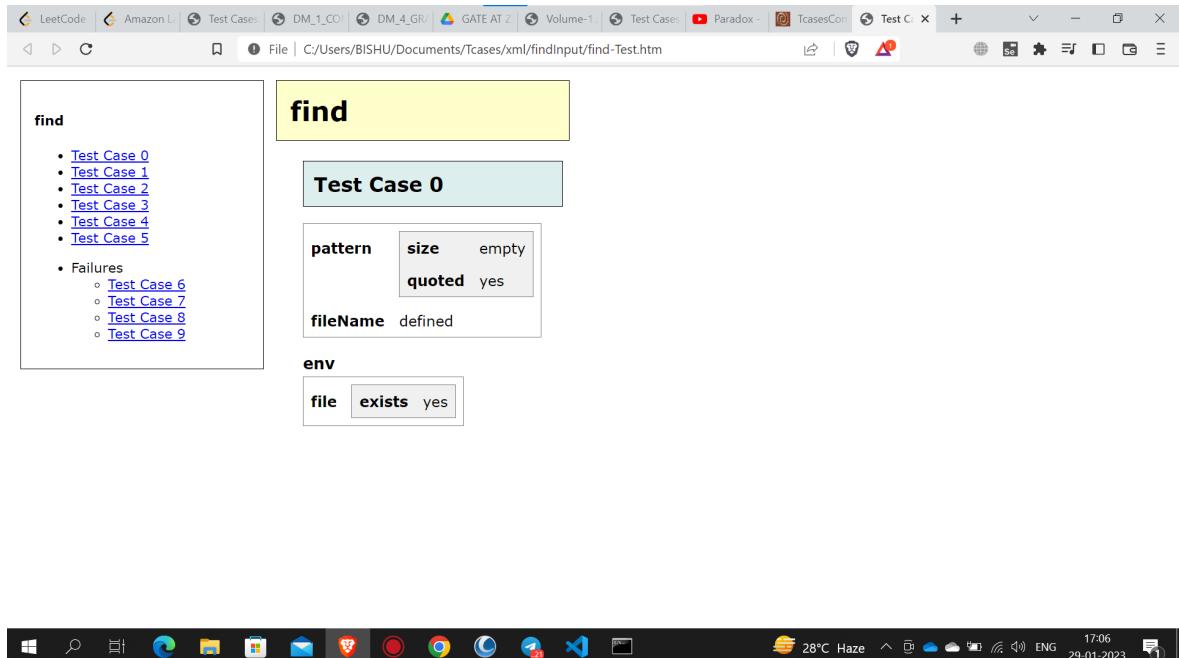


Figure 56: Find-Input HTML View

5.4.2 Find-Input XML Code

```

1 <System name="Examples">
2   <Function name="find">
3     <!--
4       Usage: find pattern file
5
6       Locates one or more instances of a given pattern in a
7         text file.
8
9       All lines in the file that contain the pattern are
10      written to standard output. A
11      line containing the pattern is written only once,
12      regardless of the number of
13      times the pattern occurs in it.
14
15      The pattern is any sequence of characters whose length
16      does not exceed the

```

```

14     maximum length of a line in the file. To include a blank
15         in the pattern, the
16         entire pattern must be enclosed in quotes (""). To
17             include a quotation mark in the
18             pattern, two quotes in a row ( "") must be used.
19             -->
20             <Input type="arg">
21                 <VarSet name="pattern" when="fileExists">
22                     <Var name="size">
23                         <Value name="empty" property="empty"/>
24                         <Value name="singleChar" property="singleChar"/>
25                         <Value name="manyChars"/>
26                     </Var>
27                     <Var name="quoted">
28                         <Value name="yes" property="quoted"/>
29                         <Value name="no" whenNot="empty"/>
30                         <Value name="unterminated" failure="true"/>
31                     </Var>
32                     <Var name="blanks" whenNot="empty">
33                         <Value name="none"/>
34                         <Value name="one" when="quoted, singleChar"/>
35                         <Value name="many">
36                             <When>
37                                 <AllOf property="quoted">
38                                     <Not property="singleChar"/>
39                                 </AllOf>
40                             </When>
41                         </Value>
42                     </Var>
43                     <Var name="embeddedQuotes" whenNot="empty, singleChar">
44                         <Value name="none"/>
45                         <Value name="one"/>
46                         <Value name="many" once="true"/>
47                     </Var>
48                 </VarSet>
49             <Var name="fileName">
50                 <Value name="defined" property="fileName"/>
51                 <Value name="missing" failure="true"/>
52             </Var>
53         </Input>
54         <Input type="env">
55             <VarSet name="file" when="fileName">
56                 <Var name="exists">
57                     <Value name="yes" property="fileExists"/>
58                     <Value name="no" failure="true"/>
59             </Var>

```

```
60 <VarSet name="contents" when="fileExists" whenNot="empty">
61   <Var name="linesLongerThanPattern">
62     <Value name="one" property="matchable" once="true"/>
63     <Value name="many" property="matchable"/>
64     <Value name="none" failure="true"/>
65   </Var>
66   <Var name="patterns" when="matchable" whenNot="empty">
67     <Value name="none" once="true"/>
68     <Value name="one" property="match"/>
69     <Value name="many" property="match, many"/>
70   </Var>
71   <Var name="patternsInLine" when="match">
72     <Value name="one"/>
73     <Value name="many" once="true" when="many"/>
74   </Var>
75 </VarSet>
76 </VarSet>
77 </Input>
78
79 </Function>
80 </System>
```

CS6474: Software Testing Laboratory 2023

JCUTE

Prepared by
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222CS3113



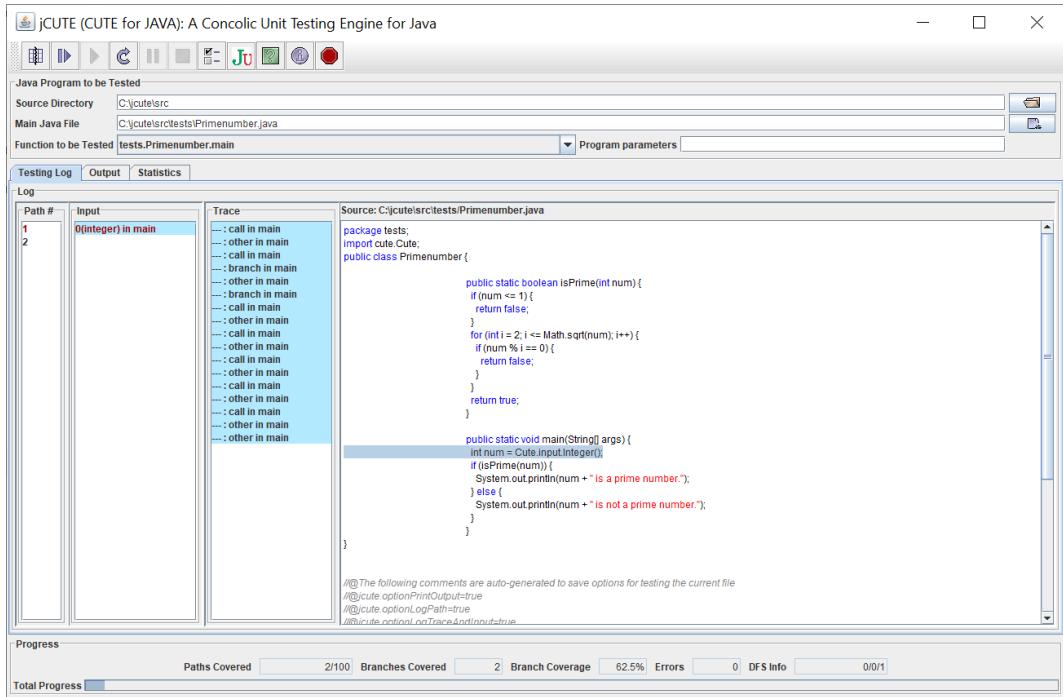
6 JCute

The Java Concolic Unit Testing Engine (jCUTE) automatically generates unit tests for Java programs. Concolic execution combines randomized concrete execution with symbolic execution and automatic constraint solving. Symbolic execution allows jCUTE to discern inputs that lead down different execution paths; randomized concrete execution helps it overcome limitations of the constraint solver, like the inability to analyze system calls or solve general systems of non-linear integer equations. Through this combination, jCUTE is able to generate test cases that execute many different execution paths in real Java programs.

jCUTE supports multi-threaded programs. It can discover race conditions and deadlocks through systematic schedule exploration.

Write code for scenarios given below using Java and apply concolic testing to improve branch coverage.

6.1 Checking prime numbers, odd numbers, or even numbers.



The screenshot shows the jCUTE interface with the following details:

- Java Program to be Tested:**
 - Source Directory: C:\jcutest\src
 - Main Java File: C:\jcutest\src\tests\Primenumbers.java
 - Function to be Tested: tests.Primenumbers.main
- Testing Log:**
 - Path #1: Input 0(integer) in main
 - Trace: Shows the execution path starting from the main method, branching through various methods and loops.
 - Source: C:\jcutest\src\tests\Primenumbers.java


```
package tests;
import cute.Cute;
public class Primenumbers {

    public static boolean isPrime(int num) {
        if (num <= 1) {
            return false;
        }
        for (int i = 2; i <= Math.sqrt(num); i++) {
            if (num % i == 0) {
                return false;
            }
        }
        return true;
    }

    public static void main(String[] args) {
        int num = Cute.input.integer();
        if (isPrime(num)) {
            System.out.println(num + " is a prime number.");
        } else {
            System.out.println(num + " is not a prime number.");
        }
    }
}
```
 - Log: Displays the execution log with Path #1 and its corresponding trace and source code.
- Progress:**
 - Paths Covered: 2/100
 - Branches Covered: 2
 - Branch Coverage: 62.5%
 - Errors: 0
 - DFS Info: 0/0/1

Figure 57: Testing log

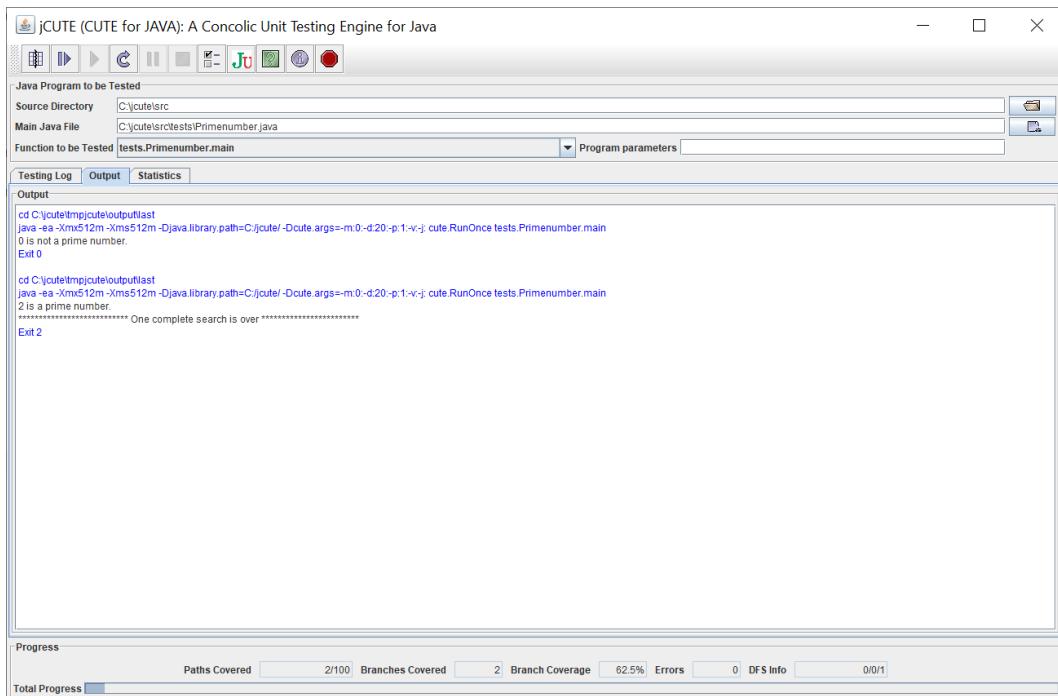


Figure 58: Output

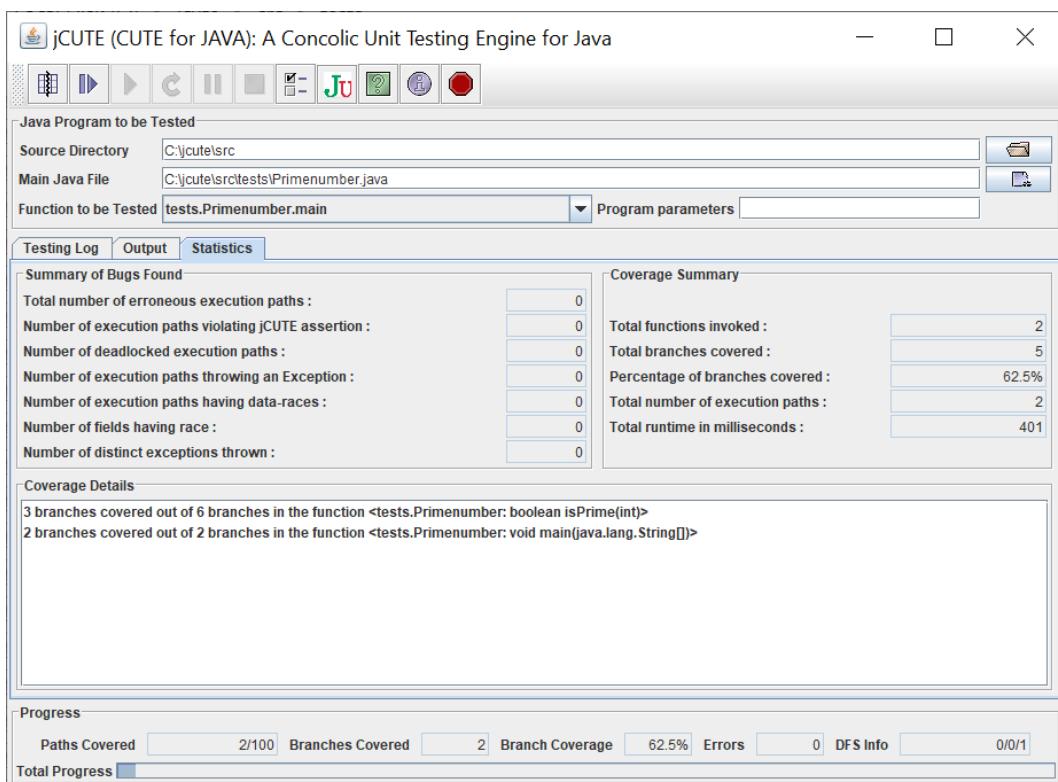


Figure 59: Statistics Screenshot

6.2 Checking odd numbers, or even numbers.

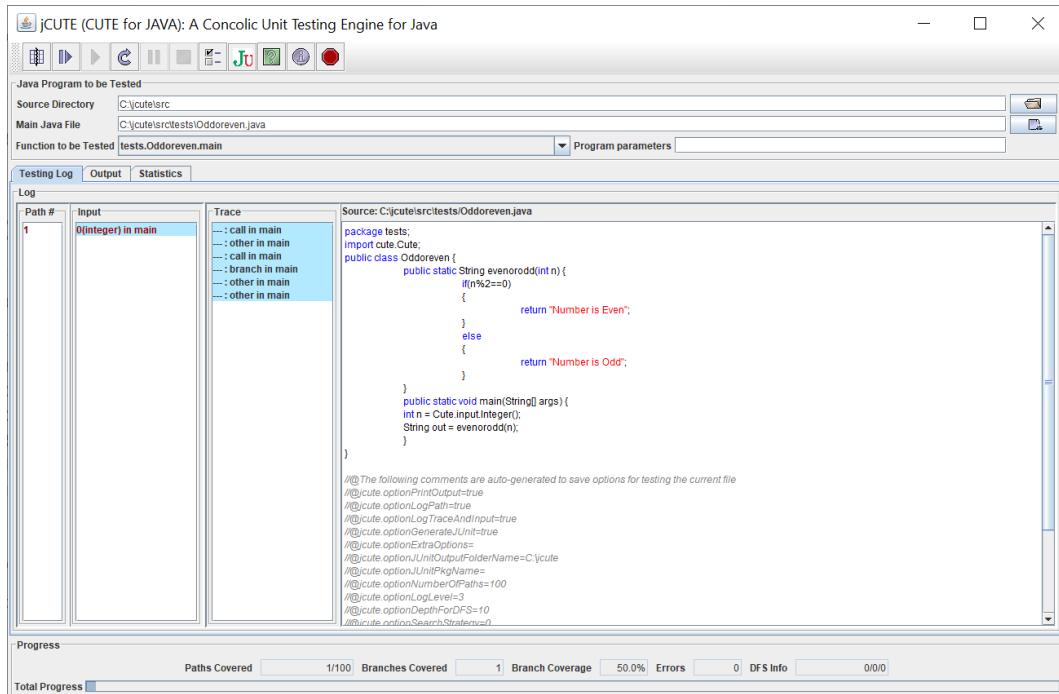


Figure 60: Testing log

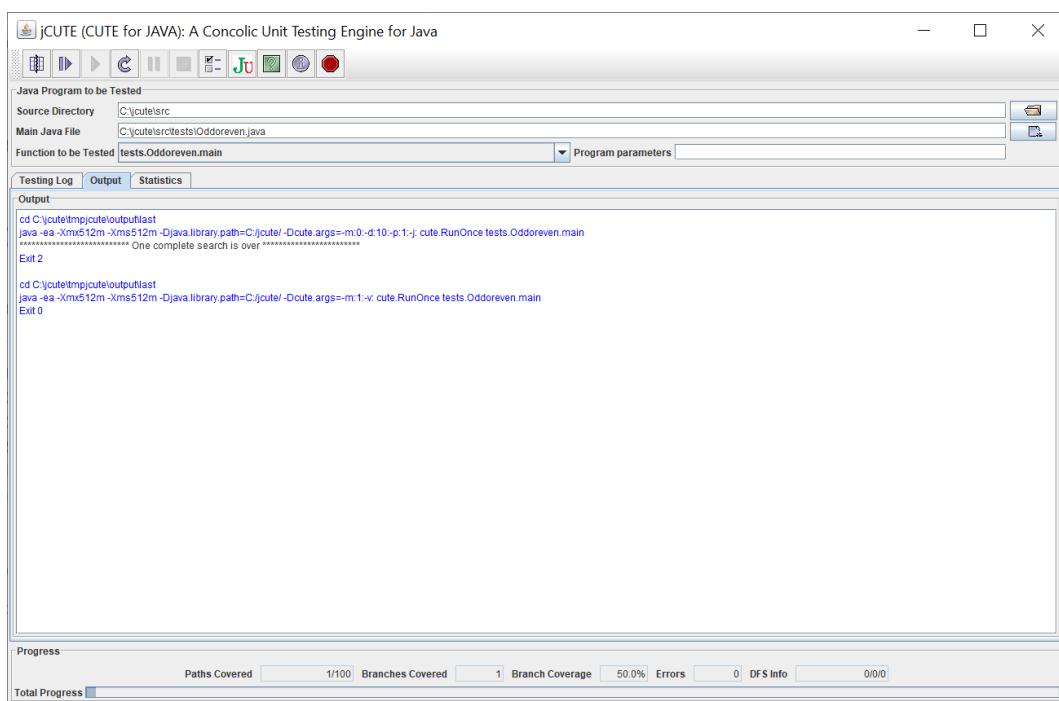


Figure 61: Output

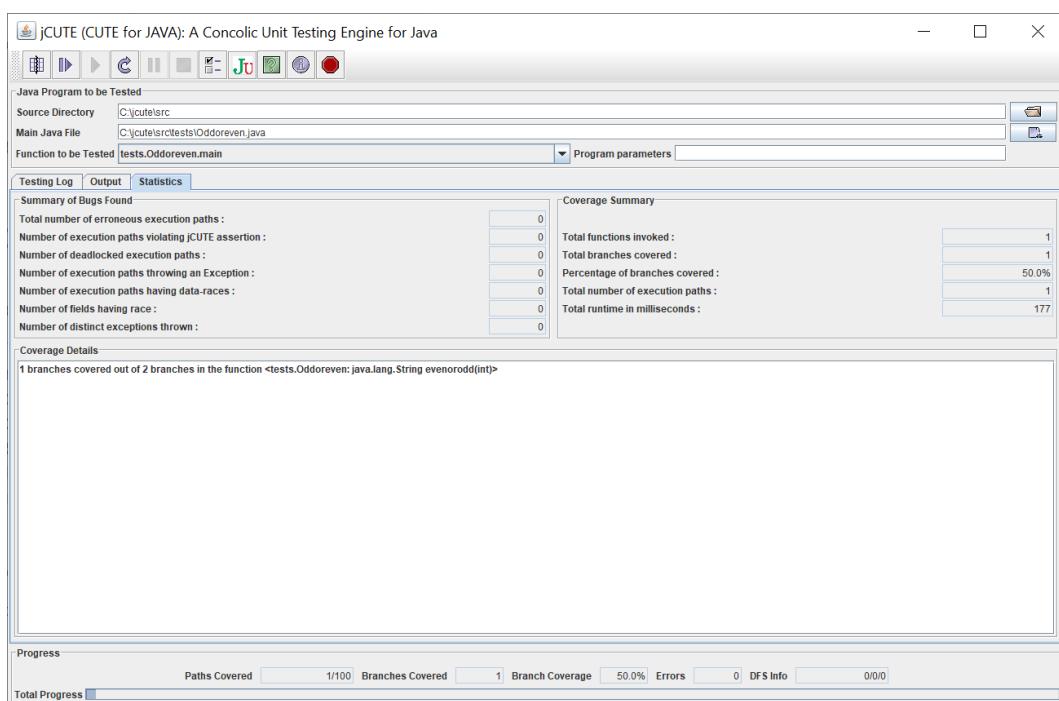


Figure 62: Statistics Screenshot

6.3 Calculator based on floating-point 32-bit numbers.

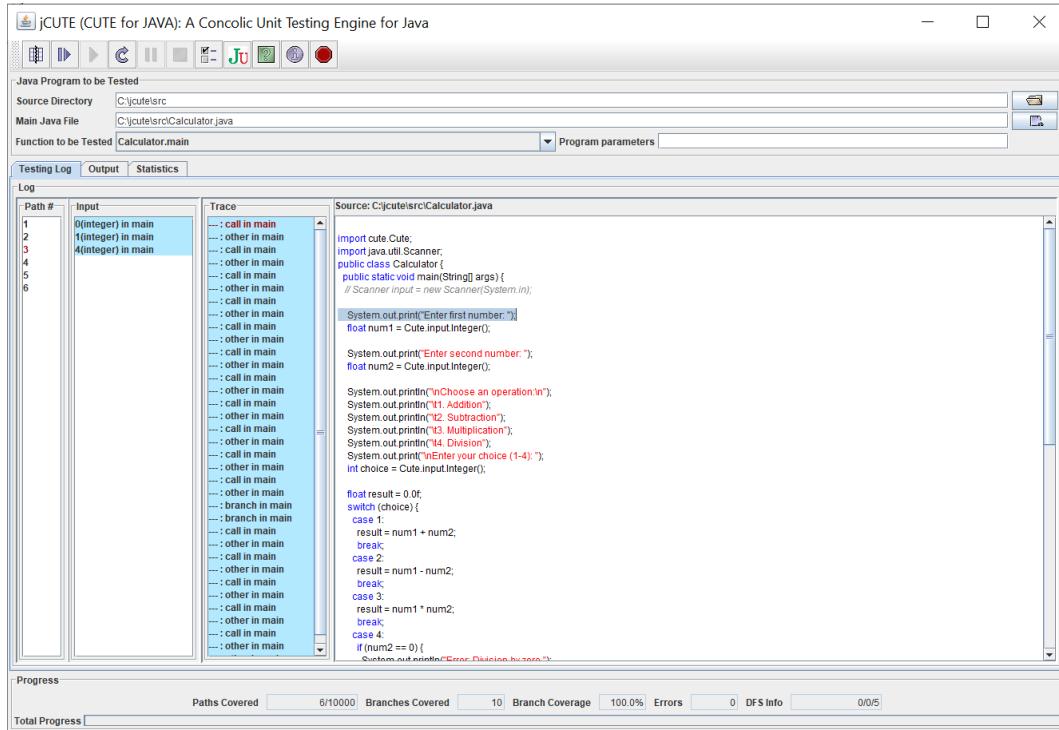


Figure 63: Testing log

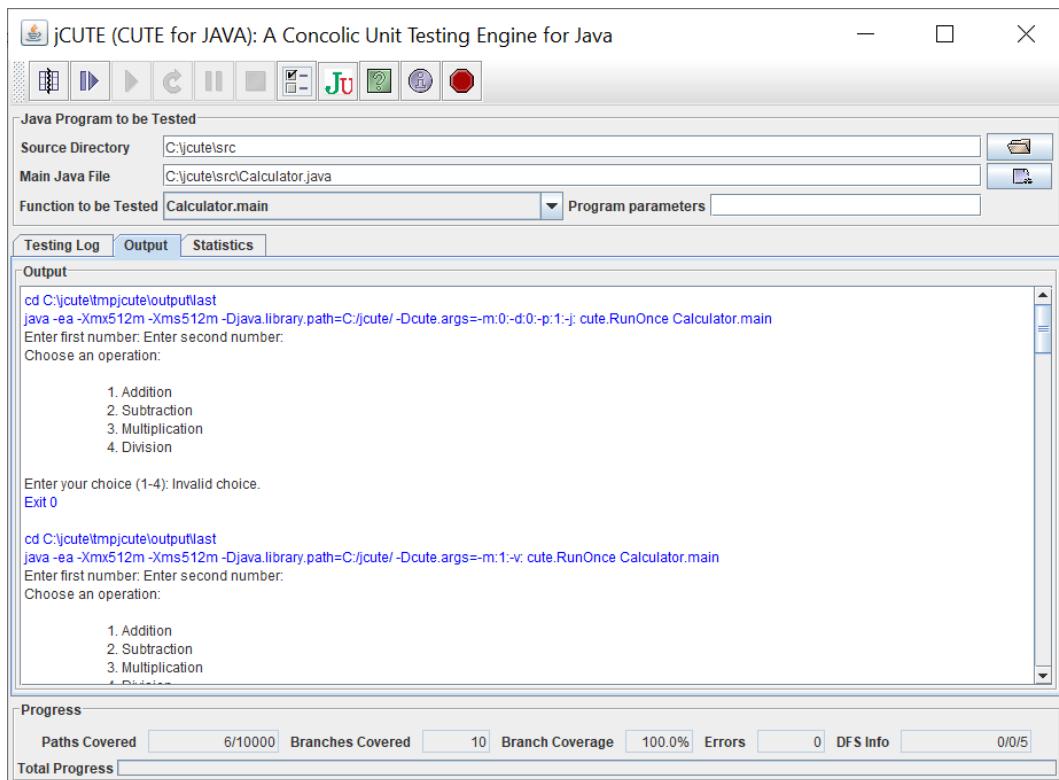


Figure 64: Output

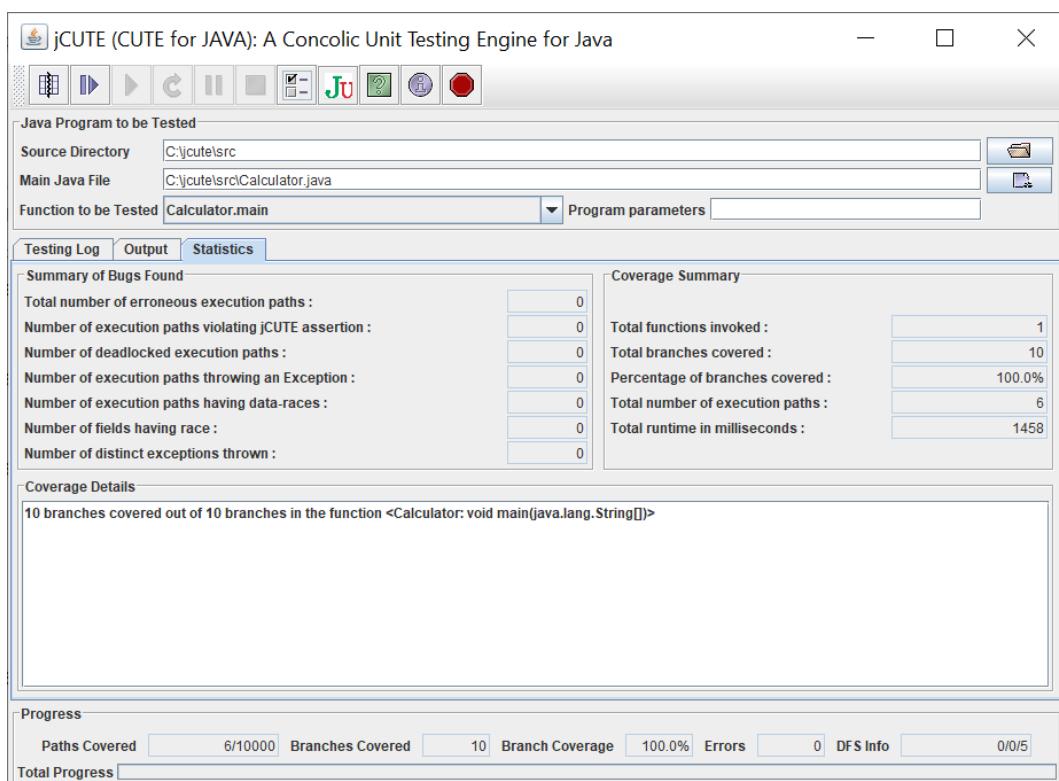


Figure 65: Statistics Screenshot

6.4 Reverse an array.

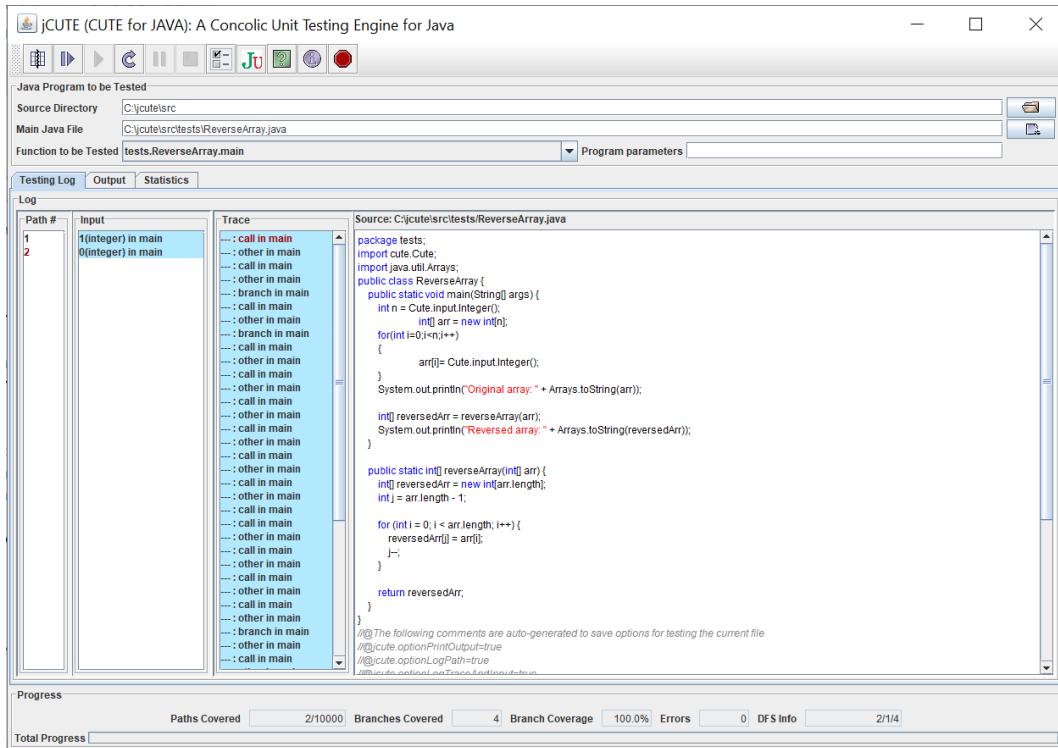


Figure 66: Testing log

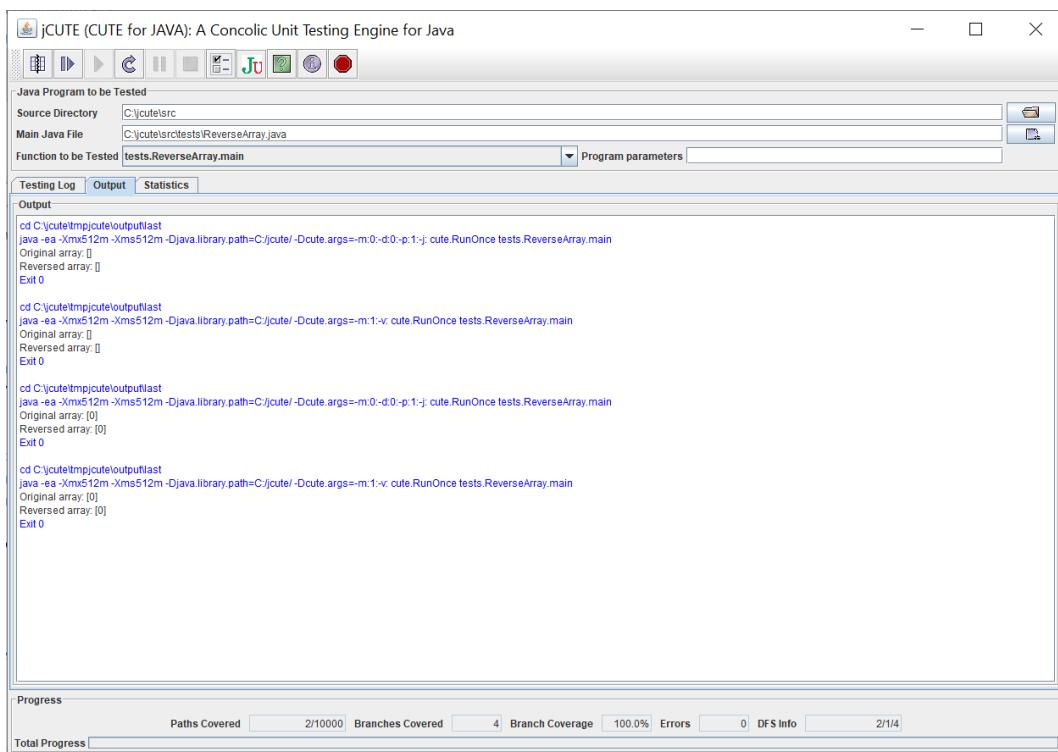


Figure 67: Output

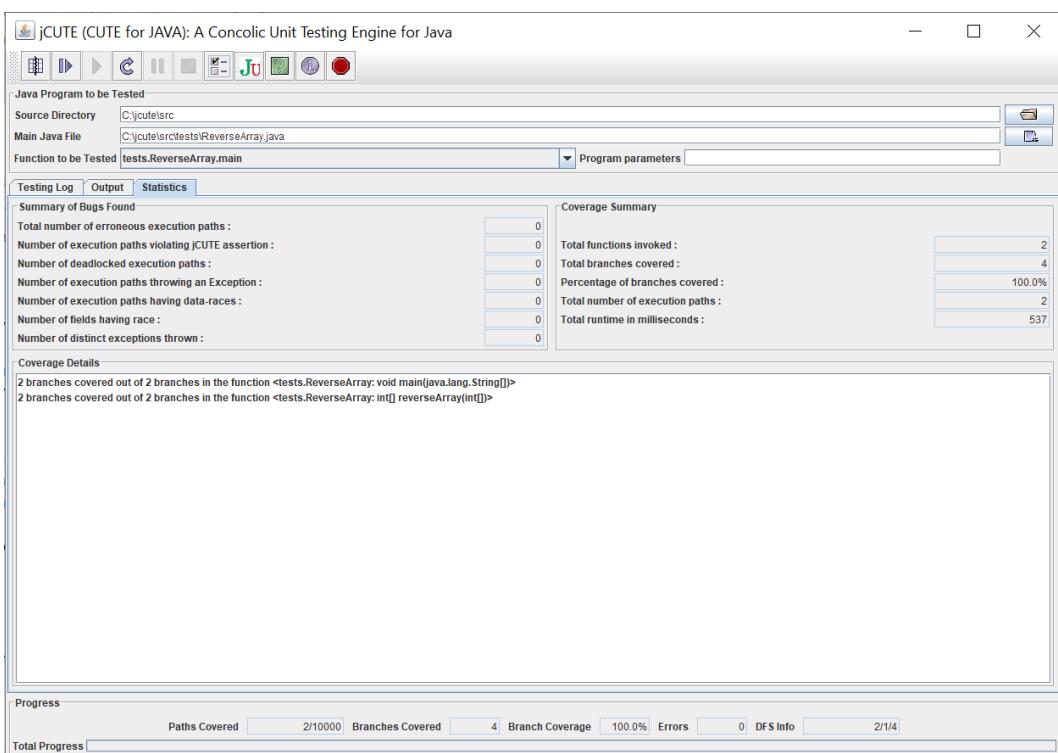


Figure 68: Statistics Screenshot

6.5 Decimal to hexadecimal.

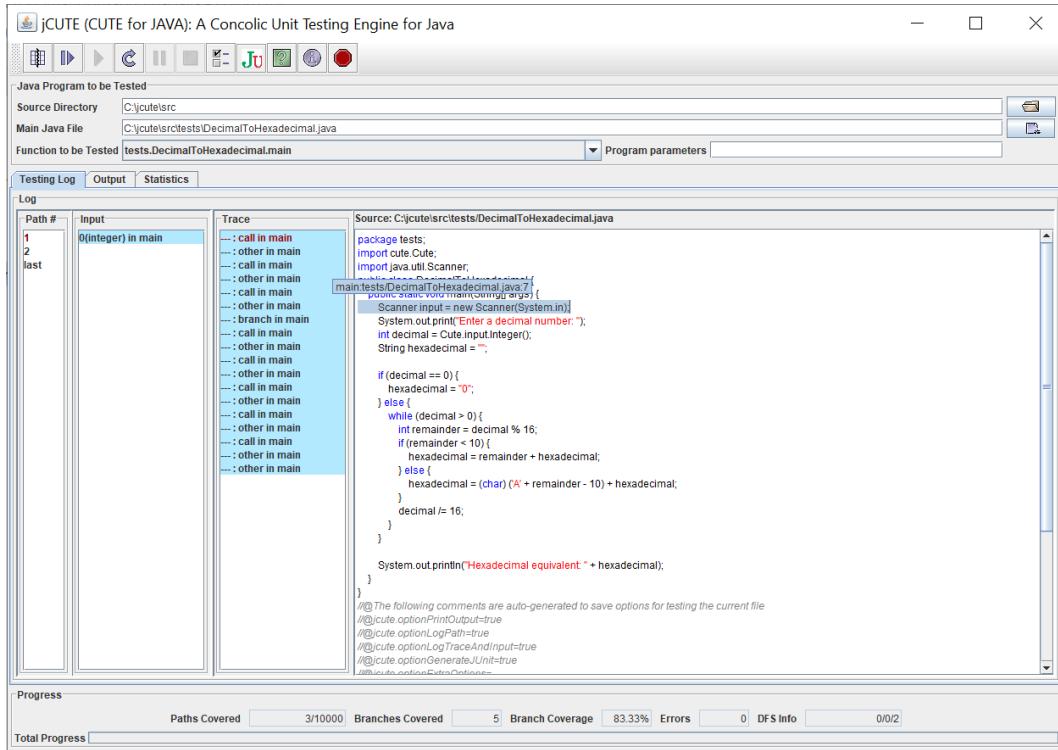


Figure 69: Testing log

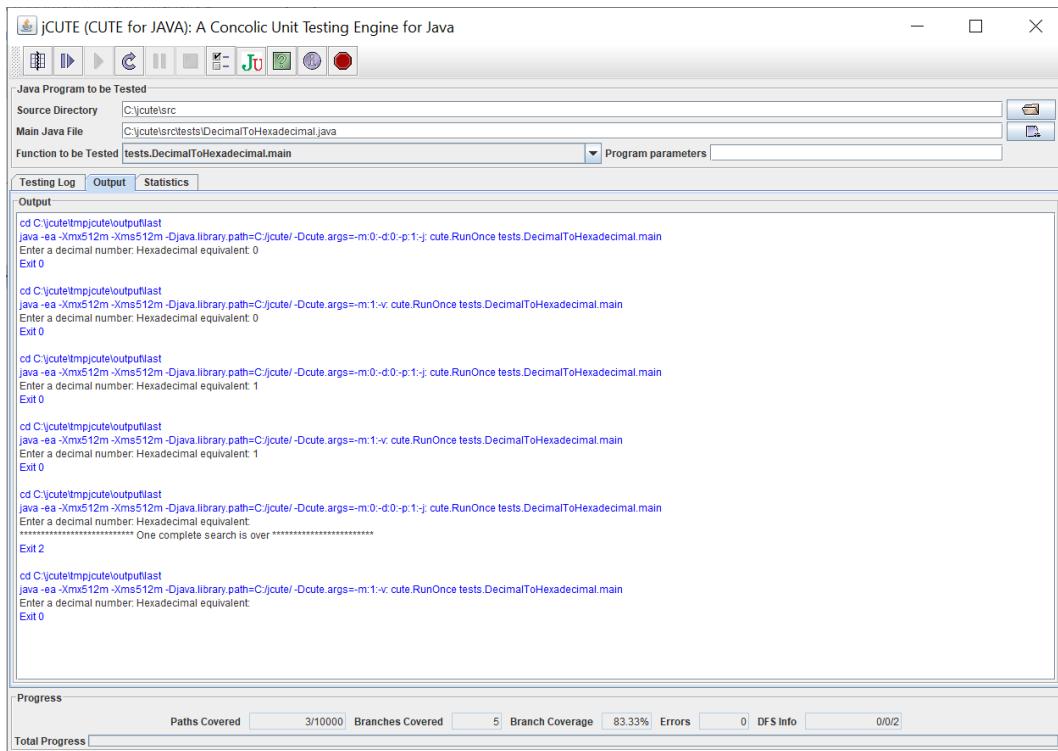


Figure 70: Output

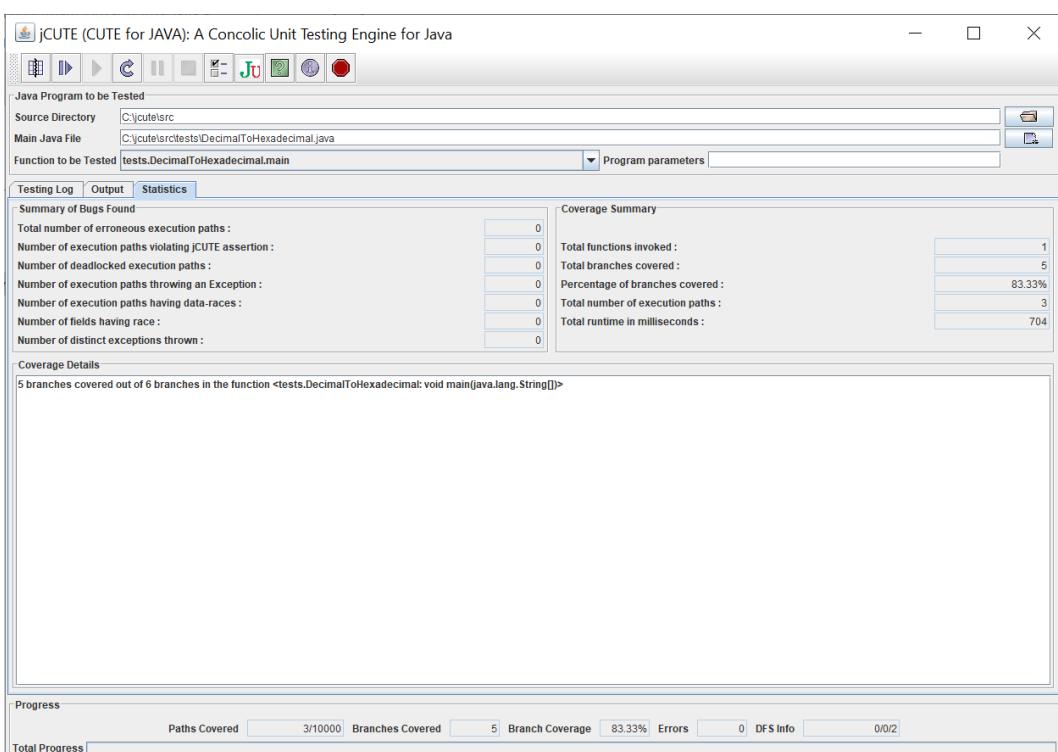


Figure 71: Statistics Screenshot

6.6 Grade students based on marks.

The screenshot shows the jCUTE interface with the following details:

- Java Program to be Tested:** C:\jcutests\GradeStudents.java
- Source Directory:** C:\jcutests\src
- Main Java File:** C:\jcutests\GradeStudents.java
- Function to be Tested:** tests.GradeStudents.main
- Testing Log:** Active tab, showing a trace of calls and branches. The trace starts with path #1 and continues through various main and other methods.
- Source:** C:\jcutests\src\tests\GradeStudents.java (contains the Java code for the GradeStudents class)
- Progress:** Paths Covered: 5/10000, Branches Covered: 8, Branch Coverage: 100.0%, Errors: 0, DFS Info: 0/04

Figure 72: Testing log

The screenshot shows the jCUTE interface with the following details:

- Java Program to be Tested:** C:\jcutests\GradeStudents.java
- Source Directory:** C:\jcutests\src
- Main Java File:** C:\jcutests\GradeStudents.java
- Function to be Tested:** tests.GradeStudents.main
- Output:** Active tab, showing the execution of the program. The output includes command-line arguments, user input (RollNumber and marks), and the resulting grade (e.g., C, B, A).
- Progress:** Paths Covered: 5/10000, Branches Covered: 8, Branch Coverage: 100.0%, Errors: 0, DFS Info: 0/04

Figure 73: Output

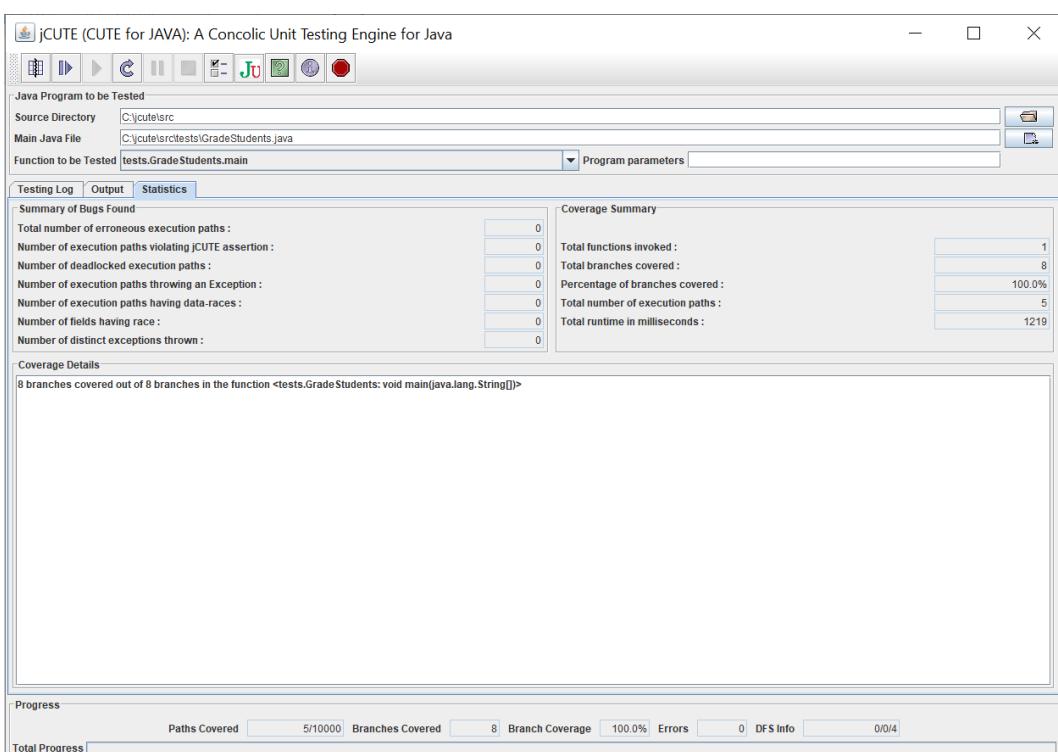


Figure 74: Statistics Screenshot

CS6474: Software Testing Laboratory 2023

JUMBLE

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7 Jumble

Jumble is a mutation testing tool which changes the Java code at byte code level. It runs a unit test case and applies certain set of mutations.

Passed Mutations: Changes in code which do not affect the final output

Failed Mutations: Changes in code which change the final output

Score : It is the percentage of passed mutations out of the total mutations. It is used to assess the validity of our test suite.

Jumble is a class level mutation testing tool that works in conjunction with JUnit. The purpose of mutation testing is to provide a measure of the effectiveness of test cases. A single mutation is performed on the code to be tested, the corresponding test cases are then executed. If the modified code fails the tests, then this increases confidence in the tests. Conversely, if the modified code passes the tests this indicates a testing deficiency.

Example Here is some example Jumble output for a Java class called "Foo", which has some JUnit tests in a class called "FooTest".

Jumble starts by running the unit tests (in FooTest.class) on the unmodified Foo class to check that they all pass, and to measure the time taken by each test. Then it will mutate Foo in various ways and run the tests again to see if they detect the mutation. It continues this process until all mutations of Foo have been tried.

Installation and Usage

Release 1.3.0 of Jumble is available as an Eclipse plugin. Just add <http://jumble.sourceforge.net/update/> to Eclipse as an update site, and you will be able to install Jumble. Then you should be able to right-click on any class and do Jumble Mutation Tester / Analyse tests of this class to mutate the class and analyse its tests. Note that you click on your source code class, NOT on the JUnit tests.

For command line usage, just download jumble_1.x.y.jar via the Sourceforge Files release system, and run it with java -jar jumble_1.x.y.jar –help to see the help message.

Solve the below programs in Java

7.1 Write a program to generate a Factorial of numbers (where stack length should be at 3 (max)). The numbers should be 5, 3, 8, and 15.

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure under "jumble".
- Editor:** Displays the `FactorialTest.java` file containing JUnit test cases for a factorial function.
- Outline View:** Shows the class `FactorialTest` with methods `test1()`, `test2()`, `test3()`, and `test4()`.
- Console:** Shows the output of the test run: "Runs: 4/4", "Errors: 0", and "Failures: 1".
- Failure Trace:** Details a failure in `test2` due to a comparison failure between expected and actual values.
- Bottom Status Bar:** Shows system information like temperature (33°C), battery level, and date/time (04-03-2023).

```

eclipse-workspace - jumble/src/jumble/FactorialTest.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer jumble JRE System Library [JavaSE-1.8]
src jumble
  Add.java AddTest.java Transpose.java TransposeTest.java Factorial.java FactorialTest.java
  1 package jumble;
  2 import junit.framework.TestCase;
  3 public class FactorialTest extends TestCase {
  4     public void test1() {
  5         assertEquals("479001600",Factorial факт(12));
  6     }
  7     public void test2() {
  8         assertEquals("1",Factorial факт(0));
  9     }
 10    public void test3() {
 11        assertEquals("1",Factorial факт(1));
 12    }
 13    public void test4() {
 14        assertEquals("24",Factorial факт(4));
 15    }
 16
 17 }
 18
  
```

Figure 75: Jumble Test Case

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure under "jumble".
- Editor:** Displays the `Factorial.java` file containing the implementation of a factorial function.
- Outline View:** Shows the class `Factorial` with a method `fact(int n)`.
- Console:** Shows the output of the test run: "Runs: 4/4", "Errors: 0", and "Failures: 1".
- Failure Trace:** Details a failure in `test2` due to a comparison failure between expected and actual values.
- Bottom Status Bar:** Shows system information like temperature (33°C), battery level, and date/time (04-03-2023).

```

eclipse-workspace - jumble/src/jumble/Factorial.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer jumble JRE System Library [JavaSE-1.8]
src jumble
  Factorial.java
  1 package jumble;
  2
  3 public class Factorial {
  4     public static String fact(int n) {
  5         if(n==0)
  6         {
  7             return "+1";
  8         }
  9         else if(n<0)
 10         {
 11             return "For Negative number no factorial";
 12         }
 13         else
 14         {
 15             long fact[] = new long [n+1];
 16             fact[0]=1;
 17             for(int i=1;i<n;i++)
 18             {
 19                 fact[i]=fact[i-1]*i;
 20             }
 21             return "+"+fact[n];
 22         }
 23     }
 24 }
 25
  
```

Figure 76: Factorial Code

7.2 Write a program to generate Fibonacci numbers.

The screenshot shows the Eclipse IDE interface with the following details:

- File Menu:** File, Edit, Source, Refactor, Navigate, Search, Project, Run, Window, Help.
- Toolbar:** Standard Eclipse toolbar icons.
- Package Explorer:** Shows the project structure under the package `jumble`, including `Add.java`, `Transpose.java`, `TransposeTest.java`, `Factorial.java`, `FactorialTest.java`, `Fibonacci.java`, `FibonacciTest.java`, `TransposeTest.java`, and `TransposeTest.java`.
- Outline View:** Shows the class `FibonacciTest` with three test methods: `test1()`, `test2()`, and `test3()`.
- Editor:** Displays the Java code for `FibonacciTest.java`. The code uses JUnit annotations to assert the correctness of the `fibo` method from the `Fibonacci` class.
- Console:** Shows the test results: "Runs: 3/3", "Errors: 0", "Failures: 0". It also displays the failure trace for the third test case.
- Bottom Status Bar:** Shows the system tray, battery level, and date/time (23:01, 04-03-2023).

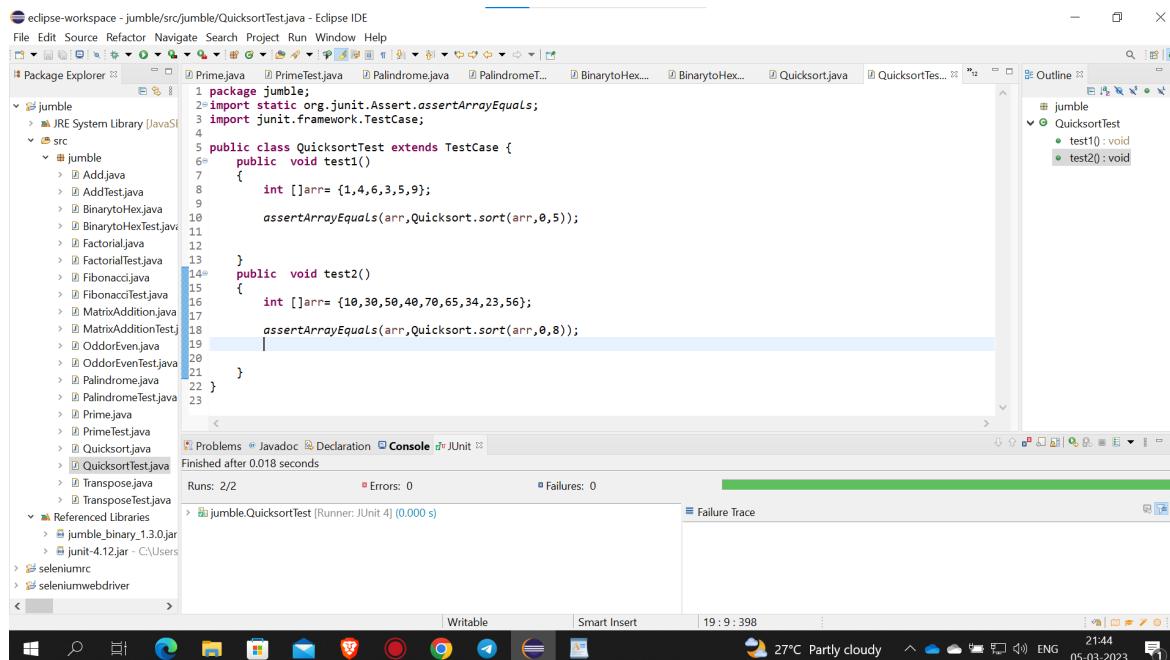
Figure 77: Jumble Test Case

The screenshot shows the Eclipse IDE interface with the following details:

- File Menu:** File, Edit, Source, Refactor, Navigate, Search, Project, Run, Window, Help.
- Toolbar:** Standard Eclipse toolbar icons.
- Package Explorer:** Shows the project structure under the package `jumble`, including `Add.java`, `Transpose.java`, `TransposeTest.java`, `Factorial.java`, `FactorialTest.java`, `Fibonacci.java`, and `FibonacciTest.java`.
- Outline View:** Shows the class `Fibonacci` with one method: `fibo(int n)`.
- Editor:** Displays the Java code for `Fibonacci.java`. The code implements the `fibo` method using a loop to calculate the sum of the last two numbers in the sequence.
- Console:** Shows the test results: "Runs: 3/3", "Errors: 0", "Failures: 0". It also displays the failure trace for the third test case.
- Bottom Status Bar:** Shows the system tray, battery level, and date/time (23:01, 04-03-2023).

Figure 78: Fibonacci Code

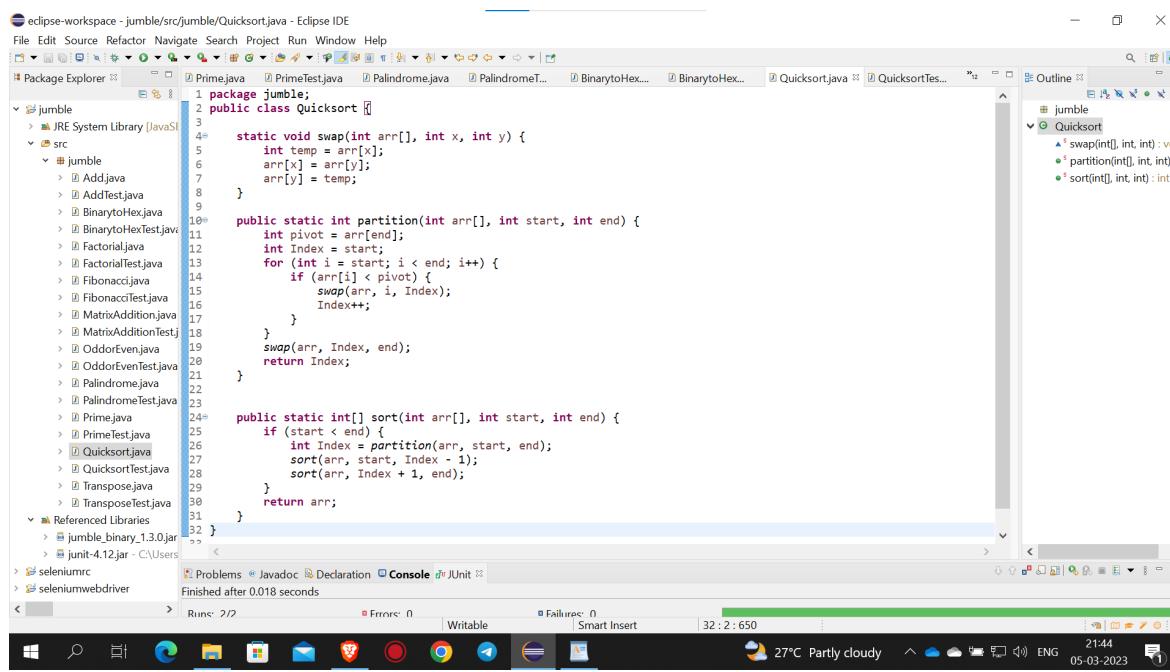
7.3 Write a program that performs sorting of a group of integer values using the quick sort technique.



The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the 'jumble' project structure with various Java files like Prime.java, Add.java, etc., and test cases like QuicksortTest.java.
- Code Editor:** Displays the content of QuicksortTest.java, which contains two test methods: test1() and test2().
- Outline View:** Shows the class hierarchy with QuicksortTest extending TestCase.
- Console:** Shows the output "Finished after 0.018 seconds" and "Runs: 2/2 Errors: 0 Failures: 0".
- Bottom Status Bar:** Shows the date and time as 05-03-2023 21:44.

Figure 79: Jumble Test Case



The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the 'jumble' project structure with various Java files like Prime.java, Add.java, etc., and the Quicksort.java file.
- Code Editor:** Displays the content of Quicksort.java, which contains the Quicksort algorithm implementation.
- Outline View:** Shows the class hierarchy with Quicksort having swap(), partition(), and sort() methods.
- Console:** Shows the output "Finished after 0.018 seconds" and "Runs: 2/2 Errors: 0 Failures: 0".
- Bottom Status Bar:** Shows the date and time as 05-03-2023 21:44.

Figure 80: Quicksort Code

7.4 Write a program that accepts elements of a matrix and displays its transpose.

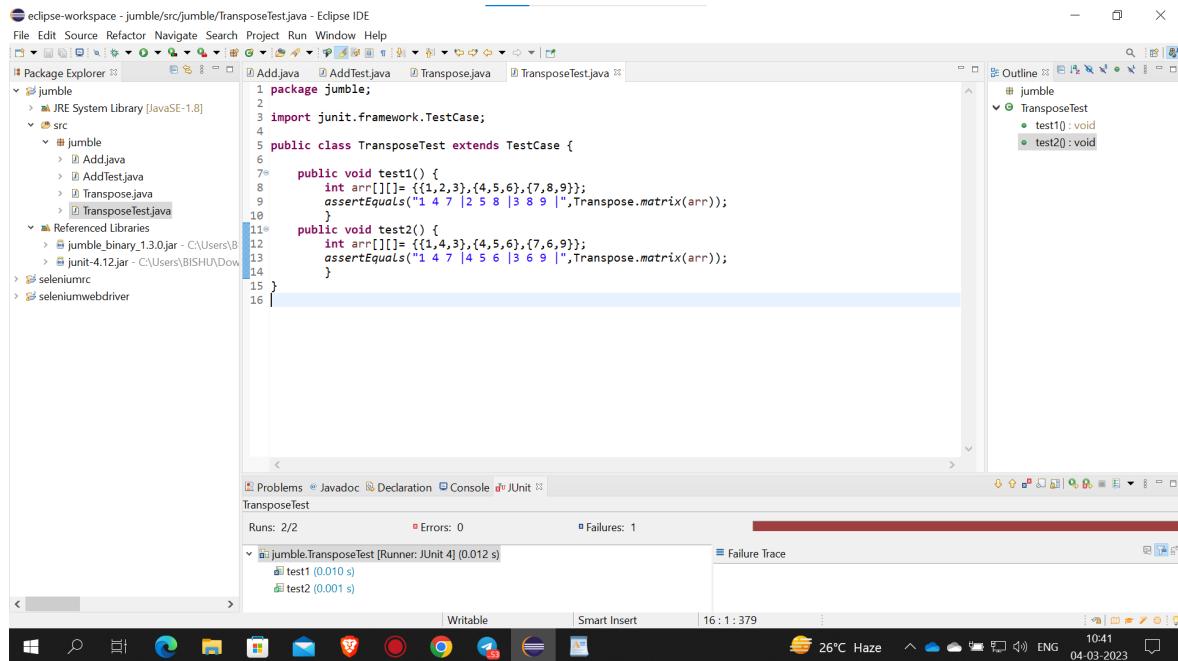


Figure 81: Jumble Test Case

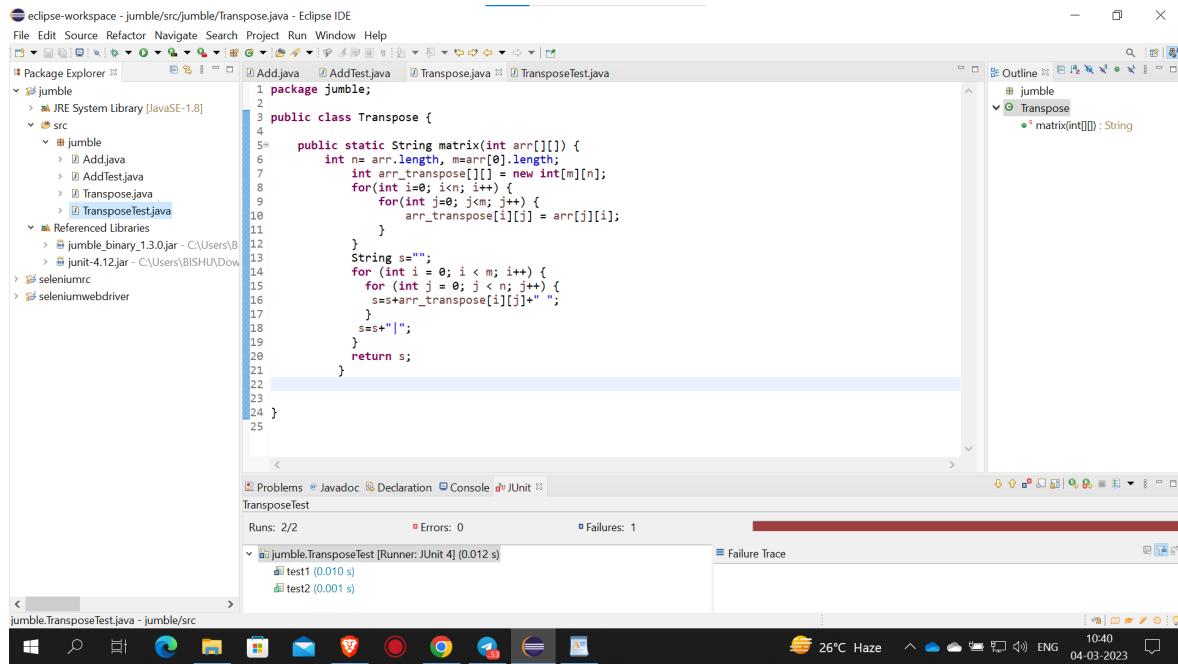


Figure 82: Matrix Transpose Code

7.5 Write a program to add two matrices and display the sum matrix.

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure under the package `jumble`, including files like `Add.java`, `MatrixAddition.java`, and test cases.
- Code Editor:** Displays the `MatrixAdditionTest.java` file with two test methods: `test1()` and `test2()`. The code uses `junit.framework.TestCase` and `assertEquals` to verify matrix addition results.
- Outline View:** Shows the class `MatrixAdditionTest` with methods `test1()` and `test2()`.
- Console View:** Shows the output of the JUnit test run: "Runs: 2/2 Errors: 0 Failures: 0".
- Bottom Status Bar:** Shows system information including temperature (36°C), battery level (Mostly sunny), and date/time (05-03-2023).

Figure 83: Jumble Test Case

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure under the package `jumble`, including files like `Add.java`, `MatrixAddition.java`, and test cases.
- Code Editor:** Displays the `MatrixAddition.java` file containing a static method `Matrix` that performs matrix addition. It initializes a result matrix `sum` and iterates through elements to calculate the sum of corresponding matrix elements.
- Outline View:** Shows the class `MatrixAddition` with a static method `Matrix(int[], int[])`.
- Console View:** Shows the output of the JUnit test run: "Runs: 2/2 Errors: 0 Failures: 0".
- Bottom Status Bar:** Shows system information including temperature (36°C), battery level (Mostly sunny), and date/time (05-03-2023).

Figure 84: Matrix Addition Code

7.6 Write a program to Print Prime Numbers from 1 to 100 using Scanner Class and For Loop.

```

1 package jumble;
2
3 public class Prime {
4
5     public static String Checkprime() {
6         String s="";
7         for(int i=1;i<=100;i++){
8             if(checkPrime(i)){
9                 s=s+i+" ";
10            }
11        }
12        return s;
13    }
14
15    public static boolean checkPrime(int num){
16
17        if(num==1){
18            return false;
19        }
20        else{
21
22            for(int i=2;i<=Math.sqrt(num);i++){
23                if(num%i==0){
24                    return false;
25                }
26            }
27        }
28
29        return true;
30    }
31 }
32

```

Figure 85: Jumble Test Case

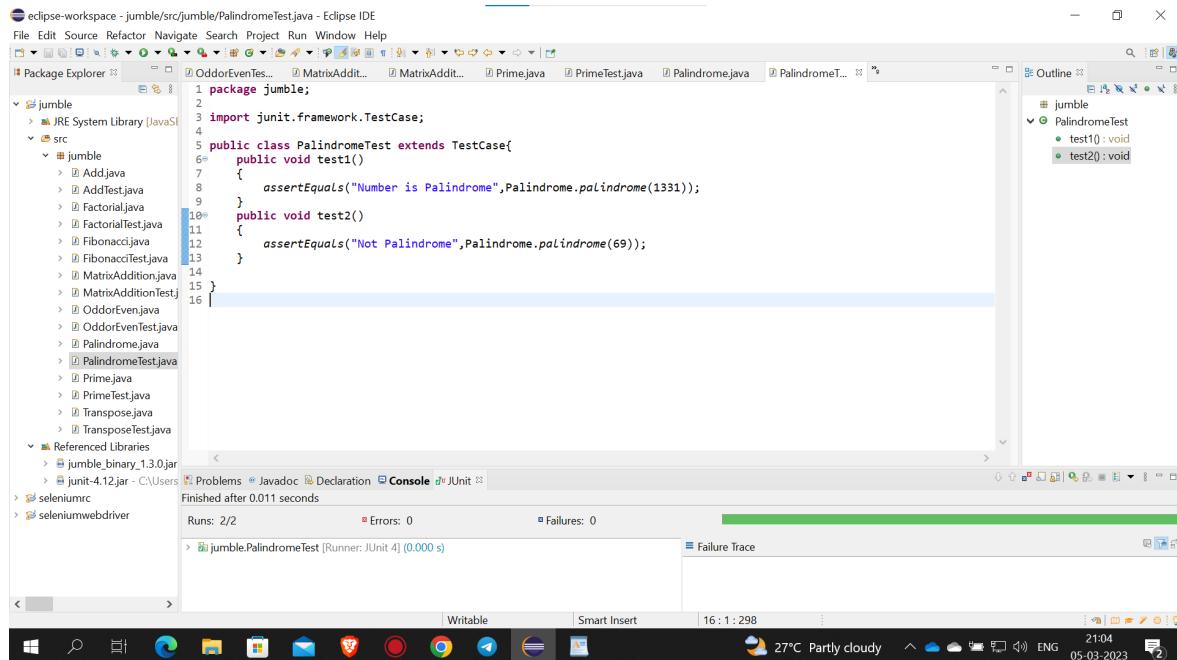
```

1 package jumble;
2
3 import junit.framework.TestCase;
4
5 public class PrimeTest extends TestCase {
6     public void test1() {
7         assertEquals(" 2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83 89 97 ",Prime.Checkprime());
8     }
9
10 }
11
12

```

Figure 86: Prime Code

7.7 Write a program to generate a palindrome of numbers.



```

1 package jumble;
2
3 import junit.framework.TestCase;
4
5 public class PalindromeTest extends TestCase{
6     public void test1()
7     {
8         assertEquals("Number is Palindrome",Palindrome.palindrome(1331));
9     }
10    public void test2()
11    {
12        assertEquals("Not Palindrome",Palindrome.palindrome(69));
13    }
14 }
15
16

```

Outline view shows the test methods:

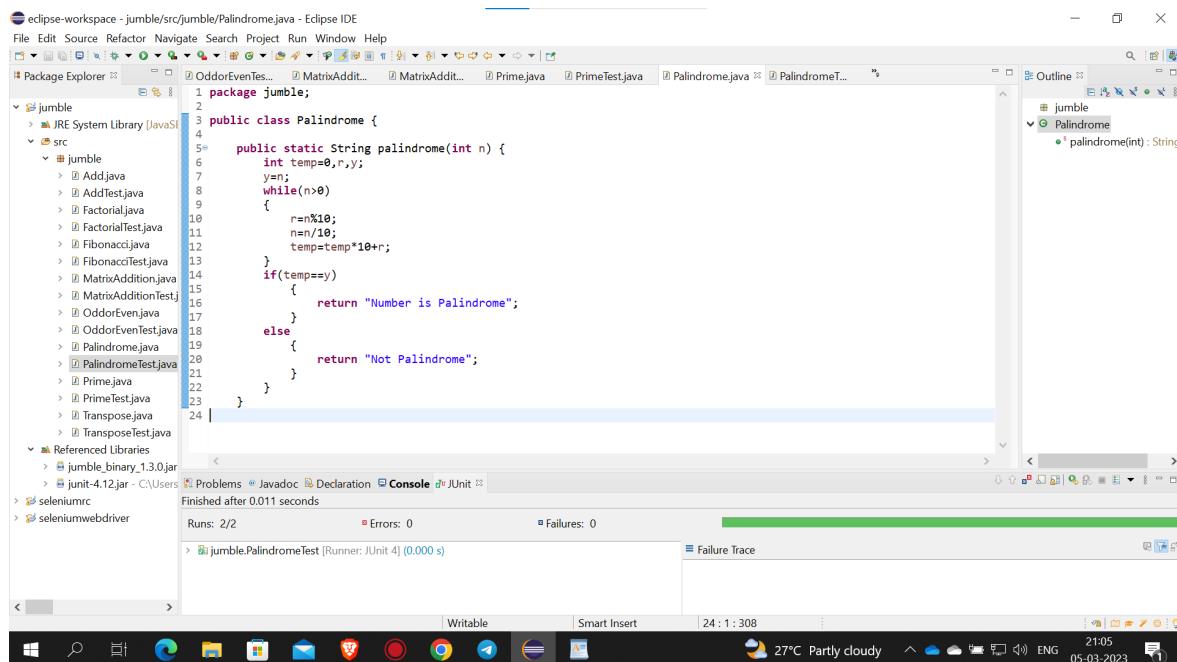
- test1(): void
- test2(): void

Console output:

- Runs: 2/2
- Errors: 0
- Failures: 0

Failure Trace: None

Figure 87: Jumble Test Case



```

1 package jumble;
2
3 public class Palindrome {
4     public static String palindrome(int n) {
5         int temp=0,r,y;
6         y=n;
7         while(n>0)
8         {
9             r=n%10;
10            n=n/10;
11            temp=temp*10+r;
12        }
13        if(temp==y)
14        {
15            return "Number is Palindrome";
16        }
17        else
18        {
19            return "Not Palindrome";
20        }
21    }
22 }
23
24

```

Outline view shows the palindrome method:

- palindrome(int): String

Console output:

- Runs: 2/2
- Errors: 0
- Failures: 0

Failure Trace: None

Figure 88: Palindrome Code

7.8 Write a program to find out the sum of two arrays.

```

package jumble;
import junit.framework.TestCase;

public class SumofarrayTest extends TestCase{
    public void test1() {
        int array1[]={2,4};
        int array2[]={3,6};
        assertEquals("15",Sumofarray.arrsum(array1,array2));
    }
    public void test2() {
        int array1[]={0,0};
        int array2[]={0,0};
        assertEquals("0",Sumofarray.arrsum(array1,array2));
    }
}

```

Figure 89: Jumble Test Case

```

package jumble;
public class Sumofarray {
    public static int arrsum(int a[],int b[]) {
        int sum=0;
        for(int i=0;i<a.length;i++) {
            sum=sum+a[i]+b[i];
        }
        return sum;
    }
}

```

Figure 90: Sum of Array Code

7.9 Write a program to check whether the number is even or odd.

```

1 package jumble;
2
3 import junit.framework.TestCase;
4
5 public class OddorEvenTest extends TestCase {
6     public void test1() {
7         assertEquals("Number is Even",OddorEven.evenorodd(2222));
8     }
9     public void test2() {
10        assertEquals("Number is Odd",OddorEven.evenorodd(69));
11    }
12    public void test3() {
13        assertEquals("Number is Even",OddorEven.evenorodd(-200));
14    }
15
16 }
17

```

Figure 91: Jumble Test Case

```

1 package jumble;
2
3 public class OddorEven {
4
5     public static String evenorodd(int n) {
6         if(n%2==0)
7             {
8                 return "Number is Even";
9             }
10            else
11            {
12                return "Number is Odd";
13            }
14        }
15    }
16 }
17

```

Figure 92: Odd or Even Code

7.10 Write a program for binary to hexadecimal conversion.

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure under the package `jumble`, including various Java files like `Add.java`, `BinarytoHex.java`, `Factorial.java`, etc., and test files like `BinarytoHexTest.java`.
- BinarytoHexTest.java Content:**

```

1 package jumble;
2
3 import junit.framework.TestCase;
4
5 public class BinarytoHexTest extends TestCase{
6     public void test1()
7     {
8         assertEquals("A ",BinarytoHex.btoh(1010));
9     }
10    public void test2()
11    {
12        assertEquals("2A ",BinarytoHex.btoh(101010));
13    }
14    public void test3()
15    {
16        assertEquals("26",BinarytoHex.btoh(100110));
17    }
18 }

```
- Console Tab:** Shows the output of the test run: "Runs: 3/3 Errors: 0 Failures: 0".
- System Tray:** Shows the date and time as 05-03-2023 21:20.

Figure 93: Jumble Test Case

The screenshot shows the Eclipse IDE interface with the following details:

- BinarytoHex.java Content:**

```

1 package jumble;
2
3 public class BinarytoHex {
4     public static String btoh(int binary) {
5         int i = 1, j = 0, rem, decimal = 0;
6         int hex[] = new int[10];
7
8         while (binary > 0)
9         {
10             rem = binary % 2;
11             decimal = decimal + rem * i;
12             i = i * 2;
13             binary = binary / 10;
14         }
15         i = 0;
16         while (decimal != 0)
17         {
18             hex[i] = decimal % 16;
19             decimal = decimal / 16;
20             i++;
21         }
22         String s="";
23         for (j = i - 1; j >= 0; j--)
24         {
25             if (hex[j] > 9)
26                 {s=s+(char)(hex[j] + 55)+" ";}
27             else
28                 {s=s+hex[j]+";";}
29         }
30     }
31 }

```
- Console Tab:** Shows the output of the test run: "Runs: 3/3 Errors: 0 Failures: 0".
- System Tray:** Shows the date and time as 05-03-2023 21:21.

Figure 94: Binary to Hexadecimal Code

CS6474: Software Testing Laboratory 2023

JMETER

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8 JMeter

The Apache JMeter is pure Java open source software, which was first developed by Stefano Mazzocchi of the Apache Software Foundation, designed to load test functional behavior and measure performance. You can use JMeter to analyze and measure the performance of web application or a variety of services. Performance Testing means testing a web application against heavy load, multiple and concurrent user traffic. JMeter originally is used for testing Web Application or FTP application

How does JMeter perform tests?

- Creates a request and sends the request to the server
- Collects responses from the server and visualizes the details in a chart or graph
- Processes the response from the server
- Generates test results in several formats such as text, XML, JSON for the tester to analyze data

Advantages of JMeter

- Easy to use without extensive knowledge of programming. It has a user-friendly UI and one can also use CLI.
- Provides integration with Jenkins and reporting
- Easy installation on any operating system
- Key features like the Thread Group, helps to see whether software performance is good.
- Test IDE allows test recording from browsers or native applications
- Allows API testing, Database Testing, and MQ testing with ease
- When there's a high number of TPS, one can achieve more transactions per second given the hyper-limitations

Disadvantages of JMeter

- Automation is difficult with JMeter
- JMeter output reports are difficult to understand without training
- It doesn't support JavaScript and AJAX requests.
- Complex applications that use dynamic content or use JS to alter requests can be difficult to test using JMeter.
- It's difficult to get data from one place or to perform customizations.

8.1 NITRKL Stress Testing Using Constant Timer

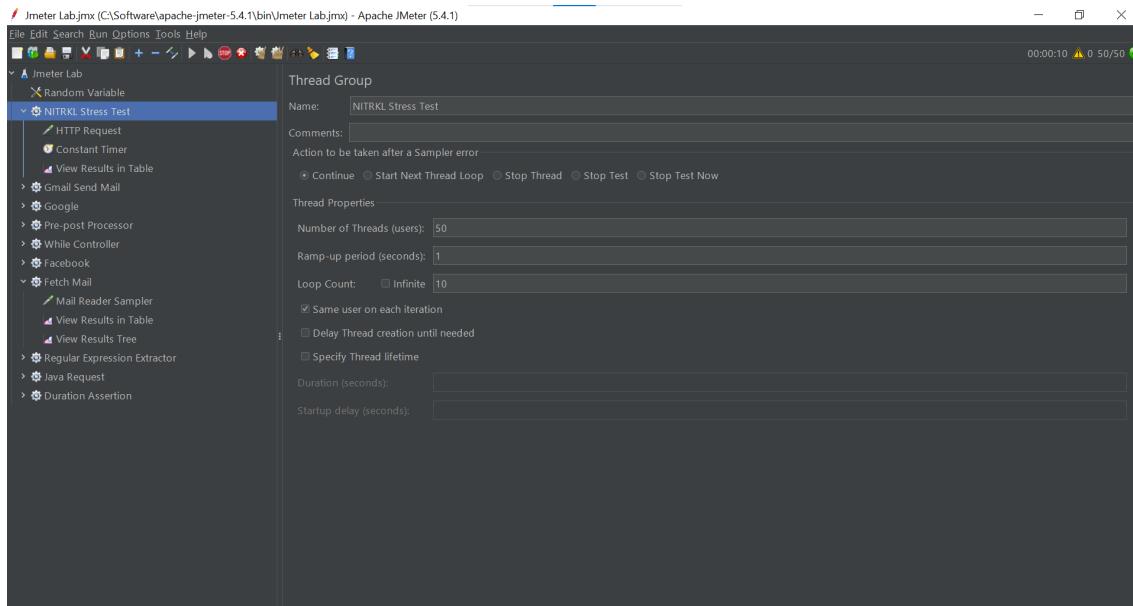


Figure 95:

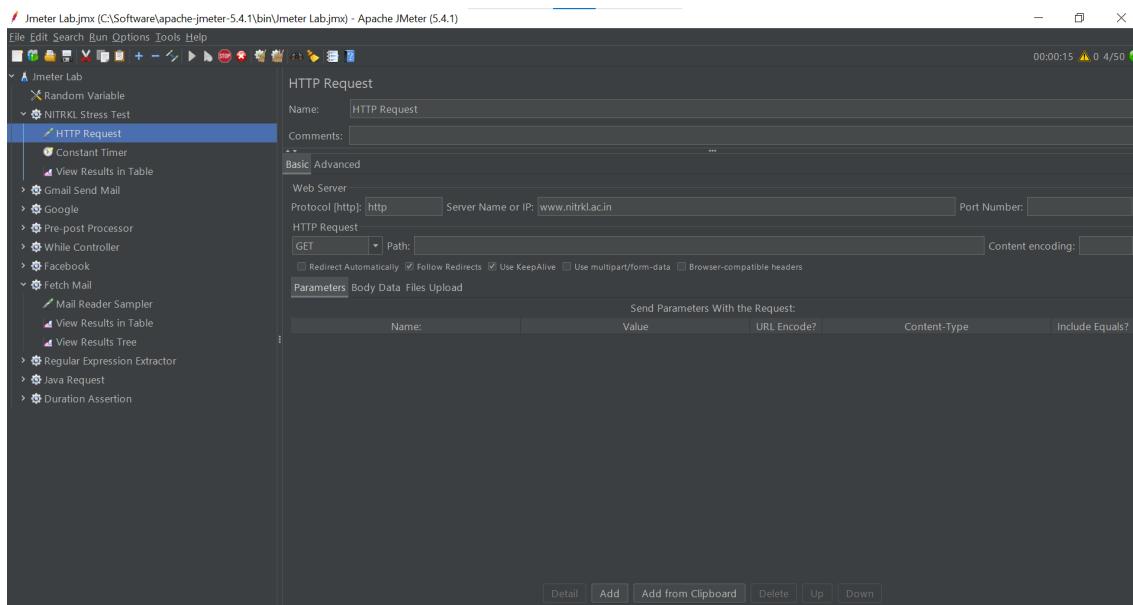


Figure 96:

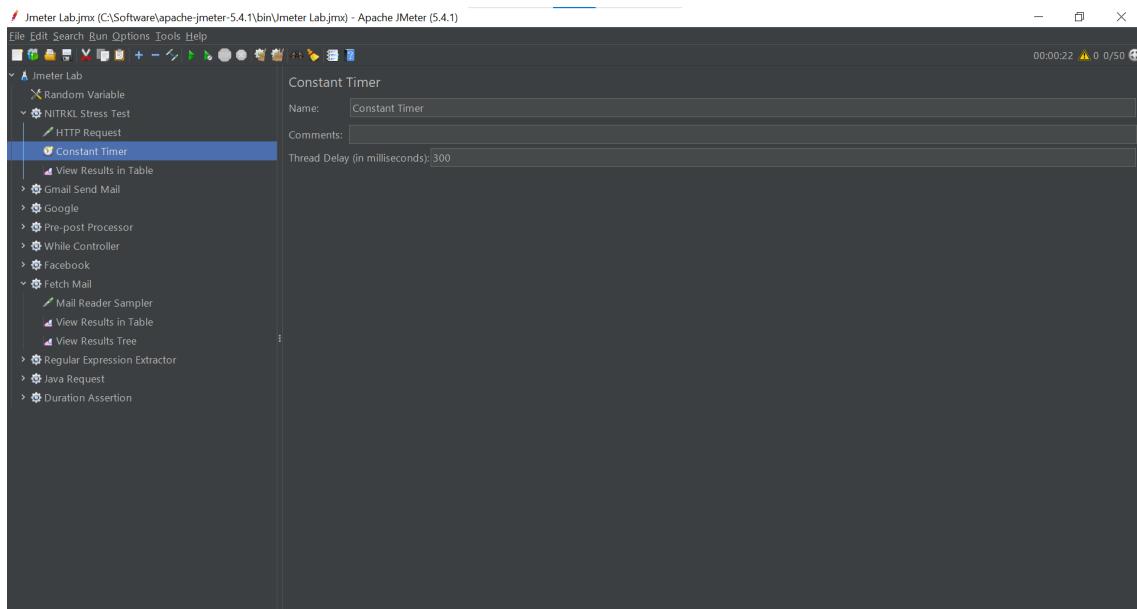


Figure 97:

| Sample # | Start Time | Thread Name | Label | Sample Time... | Status | Bytes | Sent Bytes | Latency | Connect Time... |
|----------|--------------|-------------------|--------------|----------------|--------|---------|------------|---------|-----------------|
| 1 | 18:52:22.191 | NITRKL Stress ... | HTTP Request | 1429 | ✓ | 1003967 | 242 | 8 | 3 |
| 2 | 18:52:22.406 | NITRKL Stress ... | HTTP Request | 1445 | ✓ | 1003967 | 242 | 26 | 11 |
| 3 | 18:52:22.324 | NITRKL Stress ... | HTTP Request | 1565 | ✓ | 1003967 | 242 | 6 | 3 |
| 4 | 18:52:22.389 | NITRKL Stress ... | HTTP Request | 1841 | ✓ | 1003967 | 242 | 26 | 4 |
| 5 | 18:52:22.516 | NITRKL Stress ... | HTTP Request | 1882 | ✓ | 1003967 | 242 | 7 | 4 |
| 6 | 18:52:22.264 | NITRKL Stress ... | HTTP Request | 2164 | ✓ | 1003967 | 242 | 7 | 4 |
| 7 | 18:52:22.346 | NITRKL Stress ... | HTTP Request | 2441 | ✓ | 1003967 | 242 | 11 | 8 |
| 8 | 18:52:22.244 | NITRKL Stress ... | HTTP Request | 2747 | ✓ | 1003967 | 242 | 5 | 2 |
| 9 | 18:52:22.207 | NITRKL Stress ... | HTTP Request | 2821 | ✓ | 1003967 | 242 | 5 | 1 |
| 10 | 18:52:22.226 | NITRKL Stress ... | HTTP Request | 3411 | ✓ | 1003967 | 242 | 7 | 3 |
| 11 | 18:52:22.366 | NITRKL Stress ... | HTTP Request | 3377 | ✓ | 1003967 | 242 | 6 | 3 |
| 12 | 18:52:22.472 | NITRKL Stress ... | HTTP Request | 3459 | ✓ | 1003967 | 242 | 10 | 7 |
| 13 | 18:52:22.450 | NITRKL Stress ... | HTTP Request | 3663 | ✓ | 1003967 | 242 | 12 | 6 |
| 14 | 18:52:22.989 | NITRKL Stress ... | HTTP Request | 3657 | ✓ | 1003967 | 242 | 10 | 5 |
| 15 | 18:52:22.606 | NITRKL Stress ... | HTTP Request | 4172 | ✓ | 1003967 | 242 | 14 | 9 |
| 16 | 18:52:22.566 | NITRKL Stress ... | HTTP Request | 4250 | ✓ | 1003967 | 242 | 13 | 4 |
| 17 | 18:52:22.485 | NITRKL Stress ... | HTTP Request | 4575 | ✓ | 1003967 | 242 | 27 | 8 |
| 18 | 18:52:22.527 | NITRKL Stress ... | HTTP Request | 4672 | ✓ | 1003967 | 242 | 19 | 11 |
| 19 | 18:52:22.926 | NITRKL Stress ... | HTTP Request | 4281 | ✓ | 1003967 | 242 | 61 | 49 |

Figure 98:

8.2 Sending Mail to another mail using SMTP Sampler

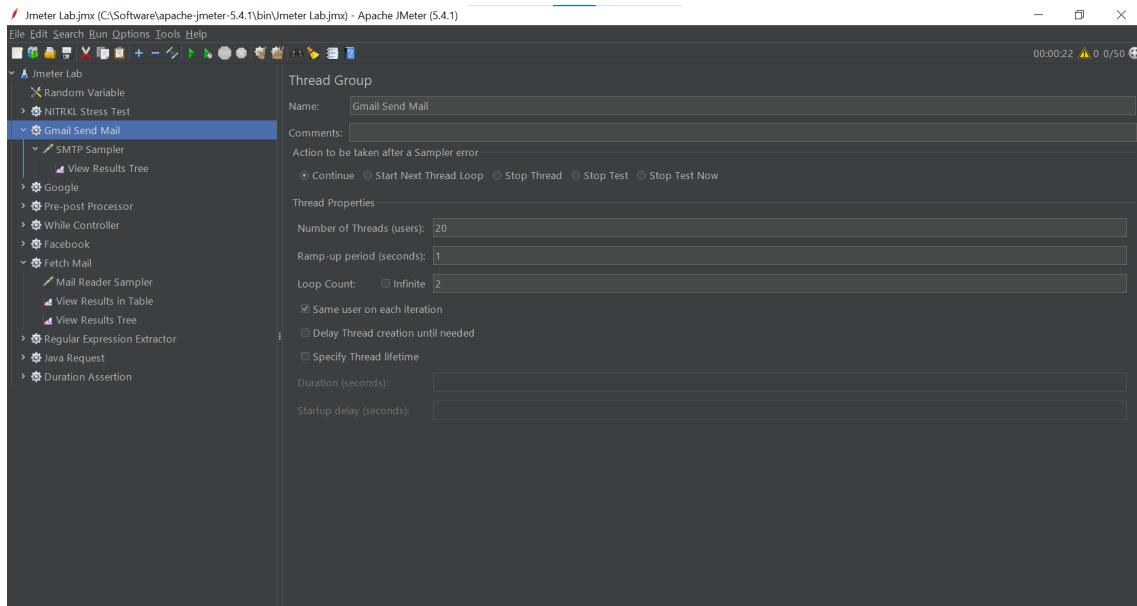


Figure 99:

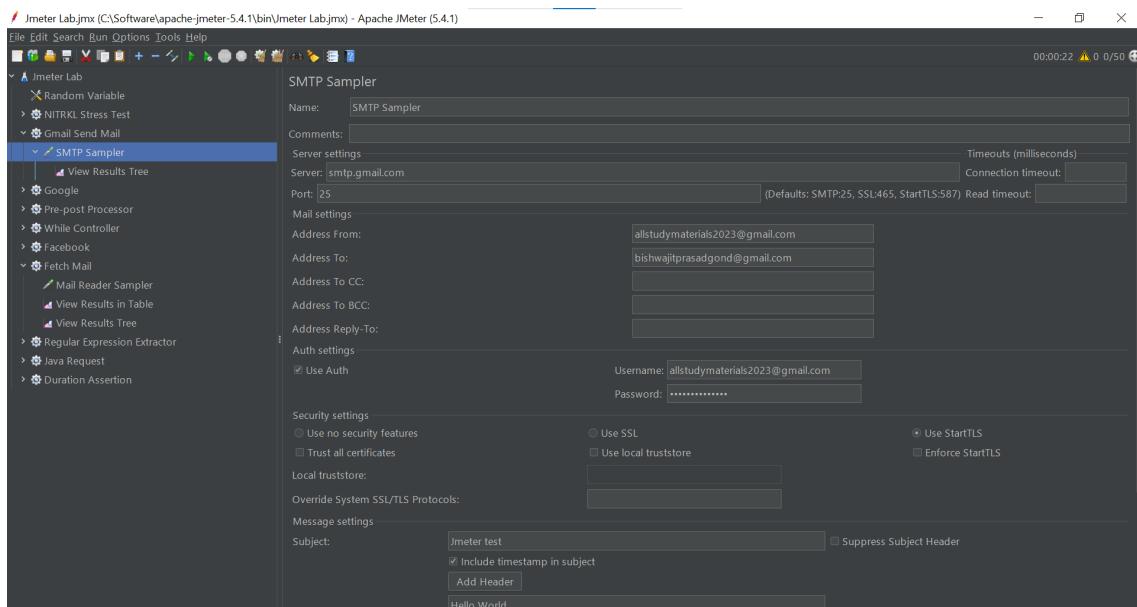


Figure 100:

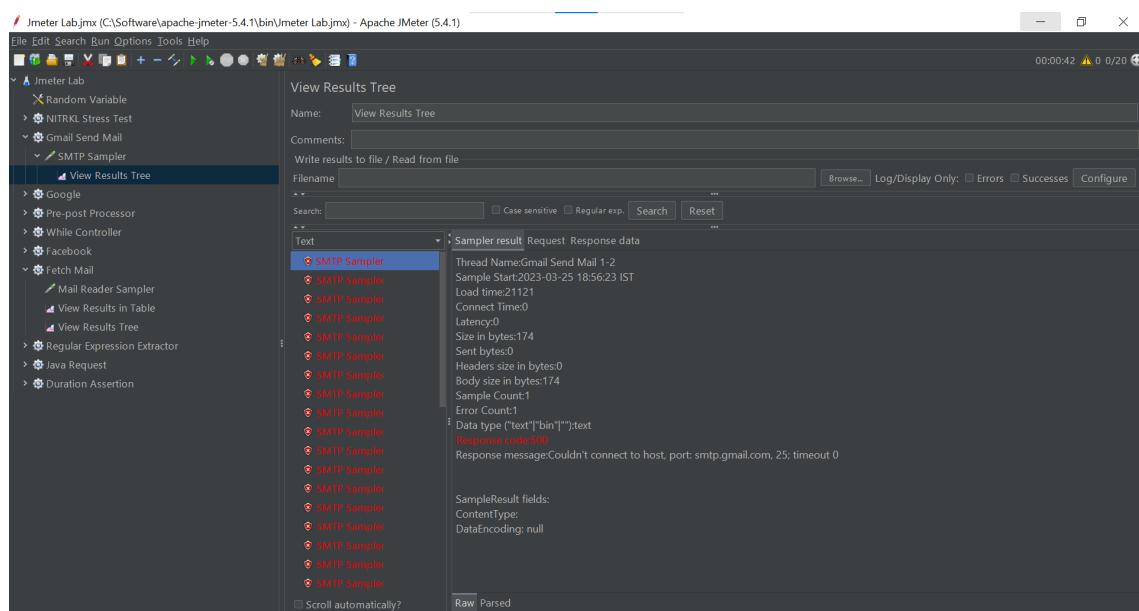


Figure 101:

8.3 Using Loop Controller to Google.com

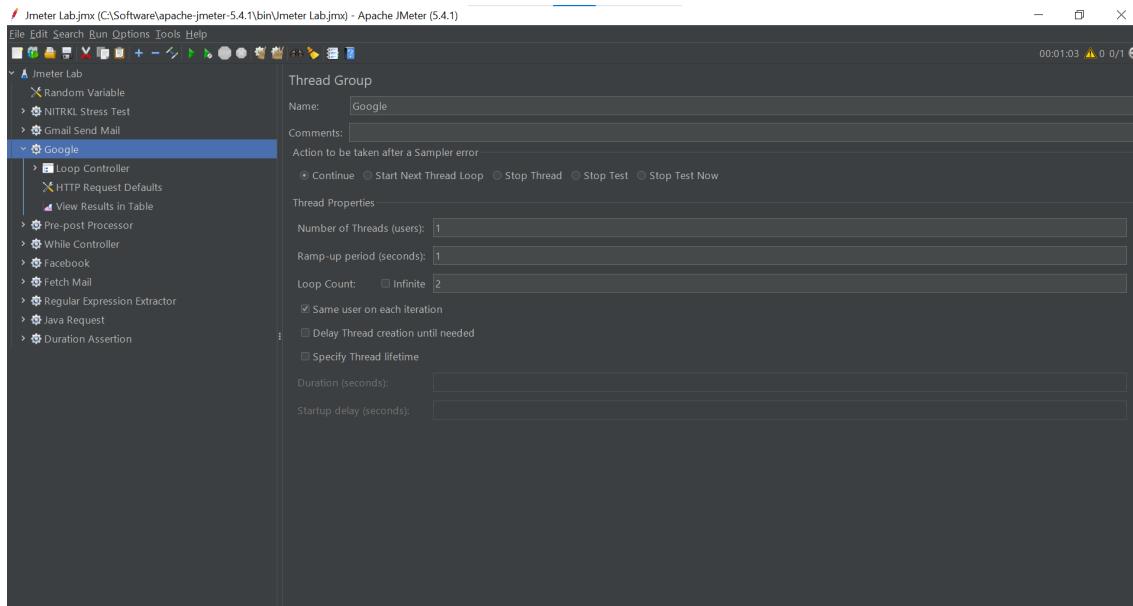


Figure 102:

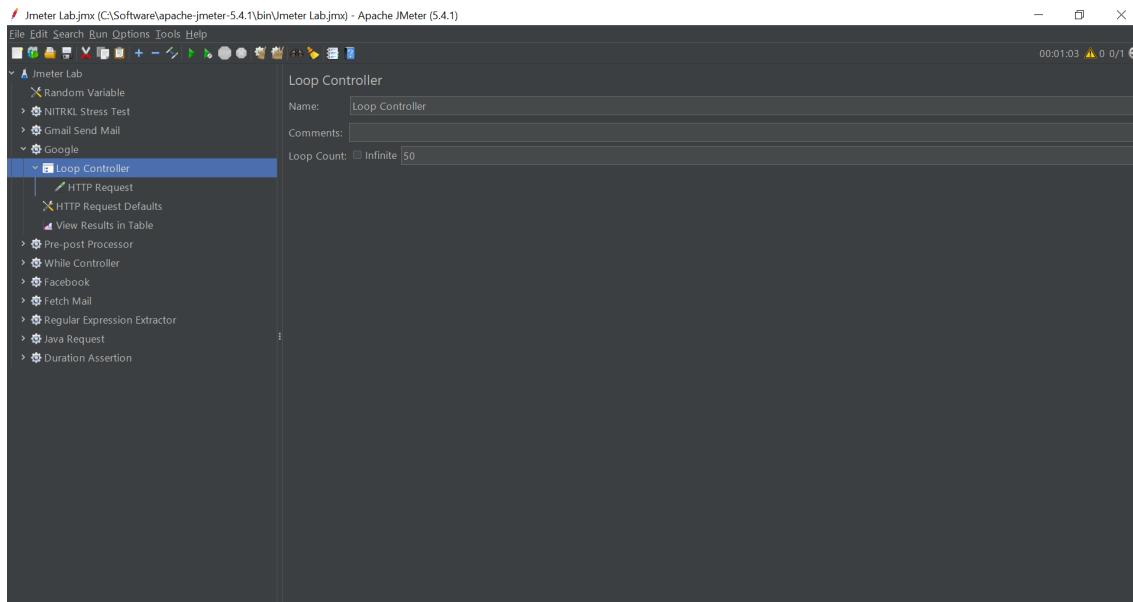


Figure 103:

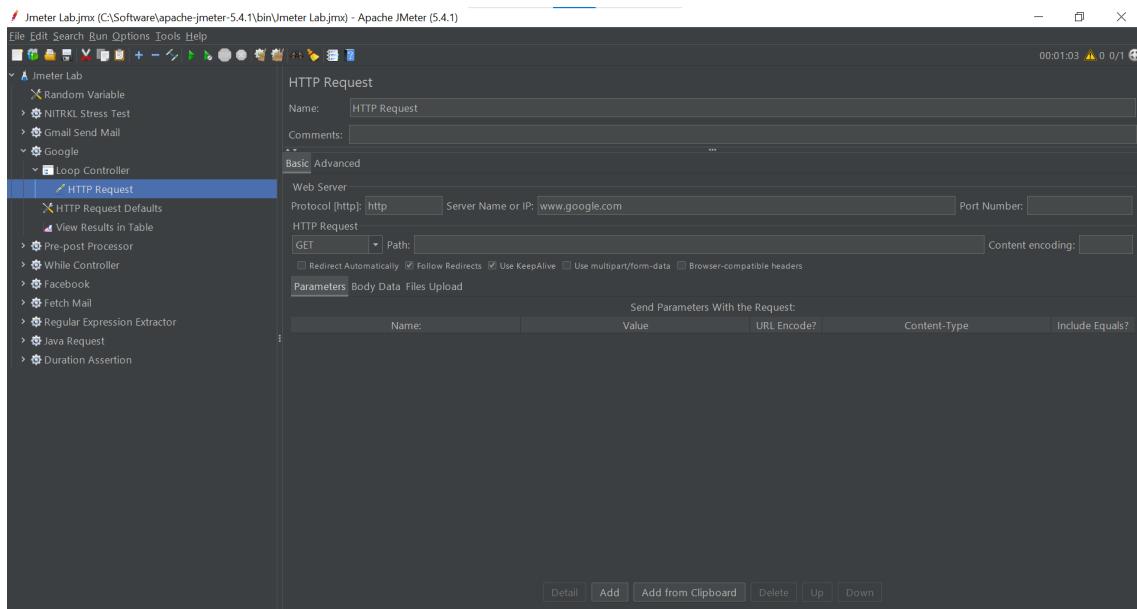


Figure 104:

| Sample # | Start Time | Thread Name | Label | Sample Time... | Status | Bytes | Sent Bytes | Latency | Connect Time... |
|----------|--------------|-------------|--------------|----------------|--------|-------|------------|---------|-----------------|
| 1 | 19:02:24.567 | Google 1-1 | HTTP Request | 738 | ✓ | 17610 | 119 | 679 | 84 |
| 2 | 19:02:25.307 | Google 1-1 | HTTP Request | 1585 | ✓ | 17587 | 119 | 1557 | 0 |
| 3 | 19:02:26.894 | Google 1-1 | HTTP Request | 650 | ✓ | 17641 | 119 | 622 | 0 |
| 4 | 19:02:27.545 | Google 1-1 | HTTP Request | 1600 | ✓ | 17559 | 119 | 1573 | 0 |
| 5 | 19:02:29.146 | Google 1-1 | HTTP Request | 639 | ✓ | 17615 | 119 | 611 | 0 |
| 6 | 19:02:29.785 | Google 1-1 | HTTP Request | 616 | ✓ | 17522 | 119 | 588 | 0 |
| 7 | 19:02:30.401 | Google 1-1 | HTTP Request | 623 | ✓ | 17592 | 119 | 592 | 0 |
| 8 | 19:02:31.025 | Google 1-1 | HTTP Request | 574 | ✓ | 17671 | 119 | 548 | 0 |
| 9 | 19:02:31.598 | Google 1-1 | HTTP Request | 620 | ✓ | 17586 | 119 | 593 | 0 |
| 10 | 19:02:32.219 | Google 1-1 | HTTP Request | 607 | ✓ | 17533 | 119 | 579 | 0 |
| 11 | 19:02:32.827 | Google 1-1 | HTTP Request | 603 | ✓ | 17598 | 119 | 575 | 0 |
| 12 | 19:02:33.431 | Google 1-1 | HTTP Request | 630 | ✓ | 19773 | 119 | 598 | 0 |
| 13 | 19:02:34.062 | Google 1-1 | HTTP Request | 587 | ✓ | 17612 | 119 | 561 | 0 |
| 14 | 19:02:34.650 | Google 1-1 | HTTP Request | 594 | ✓ | 17655 | 119 | 566 | 0 |
| 15 | 19:02:35.244 | Google 1-1 | HTTP Request | 588 | ✓ | 17614 | 119 | 561 | 0 |
| 16 | 19:02:35.833 | Google 1-1 | HTTP Request | 596 | ✓ | 17630 | 119 | 570 | 0 |
| 17 | 19:02:36.431 | Google 1-1 | HTTP Request | 601 | ✓ | 17627 | 119 | 575 | 0 |
| 18 | 19:02:37.033 | Google 1-1 | HTTP Request | 620 | ✓ | 17641 | 119 | 593 | 0 |
| 19 | 19:02:37.654 | Google 1-1 | HTTP Request | 617 | ✓ | 19774 | 119 | 583 | 0 |

View Results in Table

Name: View Results in Table

Comments:

Write results to file / Read from file

Filename:

Browse... Log/Display Only: Errors Successes Configure

Scroll automatically? Child samples? No of Samples: 100 Latest Sample: 619 Average: 635 Deviation: 154

Figure 105:

8.4 Json Extractor

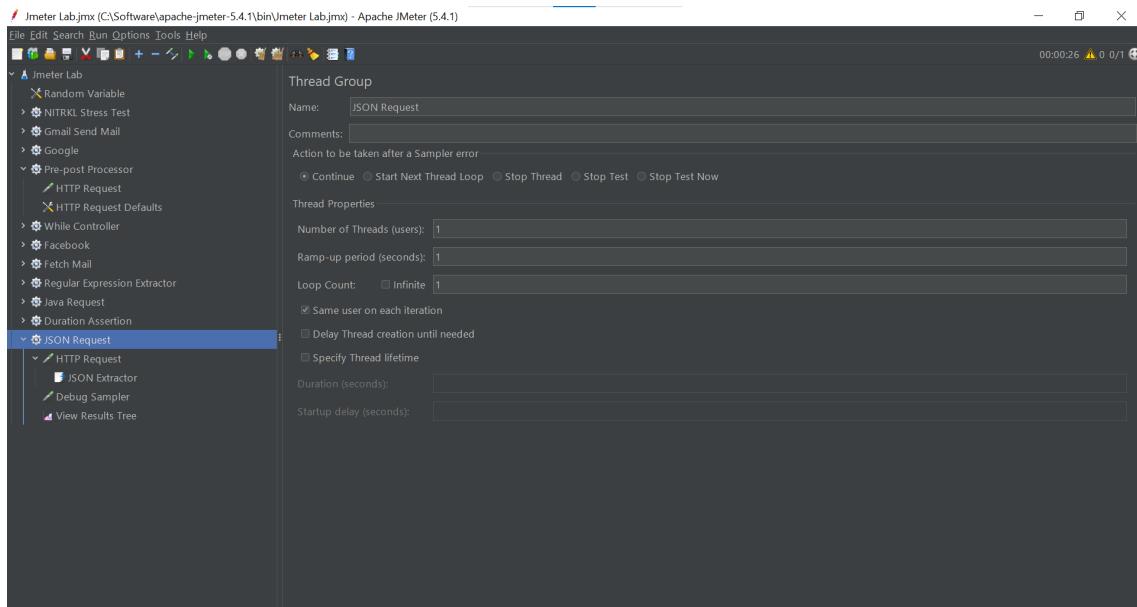


Figure 106:

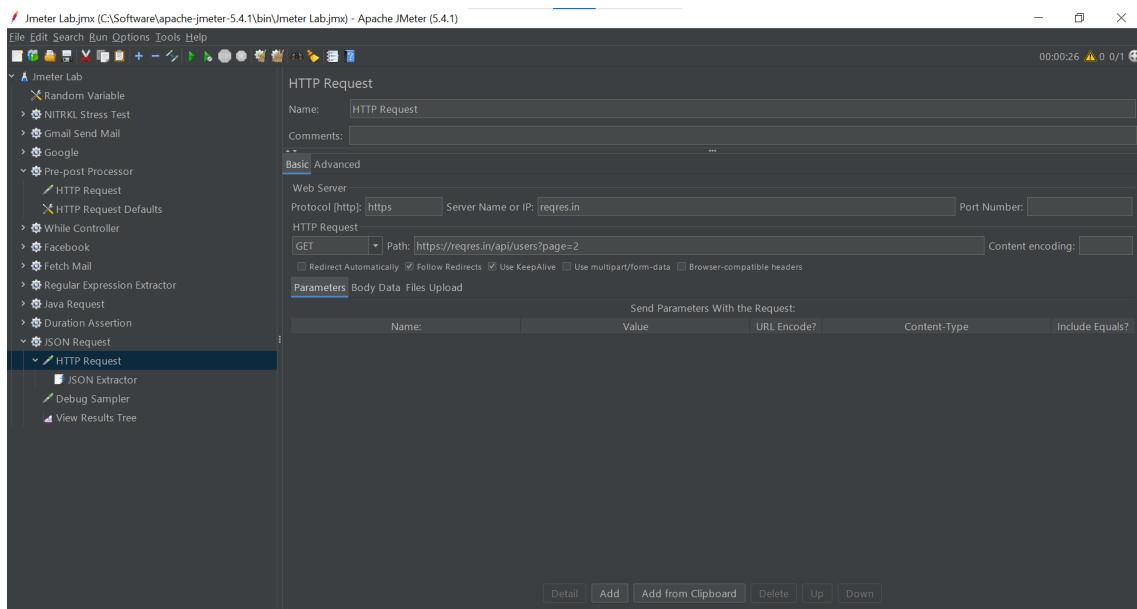


Figure 107:

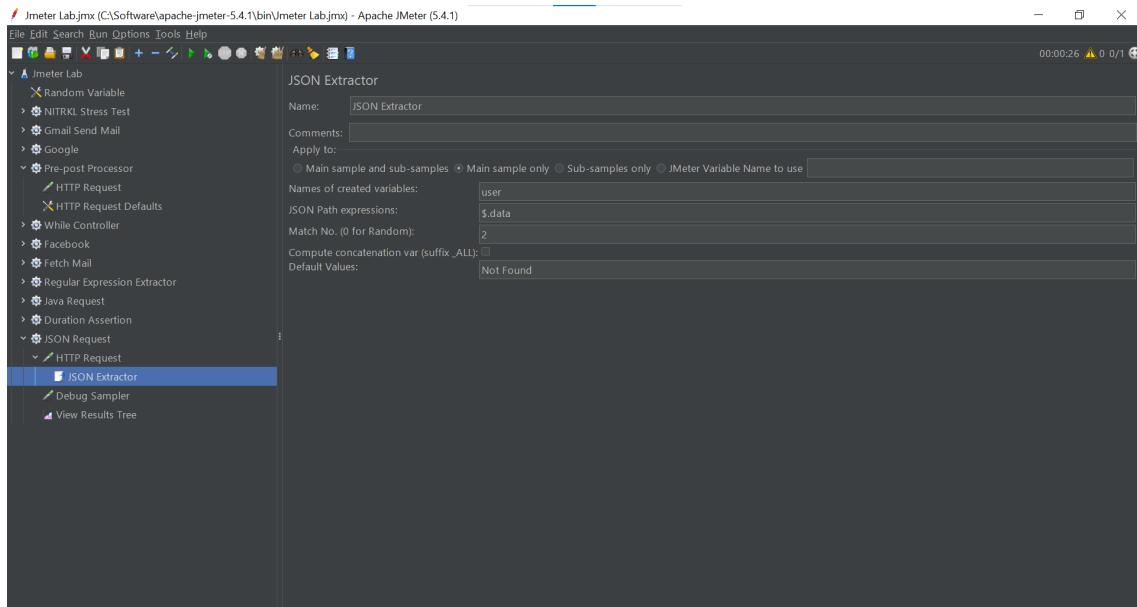


Figure 108:

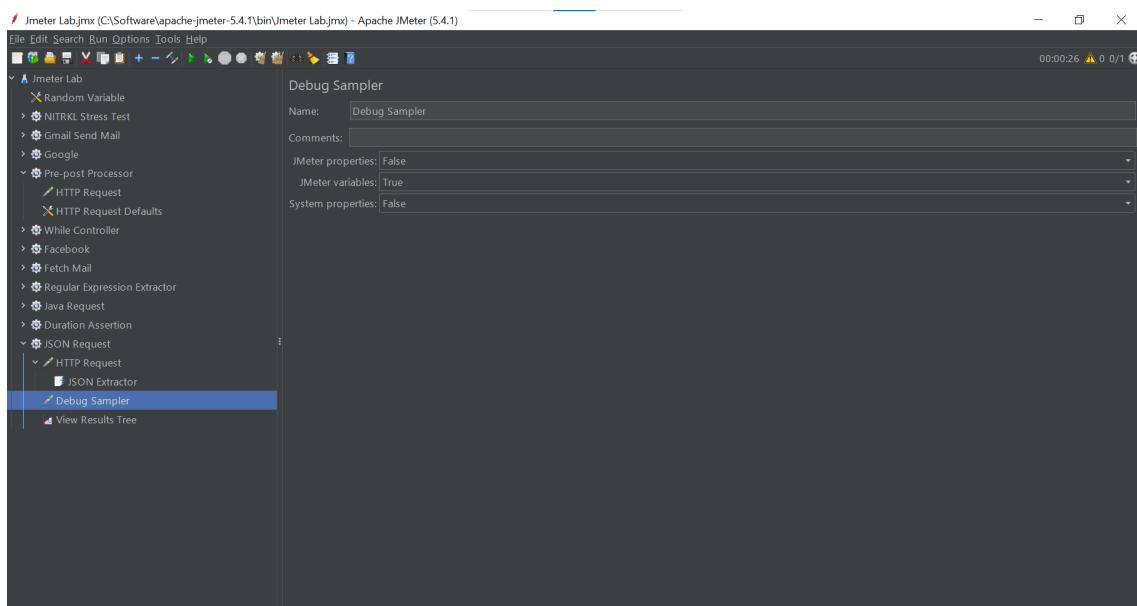


Figure 109:

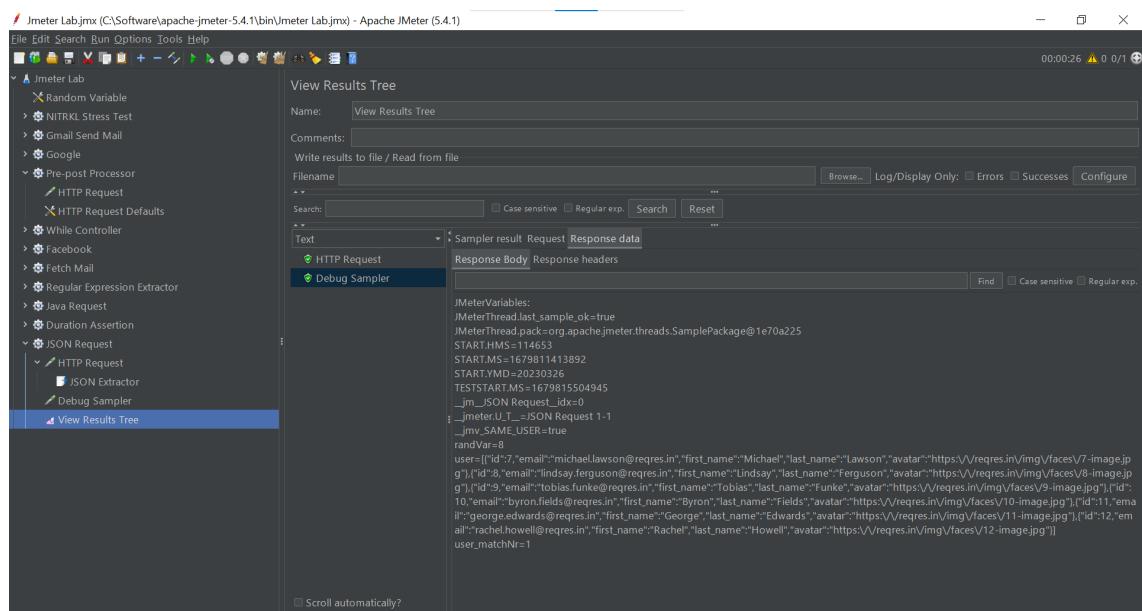


Figure 110:

8.5 While Controller

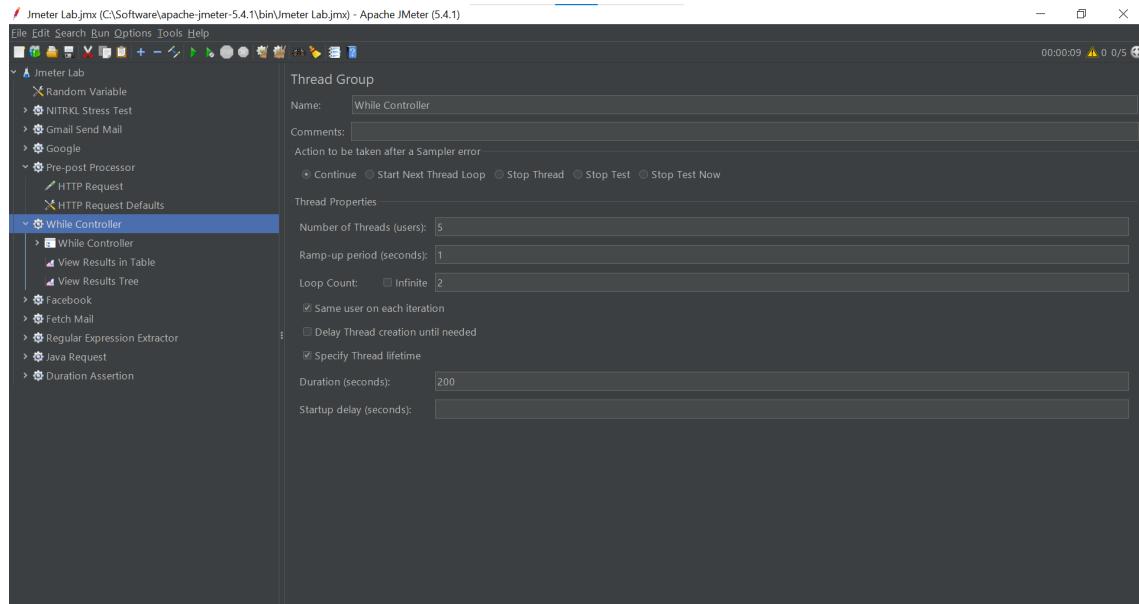


Figure 111:

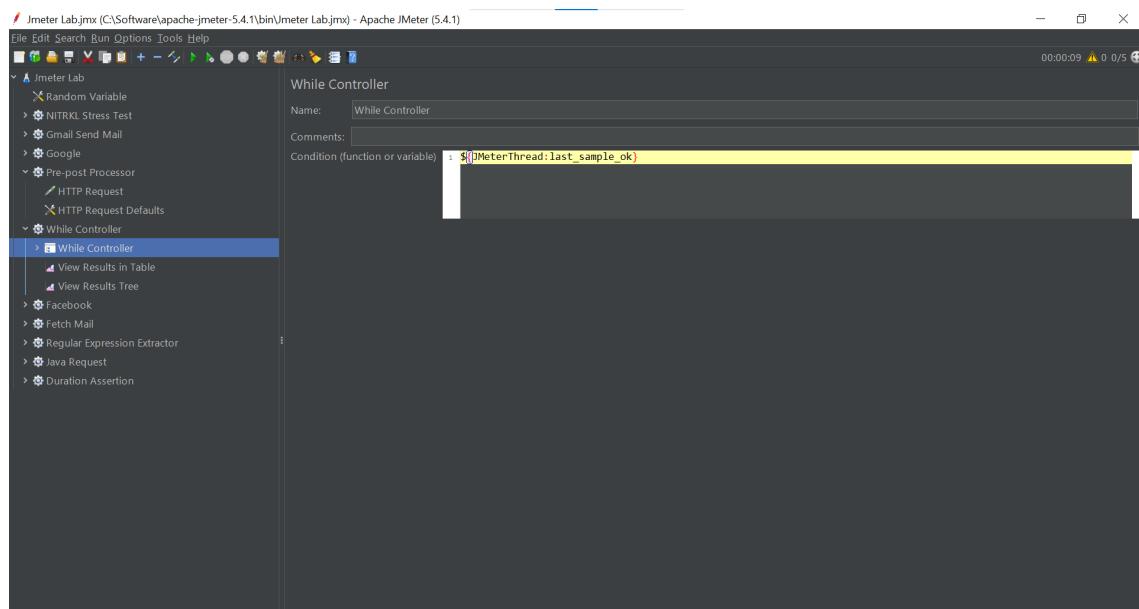


Figure 112:

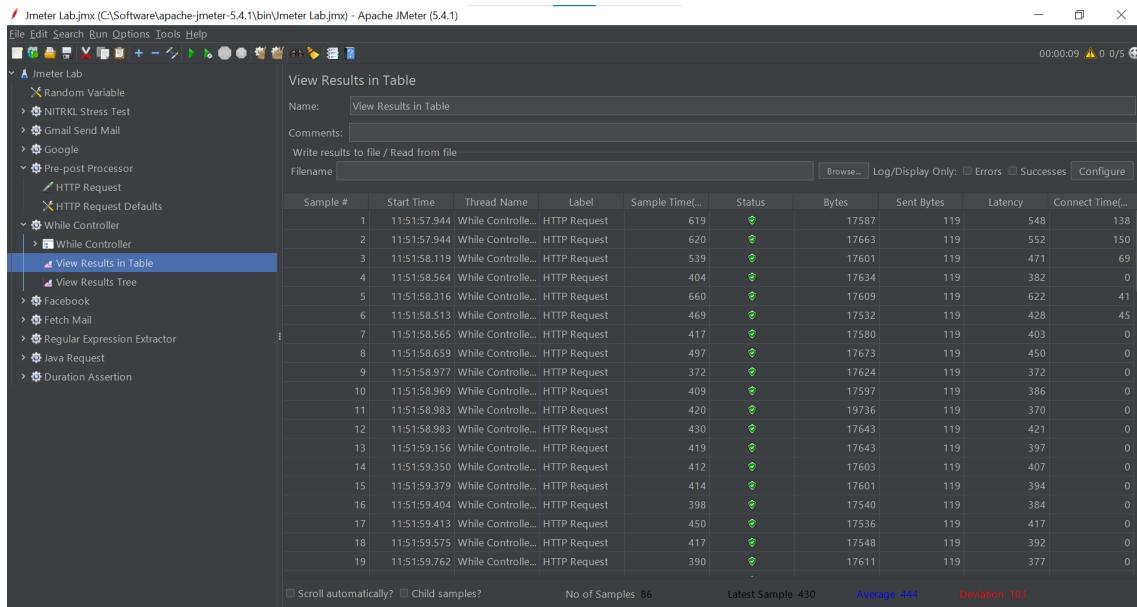


Figure 113:

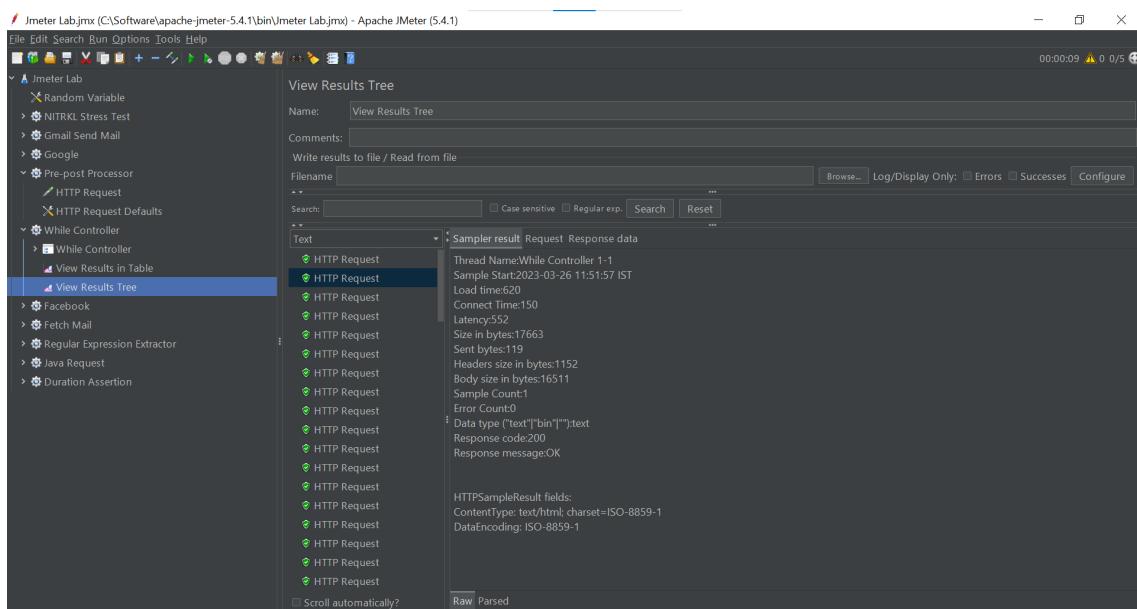


Figure 114:

8.6 Facebook

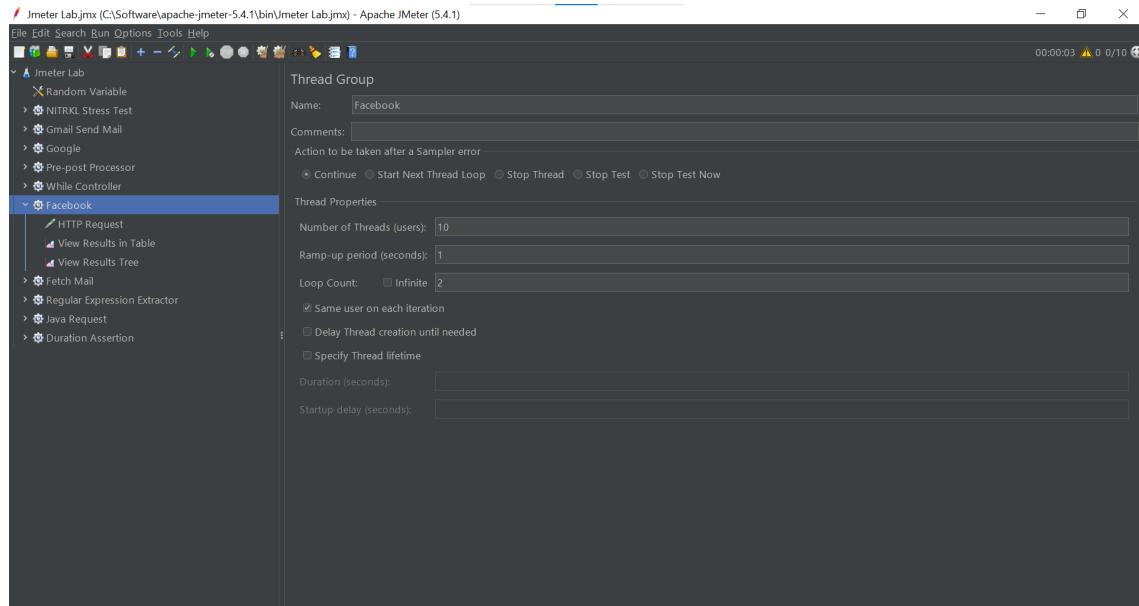


Figure 115:

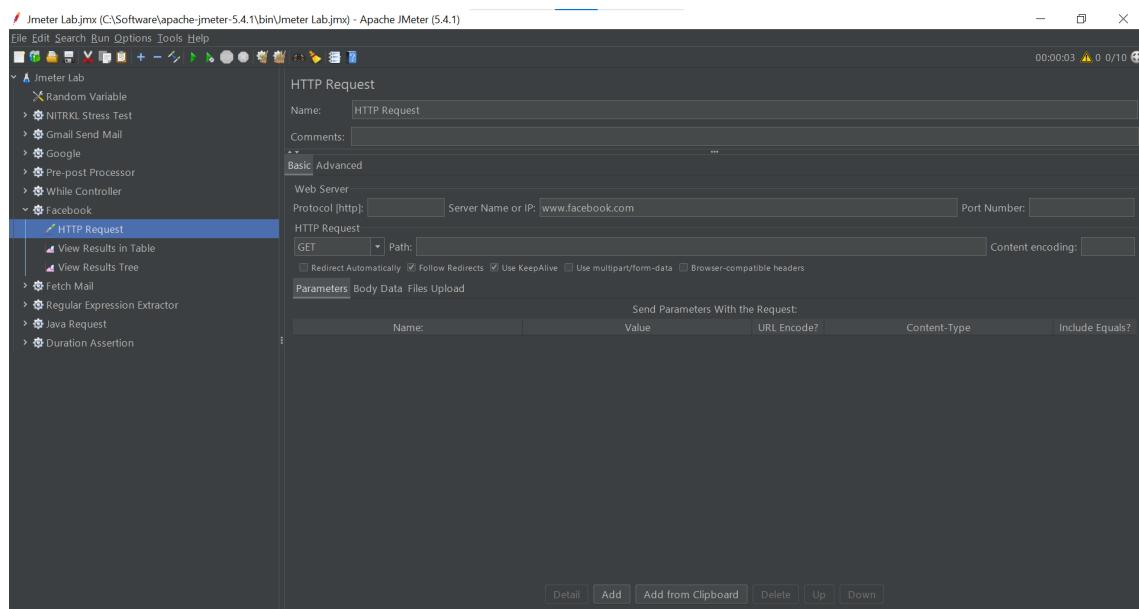


Figure 116:

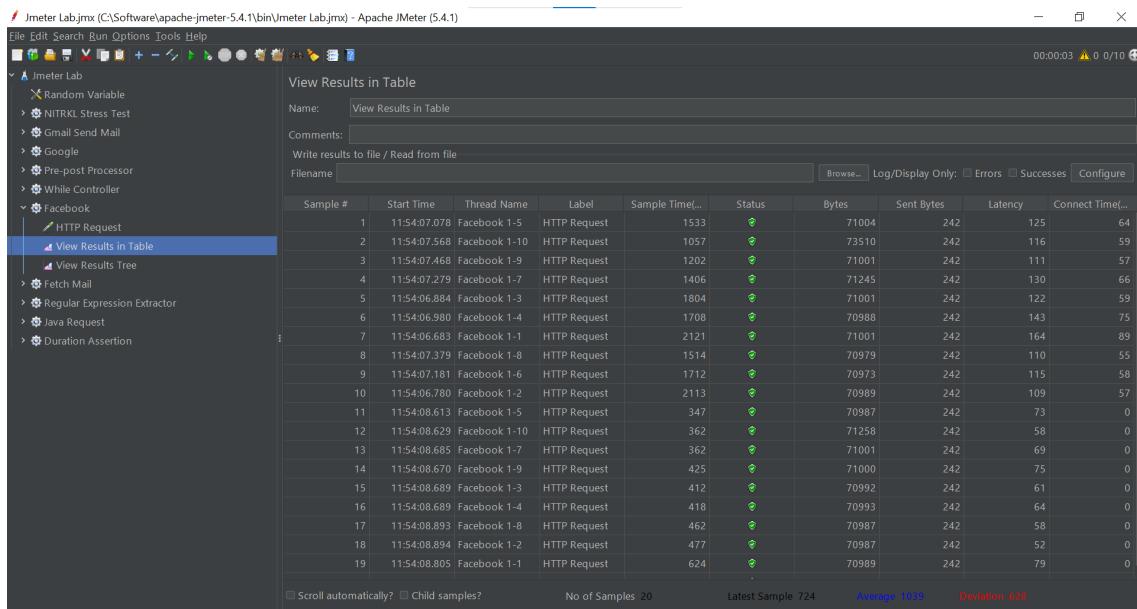


Figure 117:

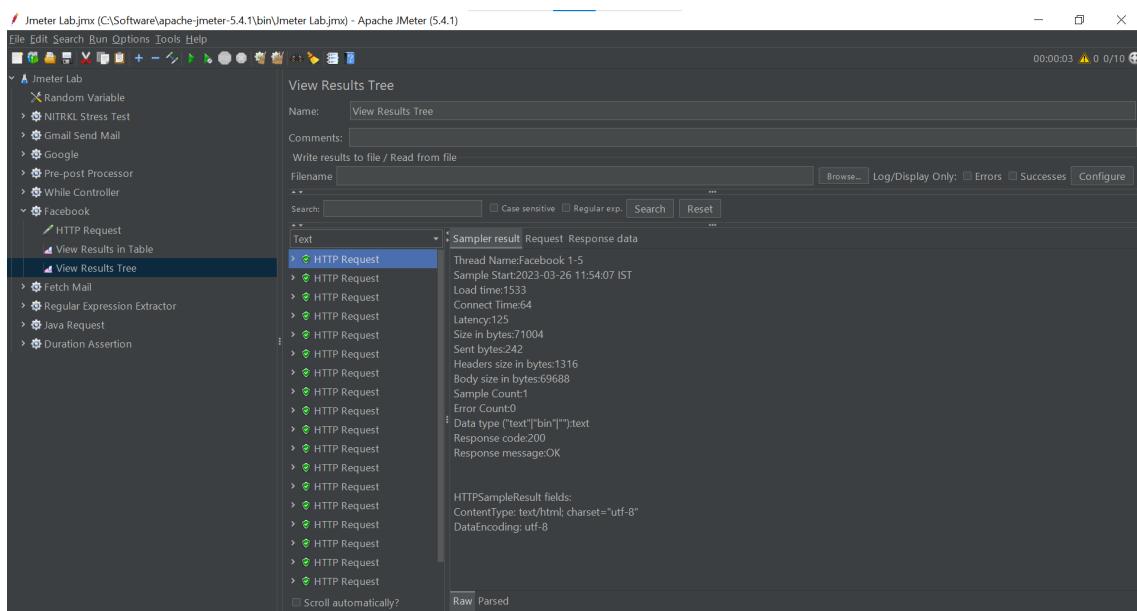


Figure 118:

8.7 Mail Reader Sampler

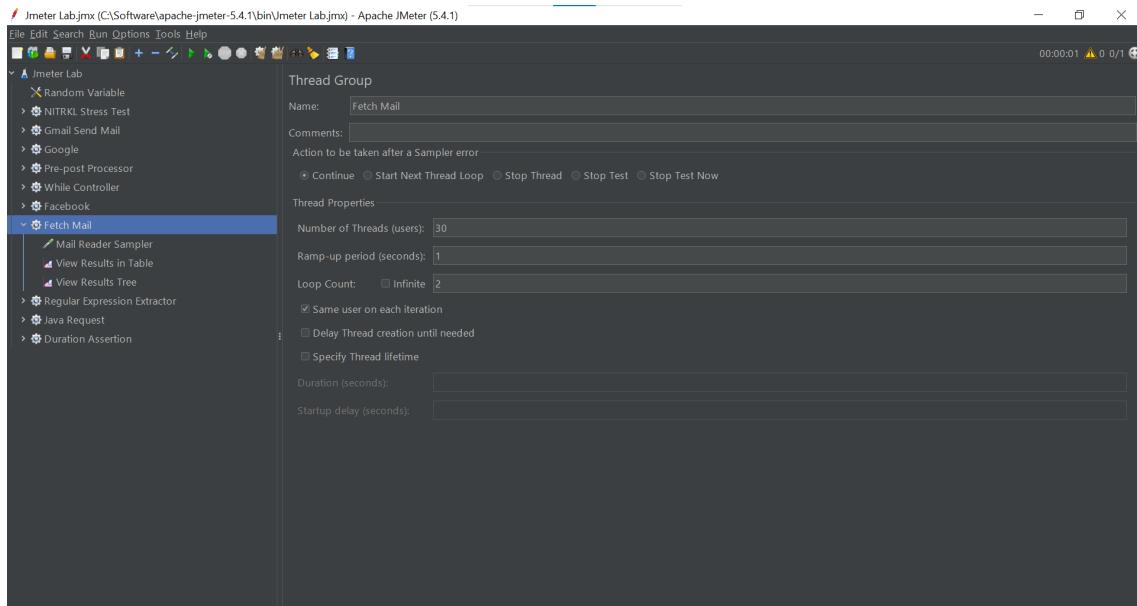


Figure 119:

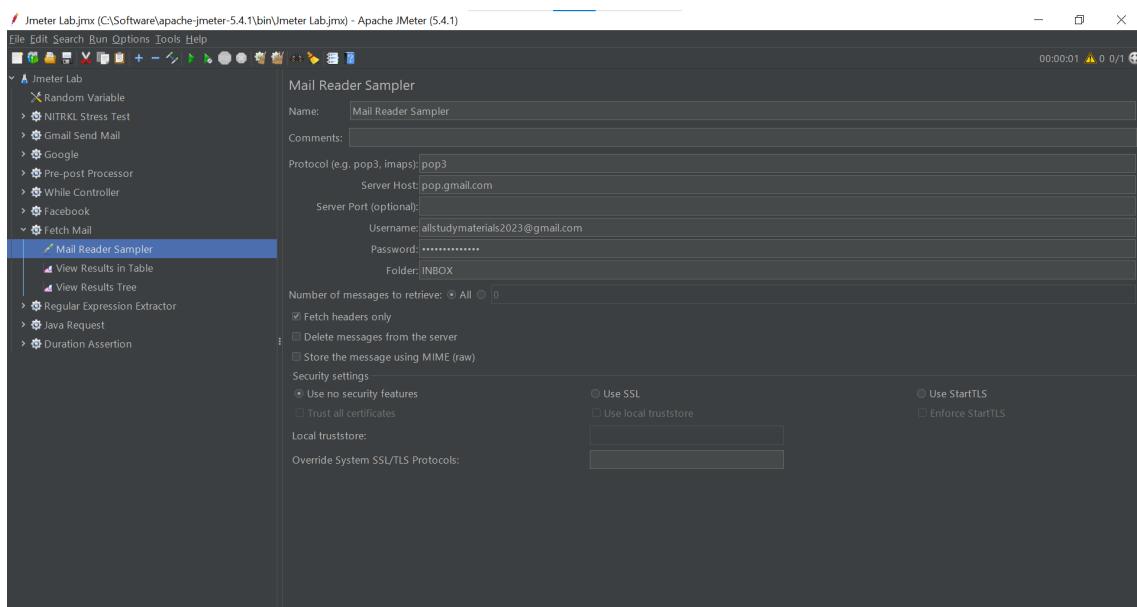


Figure 120:

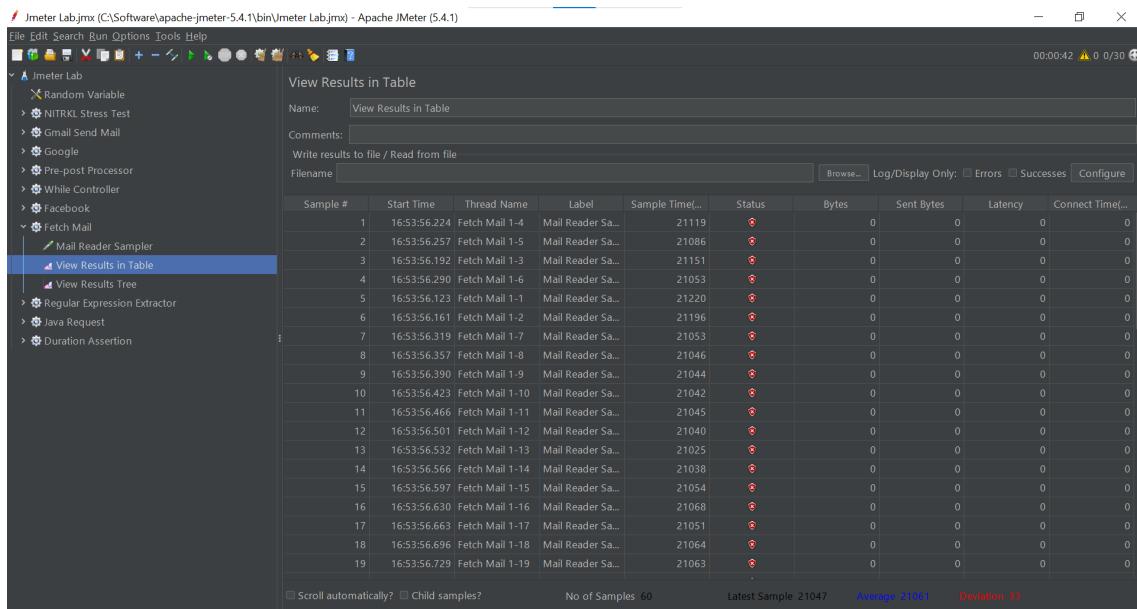


Figure 121:

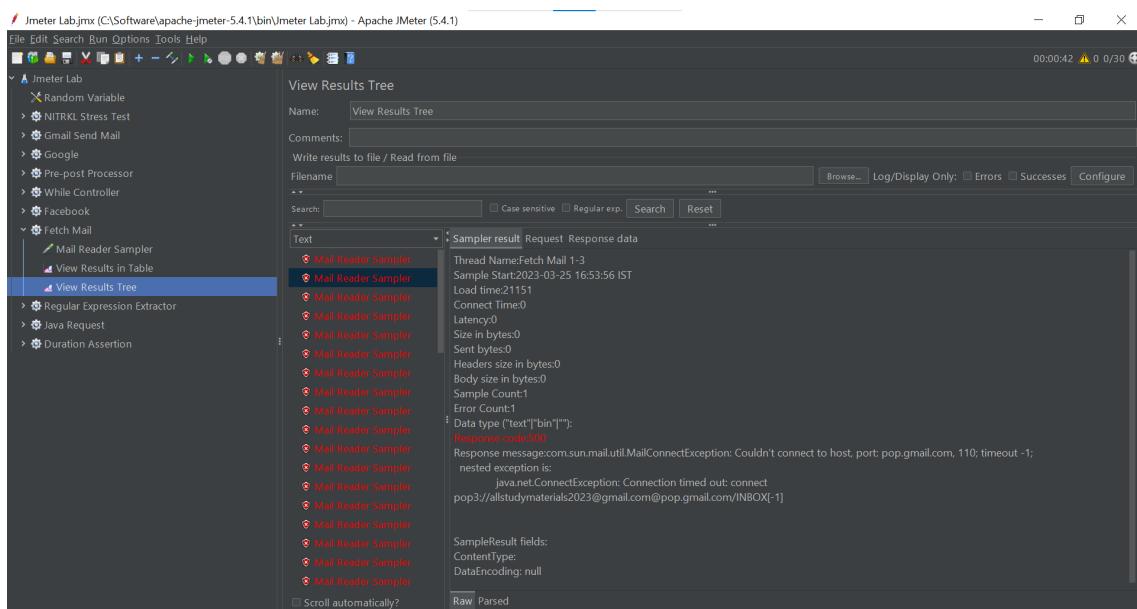


Figure 122:

8.8 Regular Expression Extractor

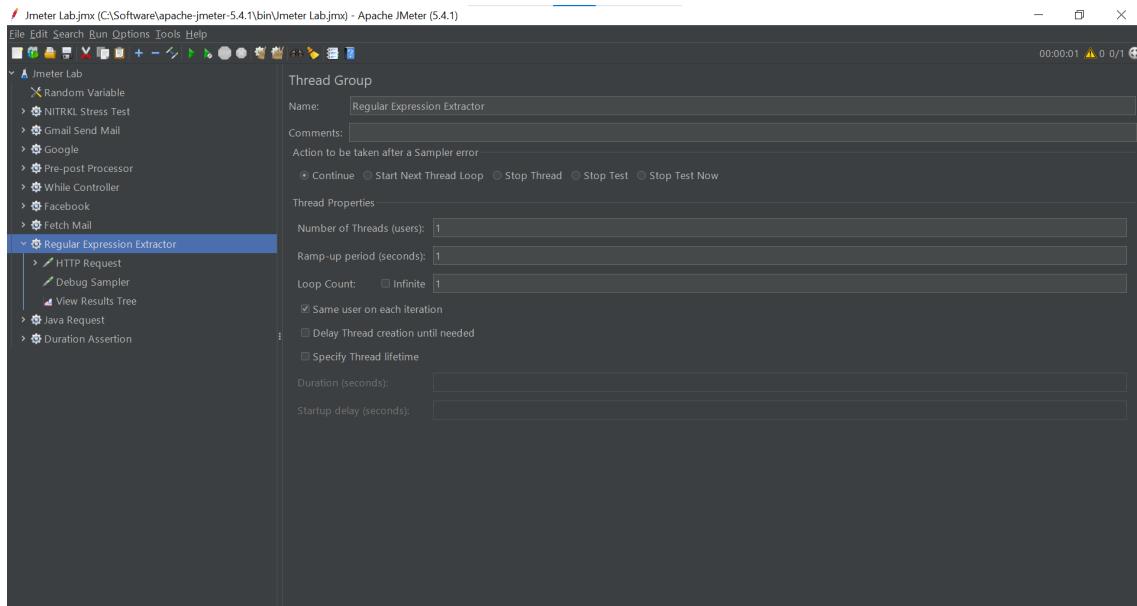


Figure 123:

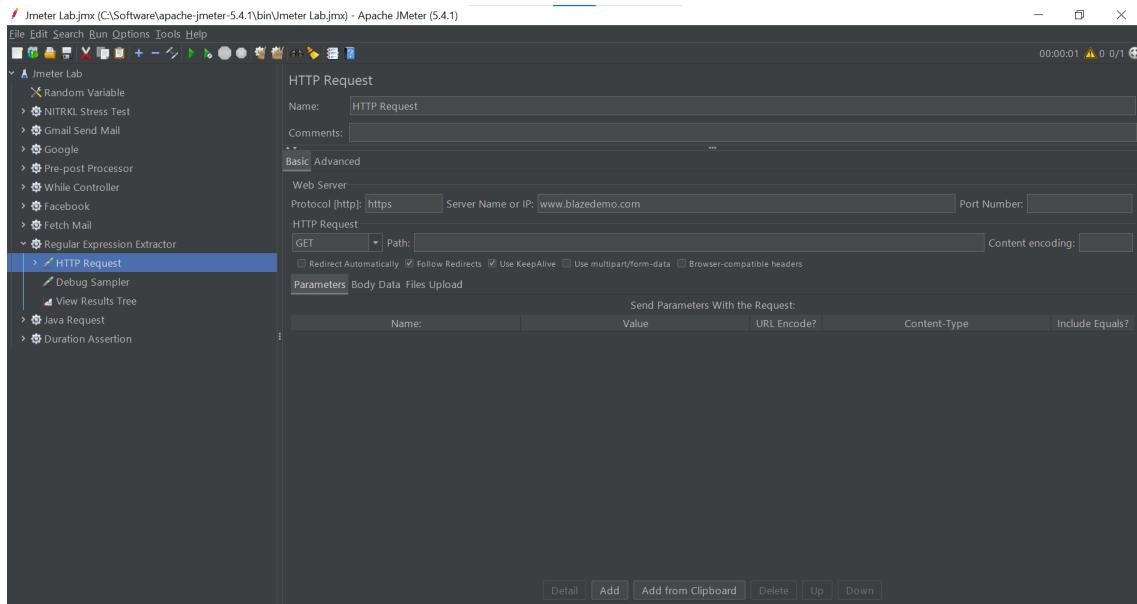


Figure 124:

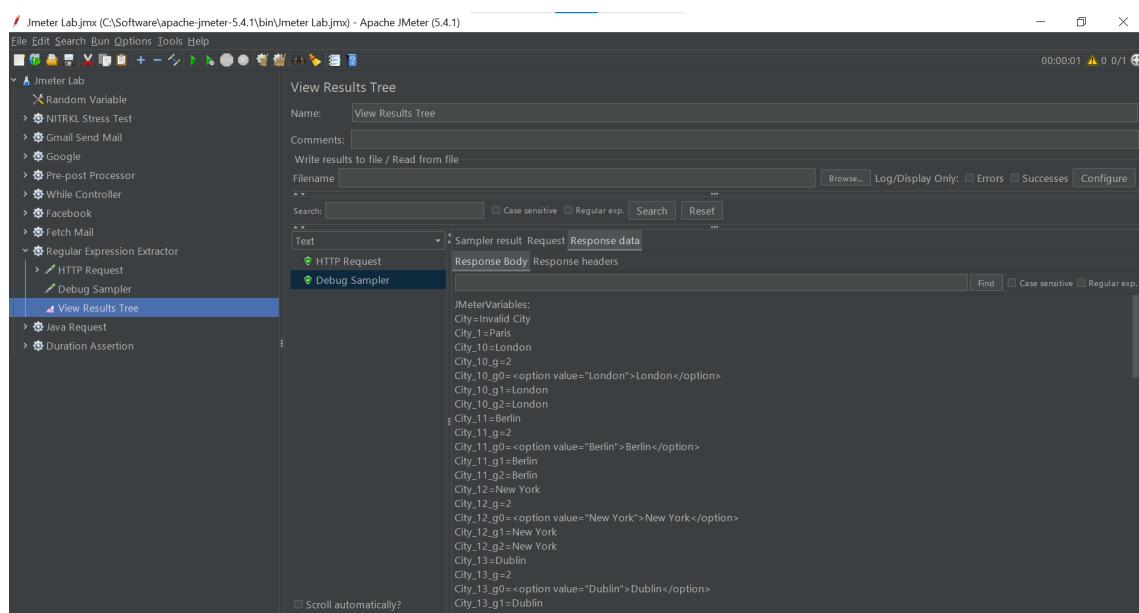


Figure 125:

8.9 Java Request

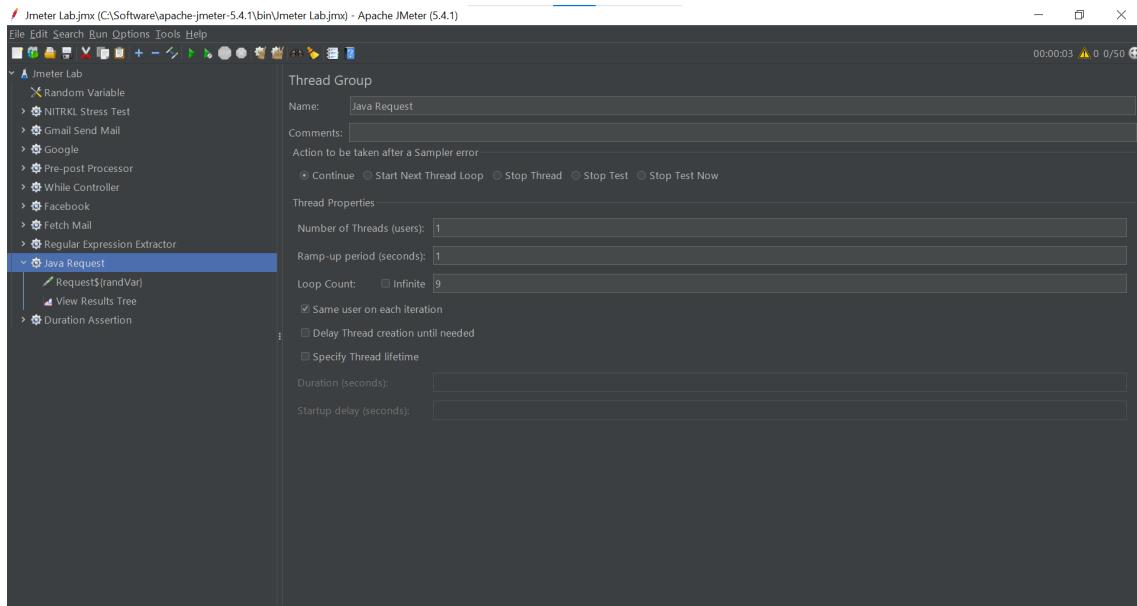


Figure 126:

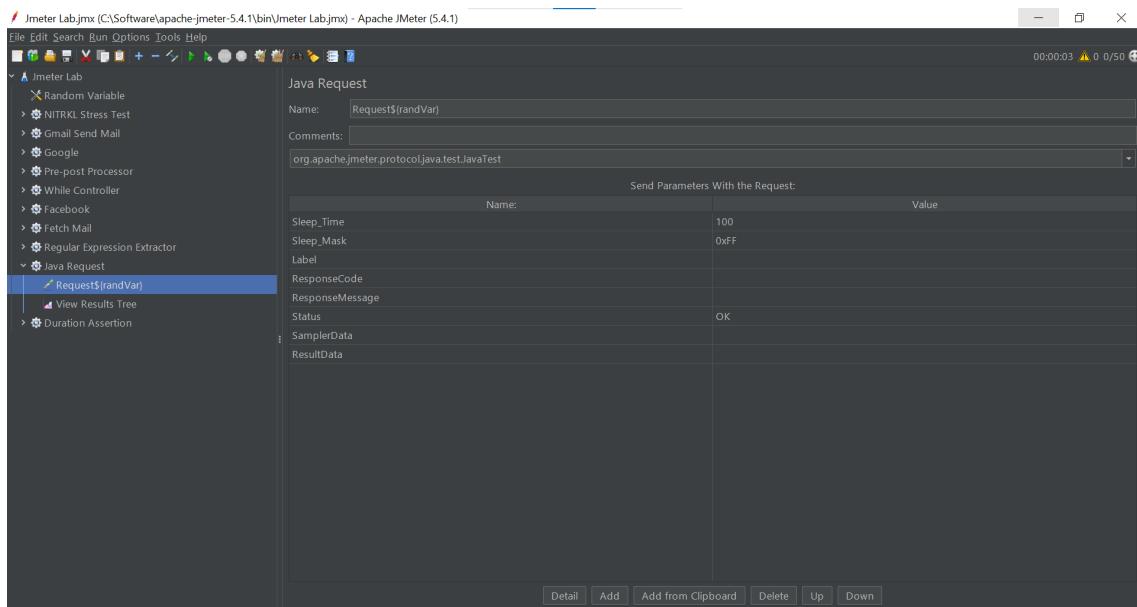


Figure 127:

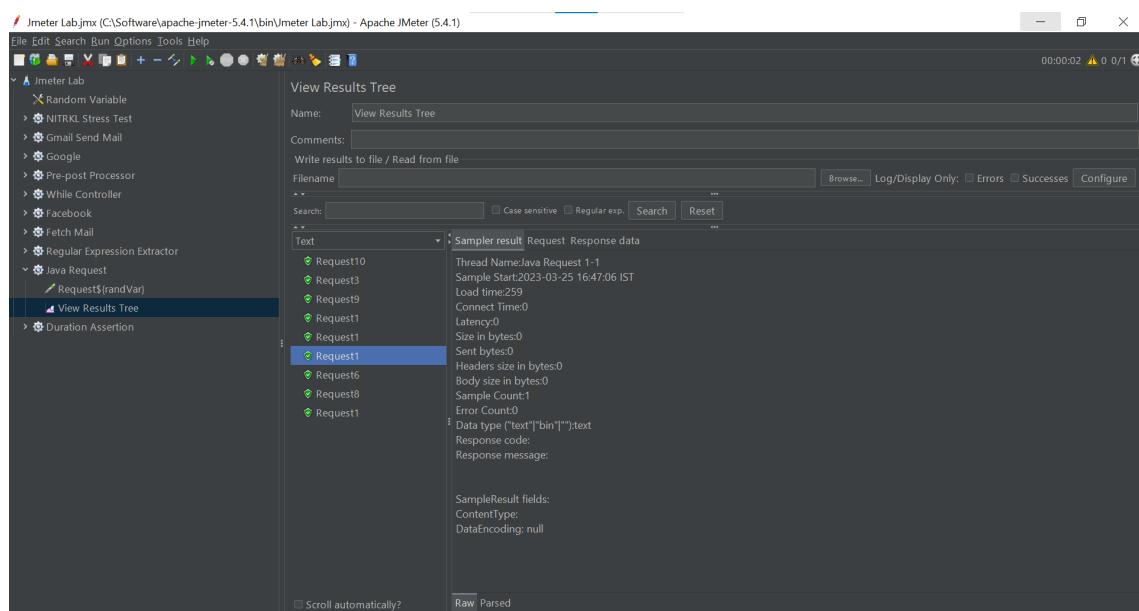


Figure 128:

8.10 Duration Assertion

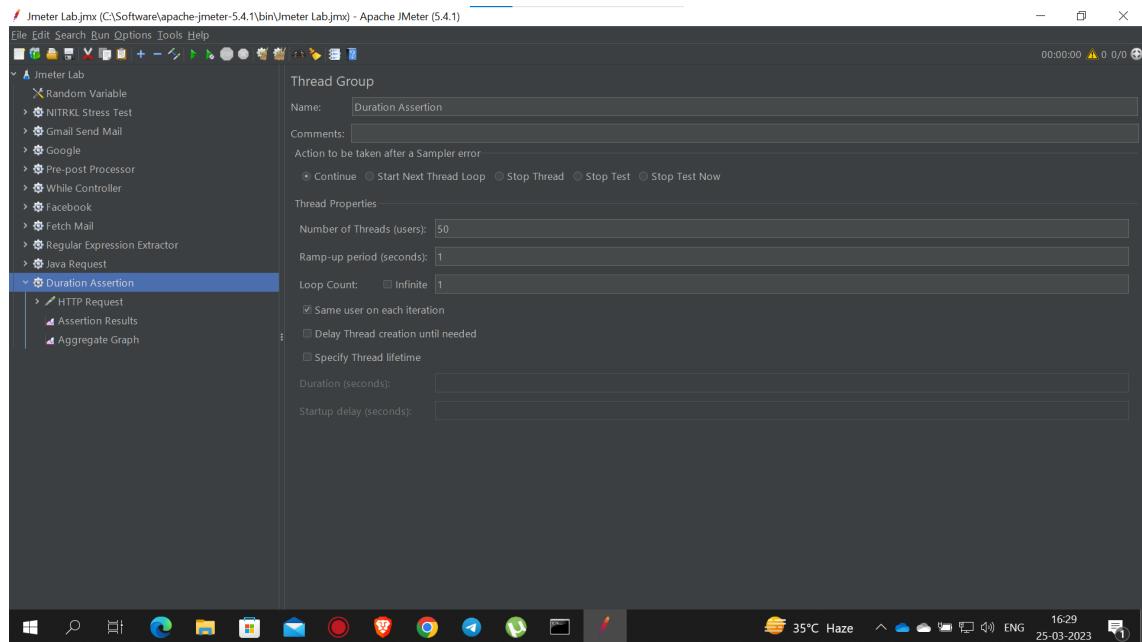


Figure 129: Thread Group

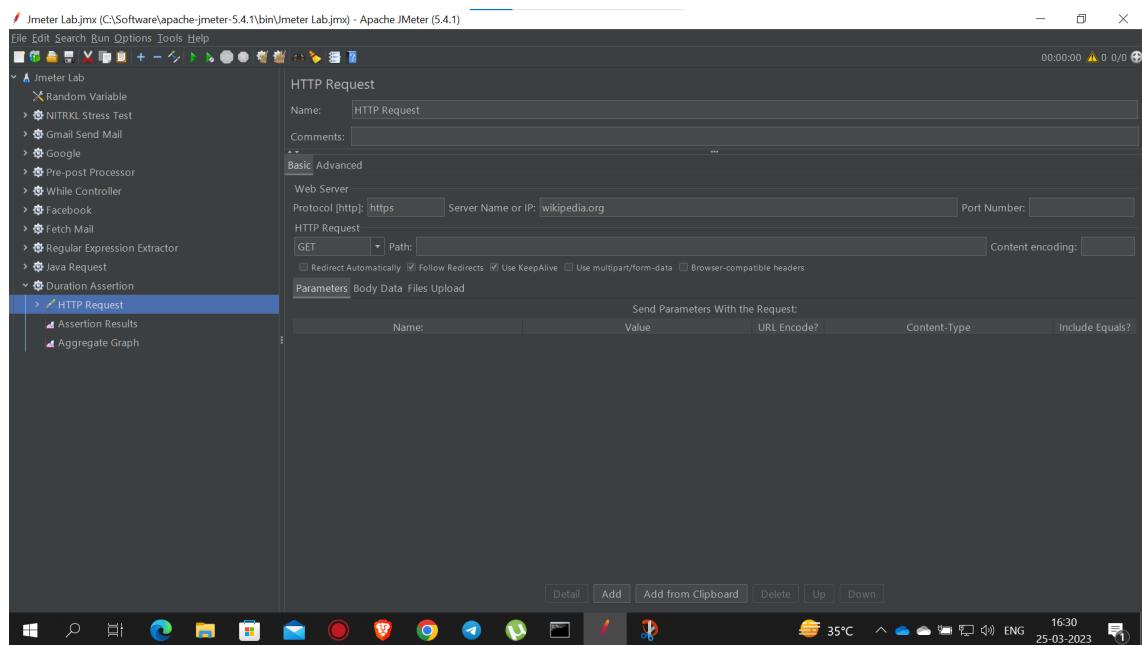


Figure 130: HTTP Request

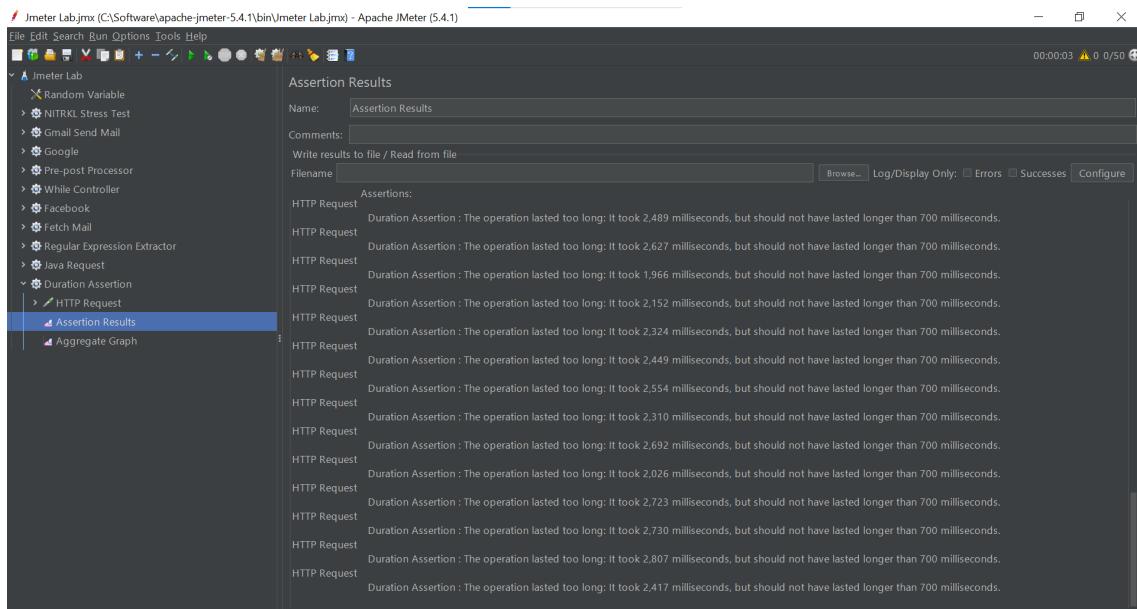


Figure 131: Assertion Results

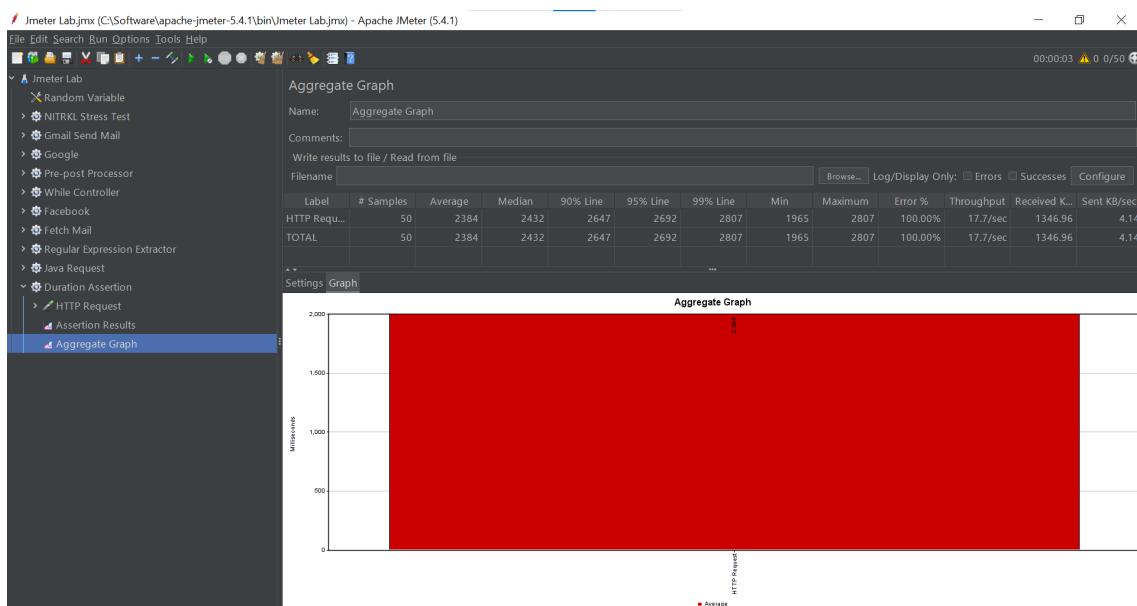


Figure 132: Graph

CS6474: Software Testing Laboratory 2023

FINDBUGS

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BISHWAJIT PRASAD GOND
222CS3113



9 FindBugs

Findbugs scans for possible bugs in Java software. Each finding is reported as a warning, but not all of these warnings are necessarily defects, e.g. warnings referring to possible performance issues. The terms bug or bug pattern are used in a misleading way by Findbugs. A better way would be to talk just about warnings. In the following article, the term warning will be used. All warnings are classified in four ranks:

- (i) scariest,
- (ii) scary,
- (iii) troubling and
- (iv) of concern.

This is a hint to the developer about the possible impact/severity of the warnings. The current version reports 400 warnings in the nine categories:

| Warnings List | | |
|------------------------------|---------|---|
| Category | Numbers | Samples |
| Correctness | 142 | Illegal format string |
| Bad practice | 84 | Confusing method names |
| Dodgy code | 71 | Useless control flow |
| Multithreaded Correctness | 45 | A thread was created using the default empty run method |
| Performance | 27 | Method concatenates strings using + in a loop |
| Malicious Code Vulnerability | 15 | Finalizer should be protected, not public |
| Security | 11 | Hardcoded constant database password |
| Experimental | 3 | Method may fail to clean up stream or resource |
| Internationalization | 2 | Consider using Locale parameterized version of invoked method |

Installation of Eclipse Plug-In

The Eclipse plug-in work with Eclipse 3.x releases from 3.3. The plug-in runs under Java 1.5 or newer.

For Eclipse 4.2 (Juno) the next steps install the plug-in:

1. In Eclipse, click on Help — Install New Software and press Add button.
 - Insert Name: Findbugs
 - Insert URL: <http://Findbugs.cs.umd.edu/eclipse>
 - press OK button
2. You should see Findbugs in the list. Select the entry and press Next button.
3. You should see the Install Details without errors and press Next button.
4. Select the "I accept the terms of the license agreement" option and click Finish button.
5. The plug-in is not digitally signed. Go ahead and install it anyway. (press OK button)
6. Click Yes to make Eclipse restart itself.

Test the below programs in FindBugs Tool

9.1 Write a program to generate a Factorial of numbers (where stack length should be at 3 (max)). The numbers should be 5, 3, 8, and 15.

```

eclipse-workspace - findBug/src/findBug/Factorial.java - Eclipse IDE
File Edit Source Refactor Navigate Project Run Window Help
Package Explorer src findBug Factorial.java BinarytoHex.java OddorEven.java Palindrome.java Prime.java Quicksort.java Sumofarray.java Transpose.java
findBug src findBug Factorial.java
1 package findBug;
2
3 public class Factorial {
4
5     public static String fact(int n) {
6         if(n==0)
7             {
8                 return "+1";
9             }
10            else if(n<0)
11            {
12                return "For Negative number no factorial";
13            }
14            else
15            {
16
17                long fact[]=new long [n+1];
18                fact[0]=1;
19                for(int i=1;i<=n;i++)
20                {
21                    fact[i]=fact[i-1]*i;
22                }
23            }
24        return "+"+fact[n];
25    }
26
27
28 }

```

Figure 133: Findbug Screenshot

9.2 Write a program to generate Fibonacci numbers.

```

eclipse-workspace - findBug/src/findBug/Fibonacci.java - Eclipse IDE
File Edit Source Refactor Navigate Project Run Window Help
BinarytoHex... Factorial.java Fibonacci.java MatrixAddit... OddorEven.java Palindrome.java Prime.java
findBug src findBug Fibonacci.java
5 public static String fibo(int n)
6 {
7     int n1=0,n2=1,n3;
8     if(n==1)
9     {
10         return "0";
11     }
12     else if(n==2) {
13         return "0 1";
14     }
15     else {
16         String s="0 1";
17
18         for(int i=3;i<=n;i++)
19         {
20             n3=n1+n2;
21             s+= " "+n3;
22             n1=n2;
23             n2=n3;
24         }
25     }
26
27     return s;
28 }
29

```

Figure 134: Findbug Screenshot

9.3 Write a program that performs sorting of a group of integer values using the quick sort technique.

```

eclipse-workspace - findBug/src/findBug/Quicksort.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer □ MatrixAddit... □ OddorEvenjava □ Palindrome.java □ Prime.java □ Quicksort.java □ Sumofarray.java □ Transpose.java
findBug (7) □ JRE System Library [JavaSE-1.8]
src (7)
  findBug (7)
    BinarytoHexjava (1)
    Factorial.java
    Fibonacci.java (1)
    MatrixAddition.java (2)
    OddorEven.java
    Palindrome.java
    Prime.java (2)
    Quicksort.java
    Sumofarray.java
    Transpose.java (1)
Jabuti
jumble (1)
Random
seleniumrc
seleniumwebdriver
SpotBugs (2)

1 package findBug;
2 public class Quicksort {
3
4     static void swap(int arr[], int x, int y) {
5         int temp = arr[x];
6         arr[x] = arr[y];
7         arr[y] = temp;
8     }
9
10    public static int partition(int arr[], int start, int end) {
11        int pivot = arr[end];
12        int Index = start;
13        for (int i = start; i < end; i++) {
14            if (arr[i] < pivot) {
15                swap(arr, i, Index);
16                Index++;
17            }
18        }
19        swap(arr, Index, end);
20        return Index;
21    }
22
23    public static int[] sort(int arr[], int start, int end) {
24        if (start < end) {
25            int Index = partition(arr, start, end);
26            sort(arr, start, Index - 1);
27            sort(arr, Index + 1, end);
28        }
29        return arr;
30    }
31}

```

Figure 135: Findbug Screenshot

9.4 Write a program that accepts elements of a matrix and displays its transpose.

```

eclipse-workspace - findBug/src/findBug/Transpose.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer □ MatrixAddit... □ OddorEvenjava □ Palindrome.java □ Prime.java □ Quicksort.java □ Sumofarray.java □ Transpose.java
findBug (7) □ JRE System Library [JavaSE-1.8]
src (7)
  findBug (7)
    BinarytoHexjava (1)
    Factorial.java
    Fibonacci.java (1)
    MatrixAddition.java (2)
    OddorEven.java
    Palindrome.java
    Prime.java (2)
    Quicksort.java
    Sumofarray.java
    Transpose.java (1)
Jabuti
jumble (1)
Random
seleniumrc
seleniumwebdriver
SpotBugs (2)

1 package findBug;
2
3     public class Transpose {
4
5         public static String matrix(int arr[][]) {
6             int m = arr.length, n=arr[0].length;
7             int arr_transpose[][] = new int[m][n];
8             for(int ie0; ie0 < n; ie0++) {
9                 for(int je0; je0 < m; je0++) {
10                     arr_transpose[je0][ie0] = arr[ie0][je0];
11                 }
12             }
13             String s="";
14             for (int i = 0; i < m; i++) {
15                 for (int j = 0; j < n; j++) {
16                     s=s+arr_transpose[i][j]+" ";
17                 }
18                 s=s+"\n";
19             }
20             return s;
21         }
22     }
23 }

Transpose.java: 16
Navigation
findBug.Transpose.matrix(int[][]) concatenates strings using + in a loop

Bug: findBug.Transpose.matrix(int[][]) concatenates strings using + in a loop
The method seems to be building a String using concatenation in a loop. In each iteration, the String is converted to a StringBuffer/StringBuilder, appended to, and converted back to a String. This can lead to a cost quadratic in the number of iterations, as the growing string is recycled in each iteration.
Better performance can be obtained by using a StringBuffer (or StringBuilder in Java 1.5) explicitly.

```

Figure 136: Findbug Screenshot

9.5 Write a program to add two matrices and display the sum matrix.

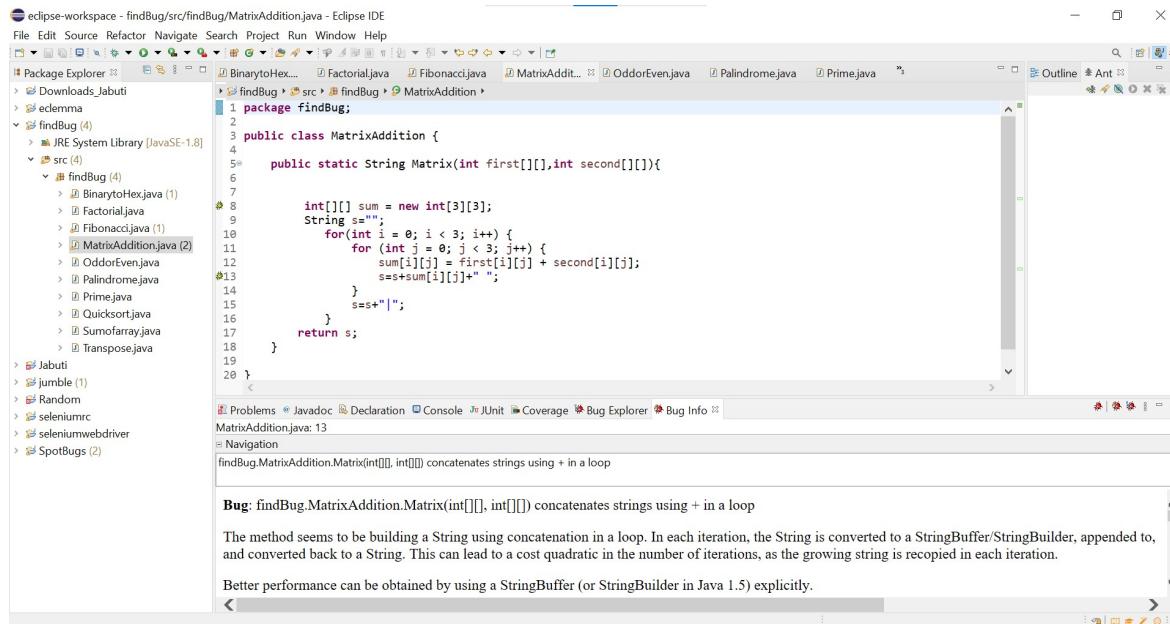


Figure 137: Findbug Screenshot

9.6 Write a program to Print Prime Numbers from 1 to 100 using Scanner Class and For Loop.

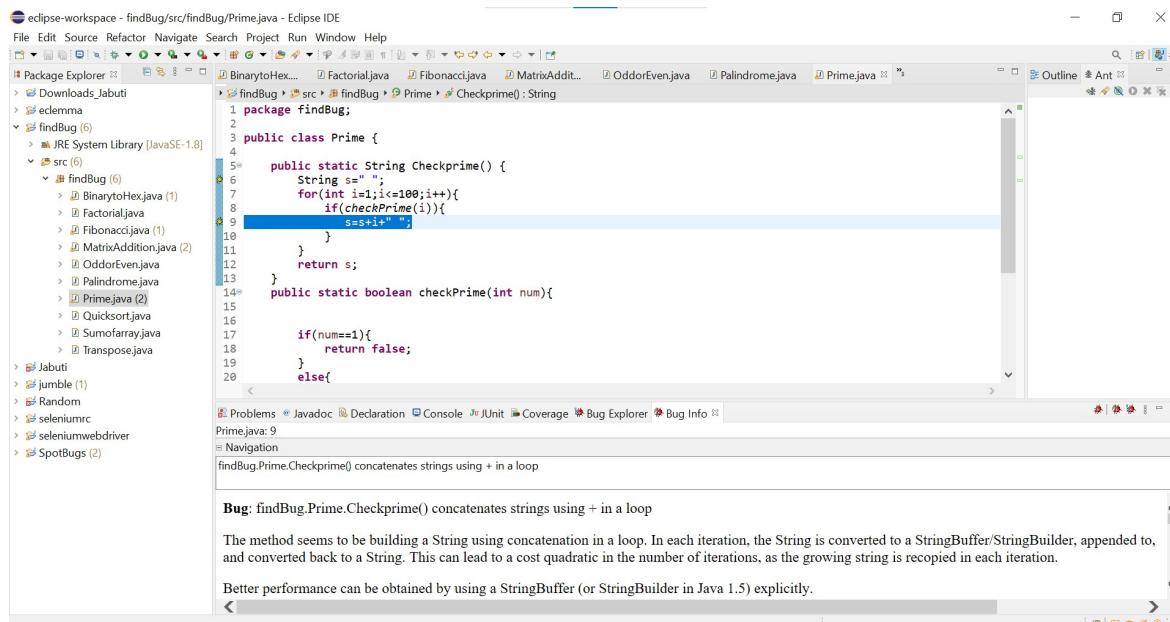


Figure 138: Findbug Screenshot

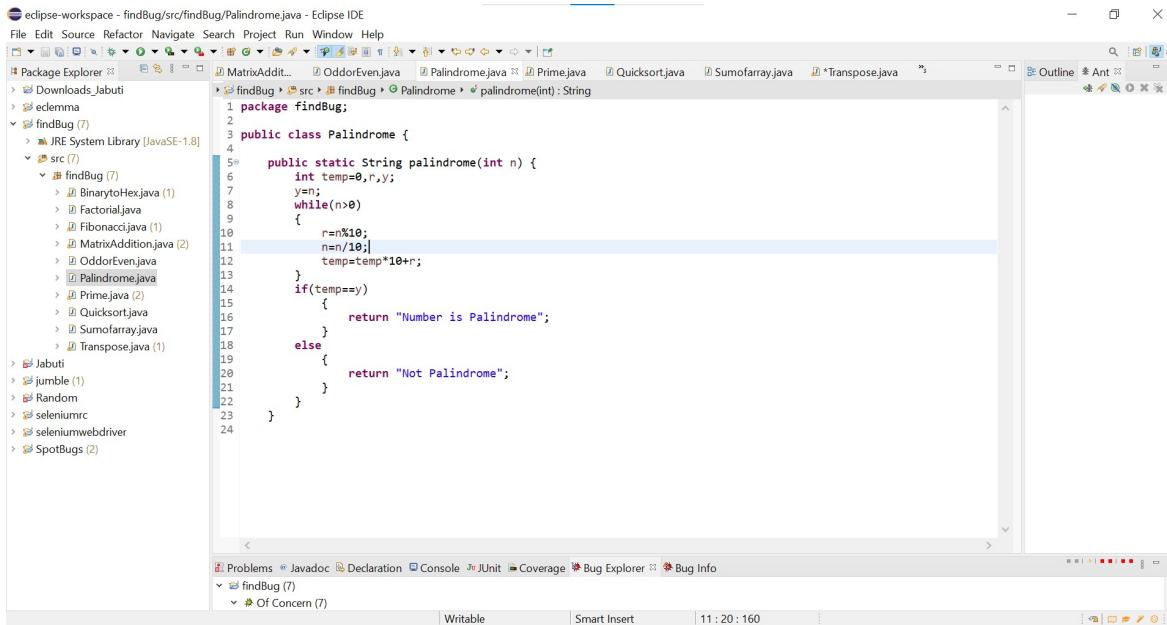


Figure 139: Findbug Screenshot

9.7 Write a program to generate a palindrome of numbers.

9.8 Write a program to find out the sum of two arrays.

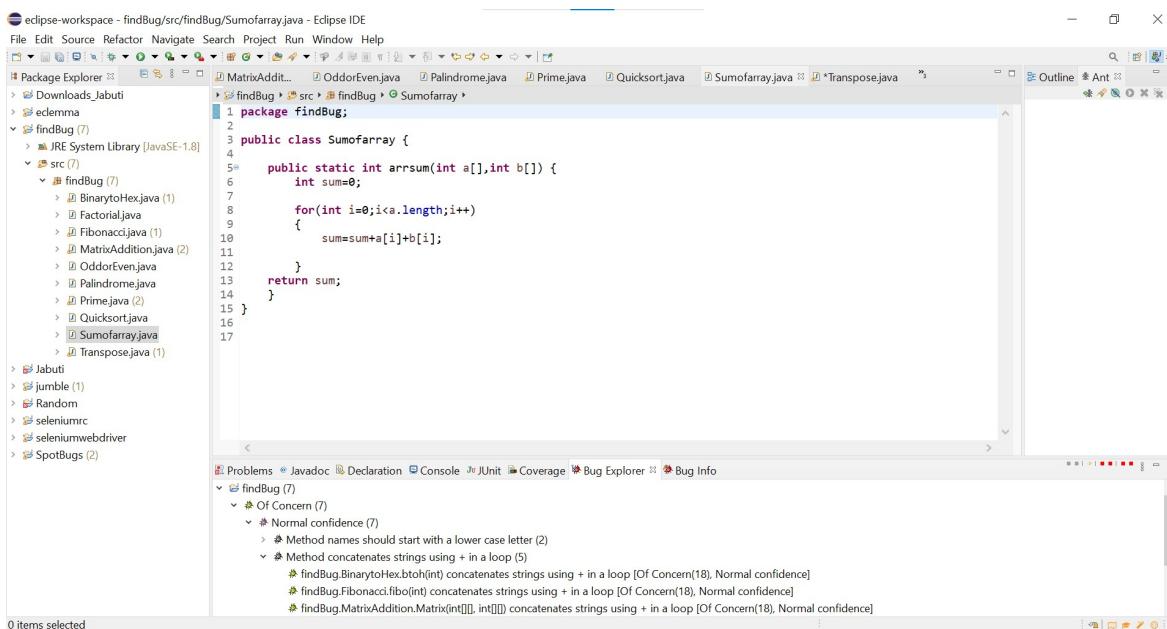
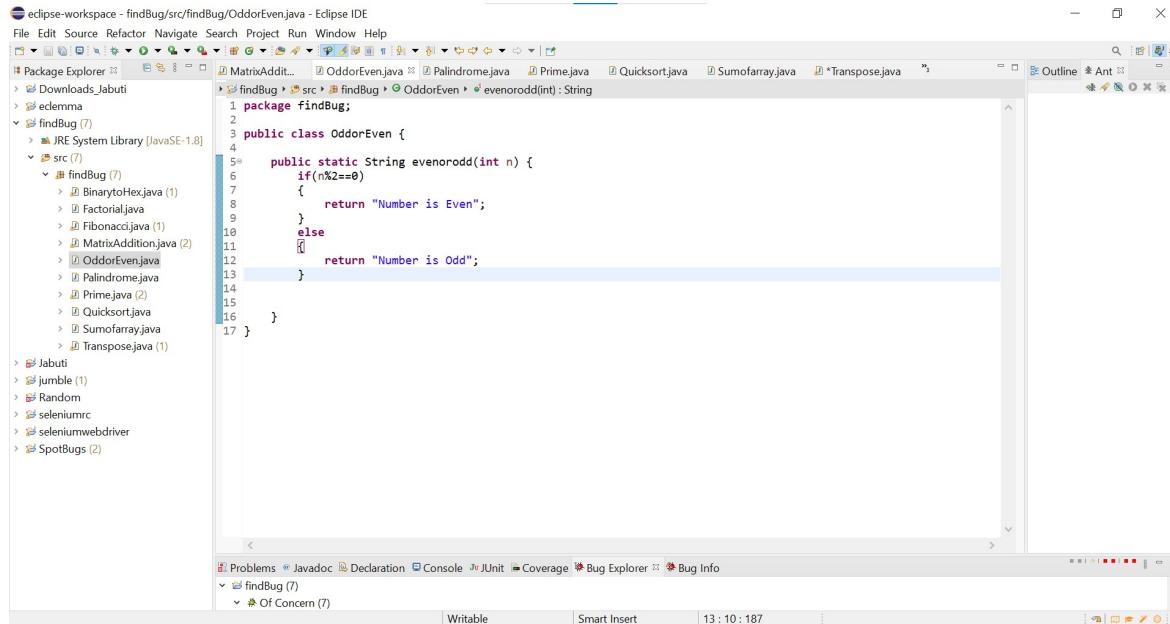


Figure 140: Findbug Screenshot

9.9 Write a program to check whether the number is even or odd.



The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure with a file named `OddorEven.java` selected.
- Code Editor:** Displays the following Java code:

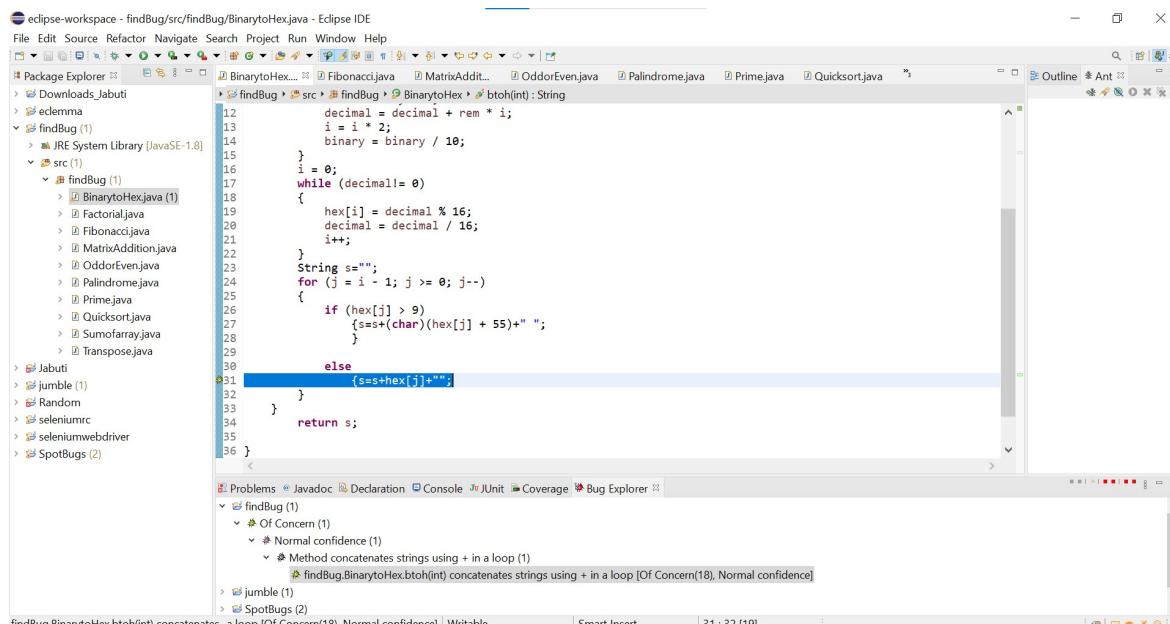
```

1 package findBug;
2
3 public class OddorEven {
4
5     public static String evenorodd(int n) {
6         if(n%2==0)
7             {
8                 return "Number is Even";
9             }
10            else
11            {
12                return "Number is Odd";
13            }
14        }
15    }
16}

```
- Outline View:** Shows the class structure.
- Problems View:** Shows one warning: `findBug(OddorEven.java): Method concatenates strings using + in a loop [Of Concern(1), Normal confidence]`.
- Bottom Status Bar:** Shows the time as 13:10:187.

Figure 141: Findbug Screenshot

9.10 Write a program for binary to hexadecimal conversion.



The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure with a file named `BinarytoHex.java` selected.
- Code Editor:** Displays the following Java code:

```

12     decimal = decimal + rem * i;
13     i = i * 2;
14     binary = binary / 16;
15   }
16   i = 0;
17   while (decimal!= 0)
18   {
19     hex[i] = decimal % 16;
20     decimal = decimal / 16;
21     i++;
22   }
23   String s="";
24   for (j = i - 1; j >= 0; j--)
25   {
26     if (hex[j] > 9)
27       {s=s+(char)(hex[j] + 55)+" ";}
28     else
29       {s=s+hex[j]+"";}
30   }
31   }
32   }
33   }
34   return s;
35 }
36 }

```
- Outline View:** Shows the class structure.
- Problems View:** Shows one warning: `findBug(BinarytoHex.btoh(int)) concatenates strings using + in a loop [Of Concern(1), Normal confidence]`.
- Bottom Status Bar:** Shows the time as 31:32 [19].

Figure 142: Findbug Screenshot

CS6474: Software Testing Laboratory 2023

PYTEST-COV

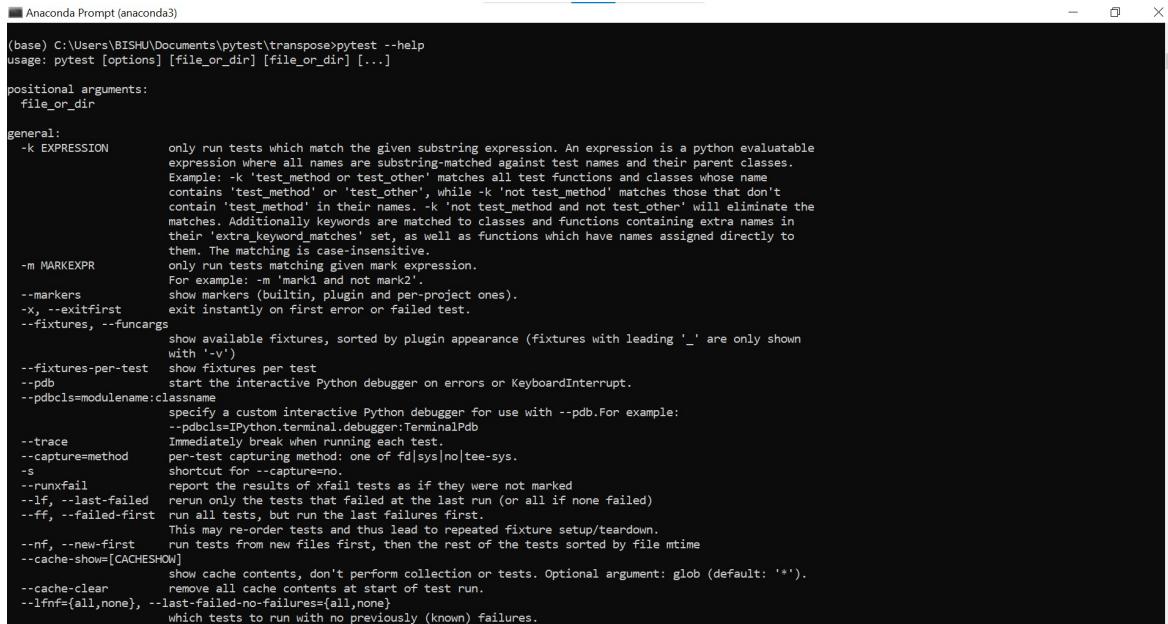
Prepared by
BISHWAJIT PRASAD GOND
222CS3113



10 Pytest-Cov

Pytest is a Python testing framework that originated from the PyPy project. It can be used to write various types of software tests, including unit tests, integration tests, end-to-end tests, and functional tests. Its features include parametrized testing, fixtures, and assert re-writing.

Pytest fixtures provide the contexts for tests by passing in parameter names in test cases; its parametrization eliminates duplicate code for testing multiple sets of input and output; and its rewritten assert statements provide detailed output for causes of failures.

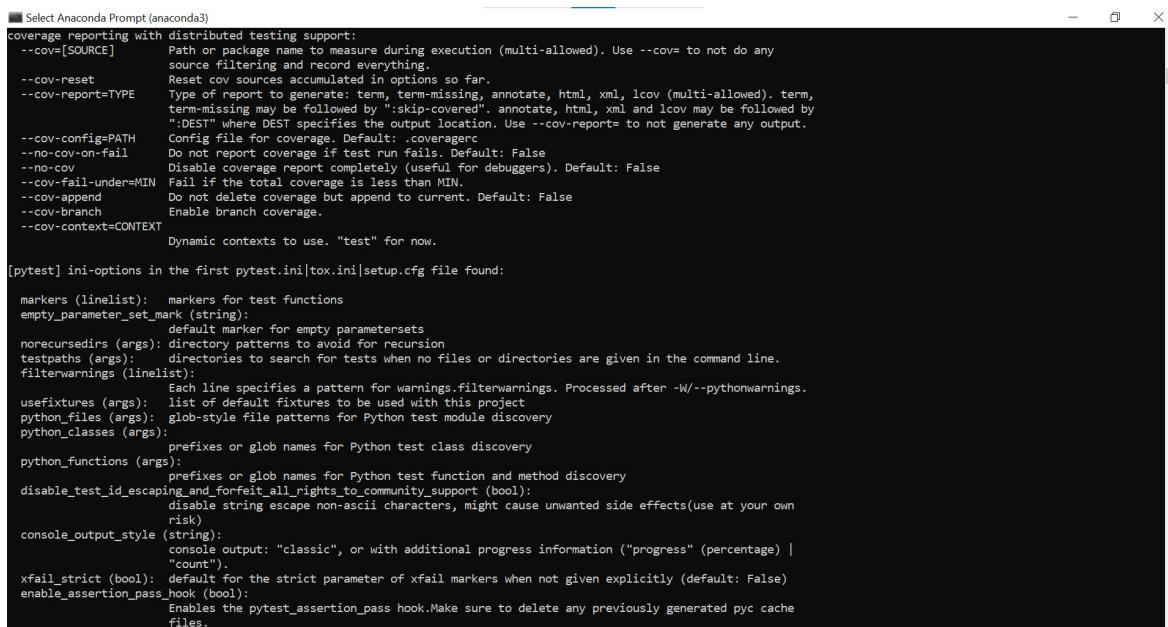


```
(base) C:\Users\BISHU\Documents\pytest\transpose>pytest --help
usage: pytest [options] [file_or_dir] [file_or_dir] [...]

positional arguments:
  file_or_dir

general:
  -k EXPRESSION      only run tests which match the given substring expression. An expression is a python evaluable expression where all names are substring-matched against test names and their parent classes.
  Example: -k 'test_method or test_other' matches all test functions and classes whose name contains 'test_method' or 'test_other', while -k 'not test_method' matches those that don't contain 'test_method' in their names. -k 'not test_method and not test_other' will eliminate the matches. Additionally keywords are matched to classes and functions containing extra names in their 'extra_keyword_matches' set, as well as functions which have names assigned directly to them. The matching is case-insensitive.
  -m MARKEXPR        only run tests matching given mark expression.
  For example: -m 'mark1 and not mark2'.
  --markers          show markers (builtin, plugin and per-project ones).
  -x, --exitfirst    exit instantly on first error or failed test.
  --fixtures, --funcargs
                     show available fixtures, sorted by plugin appearance (fixtures with leading '_' are only shown with '-v')
  --fixtures-per-test
                     show fixtures per test
  --pdb              start the interactive Python debugger on errors or KeyboardInterrupt.
  --pdbcls=modulename:classname
                     specify a custom interactive Python debugger for use with --pdb. For example:
  --pdbcls=IPython.terminal.debugger.TerminalPdb
  --trace            Immediately break when running each test.
  --capture=method   per-test capturing method: one of fd|sys|no|tee|sys.
  -s                shortcut for --capture=no.
  --runxfail         report the results of xfail tests as if they were not marked
  -iF, --last-failed
  rerun only the tests that failed at the last run (or all if none failed)
  --ff, --failed-first
  run all tests, but run the last failures first.
  This may re-order tests and thus lead to repeated fixture setup/teardown.
  --nf, --new-first
  run tests from new files first, then the rest of the tests sorted by file mtime
  --cache-show=[CACHESHOW]
  show cache contents, don't perform collection or tests. Optional argument: glob (default: '*').
  --cache-clear      remove all cache contents at start of test run.
  --lfmf={all,none}, --last-failed-no-failures={all,none}
  which tests to run with no previously (known) failures.
```

Figure 143: Pytest Options



```
[Select Anaconda Prompt (anaconda3)]
coverage reporting with distributed testing support:
--cov=[SOURCE]      Path or package name to measure during execution (multi-allowed). Use --cov= to not do any source filtering and record everything.
--cov-reset          Reset cov sources accumulated in options so far.
--cov-report=TYPE   Type of report to generate: term, term-missing, annotate, html, xml, lcov (multi-allowed). term, term-missing may be followed by :skip-covered:. annotate, html, xml and lcov may be followed by :DEST" where DEST specifies the output location. Use --cov-report= to not generate any output.
--cov-config=PATH   Config file for coverage. .coveragerc
--no-cov-on-fail   Do not report coverage if test run fails. Default: False
--no-cov            Disable coverage report completely (useful for debuggers). Default: False
--cov-fail-under=MIN
  Fail if the total coverage is less than MIN.
--cov-append        Do not delete coverage but append to current. Default: False
--cov-branch        Enable branch coverage.
--cov-context=CONTEXT
  Dynamic contexts to use. "test" for now.

[pytest] ini-options in the first pytest.ini|tox.ini|setup.cfg file found:

markers (linelist):
  markers for test functions
empty_parameter_set_mark (string):
  default marker for empty parametersets
norecursedirs (args):
  directory patterns to avoid for recursion
testpaths (args):
  directories to search for tests when no files or directories are given in the command line.
filterwarnings (linelist):
  Each line specifies a pattern for warnings.filterwarnings. Processed after -W|--pythonwarnings.
usefixtures (args):
  list of default fixtures to be used with this project
python_files (args):
  glob-style file patterns for Python test module discovery
python_classes (args):
  prefixes or glob names for Python test class discovery
python_functions (args):
  prefixes or glob names for Python test function and method discovery
disable_test_id_escaping_and_forfeit_all_rights_to_community_support (bool):
  disable string escape non-ascii characters, might cause unwanted side effects(use at your own risk)
console_output_style (string):
  console output: "classic", or with additional progress information ("progress" (percentage) | "count")
xfail_strict (bool):
  default for the strict parameter of xfail markers when not given explicitly (default: False)
enable_assertion_pass_hook (bool):
  Enables the pytest_assertion_pass hook. Make sure to delete any previously generated pyc cache files.
```

Figure 144: Pytest Options

Test the below programs in PyTest Tool

10.1 Write a program to generate a Factorial of numbers (where stack length should be at 3 (max)). The numbers should be 5, 3, 8, and 15.

The screenshot shows the Spyder Python 3.9 IDE interface. On the left, there are tabs for EvenOdd.py, test_EvenOdd.py, Factorial.py (which is the active tab), and test_Factorial.py. The Factorial.py code is displayed:

```

1  class Factorial:
2      def __init__(self):
3          self.stack = []
4
5      def push(self, item):
6          if len(self.stack) >= 3:
7              raise ValueError("Stack is full")
8          self.stack.append(item)
9
10     def pop(self):
11         if len(self.stack) == 0:
12             raise ValueError("Stack is empty")
13         return self.stack.pop()
14
15     def factorial(self):
16         result = 1
17         while len(self.stack) > 0:
18             num = self.pop()
19             for i in range(1, num+1):
20                 result *= i
21
22     return result

```

On the right, the IPython console shows the following output:

```

Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v. 1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more
information.

IPython 7.31.1 -- An enhanced Interactive Python.

In [1]:

```

Figure 145: PyCOV Screenshot

The screenshot shows the Administrator: Anaconda Prompt (anaconda3) window. The command `pytest` is run, followed by `pytest --cov=C:\Users\BISHU\Documents\pytest\fact`. The output shows the test session starts, collected 3 items, and 3 passed in 0.07s. The coverage report shows 100% coverage for Factorial.py and test_Factorial.py, with a total of 39 statements, 0 misses, and 100% coverage.

```

(base) C:\Users\BISHU\Documents\pytest\fact>pytest
=====
 test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\fact
plugins: anyio-3.5.0, cov-4.0.0
collected 3 items

test_Factorial.py ...

=====
 3 passed in 0.07s =====

(base) C:\Users\BISHU\Documents\pytest\fact>pytest --cov=C:\Users\BISHU\Documents\pytest\fact
=====
 test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\fact
plugins: anyio-3.5.0, cov-4.0.0
collected 3 items

test_Factorial.py ...

-----
 coverage: platform win32, python 3.9.13-final-0 -----
Name      Stmts   Miss  Cover
-----
Factorial.py      18      0  100%
test_Factorial.py    21      0  100%
-----
TOTAL            39      0  100%

=====
 3 passed in 0.15s =====

(base) C:\Users\BISHU\Documents\pytest\fact>

```

Figure 146: Factorial Code

10.2 Write a program to generate Fibonacci numbers.

The screenshot shows the Spyder Python IDE interface. On the left, there is a code editor with a file named `fibonacci.py` containing the following code:

```

1 # -*- coding: utf-8 -*-
2 """
3 Created on Sun Apr 9 23:53:52 2023
4
5 @author: BISHU
6 """
7
8 class Fibonacci:
9     def __init__(self):
10         self.memo = {0: 0, 1: 1}
11
12     def fibonacci(self, n):
13         if n < 0:
14             raise ValueError("n must be non-negative")
15         if n in self.memo:
16             return self.memo[n]
17         else:
18             result = self.fibonacci(n - 1) + self.fibonacci(n - 2)
19             self.memo[n] = result
20         return result
21
22
23

```

On the right, the IPython console window displays the Python environment and the output of the code execution. The console shows:

```

Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v. 1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.31.1 -- An enhanced Interactive Python.

In [1]:

```

Figure 147: PyCOV Screenshot

The screenshot shows the Anaconda Prompt window with the following command history:

```

(base) C:\Users\BISHU\Documents\pytest\fibo>pytest
=====
test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\fibo
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_fibonacci.py .

===== 1 passed in 0.13s =====

(base) C:\Users\BISHU\Documents\pytest\fibo>pytest --cov=C:\Users\BISHU\Documents\pytest\fibo
=====
test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\fibo
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_fibonacci.py .

----- coverage: platform win32, python 3.9.13-final-0 -----
Name           Stmts   Miss  Cover
-----
fibonacci.py      12      0   100%
test_fibonacci.py    20      0   100%
-----
TOTAL            32      0   100%

===== 1 passed in 0.12s =====

(base) C:\Users\BISHU\Documents\pytest\fibo>

```

Figure 148: Fibonacci Code

10.3 Write a program that performs sorting of a group of integer values using the quick sort technique.

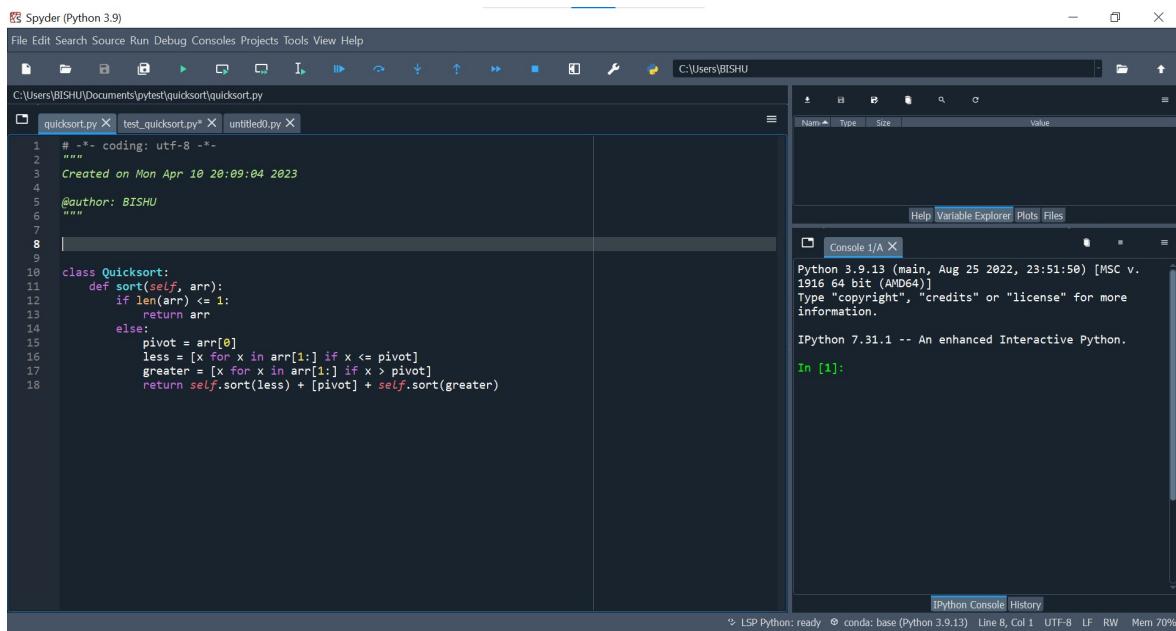


Figure 149: PyCOV Screenshot

```

(base) C:\Users\BISHU\Documents\pytest\quicksort>pytest
===== test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\quicksort
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_quicksort.py .

===== 1 passed in 0.07s =====

(base) C:\Users\BISHU\Documents\pytest\quicksort>pytest --cov=C:\Users\BISHU\Documents\pytest\quicksort\
===== test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\quicksort
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_quicksort.py .

----- coverage: platform win32, python 3.9.13-final-0 -----
Name      Stmts  Miss  Cover
-----
quicksort.py      9      0   100%
test_quicksort.py  11      0   100%
-----
TOTAL            20      0   100%

===== 1 passed in 0.12s =====

(base) C:\Users\BISHU\Documents\pytest\quicksort>

```

Figure 150: Quicksort Code

10.4 Write a program that accepts elements of a matrix and displays its transpose.

The screenshot shows the Spyder Python IDE interface. On the left, there are two tabs: 'test_transpose.py' and 'transpose.py'. The 'transpose.py' tab contains the following code:

```

1  # -*- coding: utf-8 -*-
2  """
3      Created on Mon Apr 10 20:09:04 2023
4
5      @author: BISHU
6
7
8  class Matrix:
9      def __init__(self, matrix):
10         self.matrix = matrix
11         self.rows = len(matrix)
12         self.cols = len(matrix[0])
13
14     def transpose(self):
15         transposed = [[self.matrix[j][i] for j in range(self.rows)] for i in range(self.cols)]
16         return Matrix(transposed)
17

```

To the right of the code editor is the IPython console window, which displays the Python environment information and the command 'In [1]:'.

Figure 151: PyCOV Screenshot

The screenshot shows the Anaconda Prompt window. It runs two pytest sessions. The first session shows the test results for 'test_transpose.py'. The second session shows the coverage report for the same file, indicating 100% coverage across 24 statements.

```

(base) C:\Users\BISHU\Documents\pytest\transpose>pytest
=====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\transpose
plugins: anyio-3.5.0, cov-4.0.0
collected 2 items

test_transpose.py .. [100%]

=====
2 passed in 0.09s =====

(base) C:\Users\BISHU\Documents\pytest\transpose>pytest --cov=C:\Users\BISHU\Documents\pytest\transpose\
=====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\transpose
plugins: anyio-3.5.0, cov-4.0.0
collected 2 items

test_transpose.py .. [100%]

----- coverage: platform win32, python 3.9.13-final-0 -----
Name           Stmts   Miss  Cover
-----
test_transpose.py      15      0  100%
transpose.py          9      0  100%
-----
TOTAL              24      0  100%

=====
2 passed in 0.18s =====

(base) C:\Users\BISHU\Documents\pytest\transpose>

```

Figure 152: Matrix Transpose Code

10.5 Write a program to add two matrices and display the sum matrix.

The screenshot shows the Spyder Python IDE interface. On the left, there is a file browser with several files listed: EvenOdd.py, test_EvenOdd.py, Factorial.py, test_Factorial.py, fibonaci.py, test_fibonaci.py, matrix.py, and test_matrix.py. The matrix.py file is open in the main editor area, displaying Python code for a Matrix class. The code includes methods for initialization, addition, and equality comparison. The right side of the interface features a Jupyter Notebook console window titled 'Console 1/A'. It displays Python version information (Python 3.9.13), license information, and a single cell labeled 'In [1]' which is currently empty. Below the console is a status bar showing 'LSP Python: ready' and other system details.

```

1 # -*- coding: utf-8 -*-
2 """
3 Created on Sun Apr  9 23:53:52 2023
4
5 @author: BISHU
6 """
7
8 class Matrix:
9     def __init__(self, rows, cols):
10         self.rows = rows
11         self.cols = cols
12         self.data = [[0 for j in range(cols)] for i in range(rows)]
13
14     def add(self, other):
15         if self.rows != other.rows or self.cols != other.cols:
16             raise ValueError("Matrices must have the same dimensions to be added")
17
18         result = Matrix(self.rows, self.cols)
19         for i in range(self.rows):
20             for j in range(self.cols):
21                 result.data[i][j] = self.data[i][j] + other.data[i][j]
22         return result
23
24     def __eq__(self, other):
25         if self.rows != other.rows or self.cols != other.cols:
26             return False
27
28         for i in range(self.rows):
29             for j in range(self.cols):
30                 if self.data[i][j] != other.data[i][j]:
31                     return False
32
33     return True

```

Figure 153: PyCOV Screenshot

The screenshot shows the Anaconda Prompt window. It displays two separate pytest sessions. The first session runs 'pytest' in the directory 'C:\Users\BISHU\Documents\pytest\matrix'. The output shows a test session starting, platform details (win32, Python 3.9.13), root directory, and plugins. It collects 1 item and runs 'test_matrix.py'. The test passes in 0.07s. The second session runs 'pytest --cov=C:\Users\BISHU\Documents\pytest\matrix' in the same directory. It also shows a test session starting, platform details, root directory, and plugins. It collects 1 item and runs 'test_matrix.py'. Coverage analysis is performed, showing results for 'matrix.py' and 'test_matrix.py'. The total coverage is 89%. Both sessions end with a message indicating 1 passed in 0.12s.

```

(base) C:\Users\BISHU\Documents\pytest\matrix>pytest
=====
 test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\matrix
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_matrix.py .

===== 1 passed in 0.07s =====

(base) C:\Users\BISHU\Documents\pytest\matrix>pytest --cov=C:\Users\BISHU\Documents\pytest\matrix
=====
 test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\matrix
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_matrix.py .

----- coverage: platform win32, python 3.9.13-final-0 -----
Name      Stmts   Miss  Cover
matrix.py      22      3    86%
test_matrix.py  23      2    91%
-----
TOTAL          45      5    89%

===== 1 passed in 0.12s =====

```

Figure 154: Matrix Addition Code

10.6 Write a program to Print Prime Numbers from 1 to 100 using Scanner Class and For Loop.

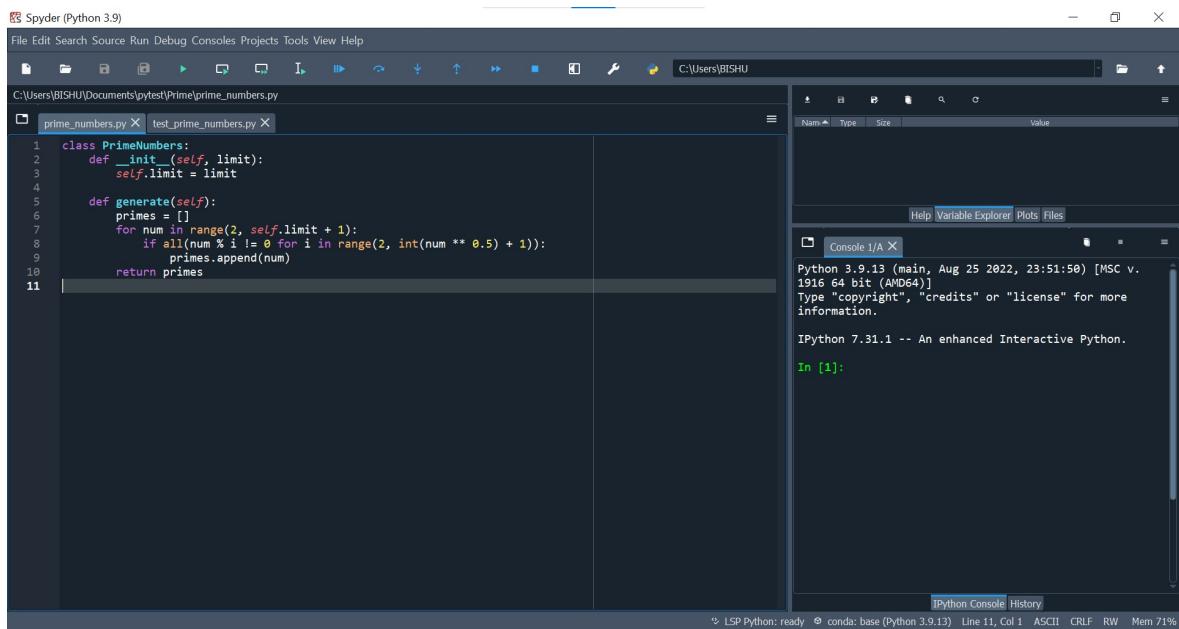


Figure 155: PyCOV Screenshot

The screenshot shows the Anaconda Prompt window with the title '(base) C:\Users\BISHU\Documents\pytest\Prime>'. It displays two separate pytest sessions and a coverage report.

Session 1:

```

(base) C:\Users\BISHU\Documents\pytest\Prime>pytest
===== test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\Prime
plugins: anyio-3.5.0, cov-4.0.0
collected 4 items

test_prime_numbers.py .... [100%]

===== 4 passed in 0.06s =====

```

Session 2:

```

(base) C:\Users\BISHU\Documents\pytest\Prime>pytest --cov=C:\Users\BISHU\Documents\pytest\Prime\
===== test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\Prime
plugins: anyio-3.5.0, cov-4.0.0
collected 4 items

test_prime_numbers.py .... [100%]

----- coverage: platform win32, python 3.9.13-final-0 -----
Name           Stmts   Miss  Cover
-----
prime_numbers.py      9      0  100%
test_prime_numbers.py  11      0  100%
-----
TOTAL              20      0  100%

===== 4 passed in 0.14s =====

```

Figure 156: Prime Code

10.7 Write a program to generate a palindrome of numbers.

The screenshot shows the Spyder Python IDE interface. On the left, there are two tabs: 'palindrome.py' and 'test_palindrome.py'. The 'palindrome.py' tab contains the following code:

```

1  # -*- coding: utf-8 -*-
2
3  """
4      Created on Sun Apr  9 23:53:52 2023
5
6      @author: BISHU
7
8  """
9
10 class PalindromeGenerator:
11     def __init__(self, length):
12         self.length = length
13
14     def generate_palindrome(self):
15         if self.length <= 0:
16             return []
17
18         nums = list(range(1, self.length+1))
19         palindrome = nums + nums[-2::-1] if self.length > 1 else nums
20
21         return palindrome

```

The 'test_palindrome.py' tab is currently active. On the right side of the interface, the IPython console shows the output of running the test file:

```

Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v. 1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.31.1 -- An enhanced Interactive Python.

In [1]:

```

Figure 157: PyCOV Screenshot

The screenshot shows the Anaconda Prompt window. It displays the results of running pytest and coverage commands on the 'palindrome' directory:

```

(base) C:\Users\BISHU\Documents\pytest\Palindrome>pytest
=====
test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\Palindrome
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_palindrome.py . [100%]

===== 1 passed in 0.43s =====

(base) C:\Users\BISHU\Documents\pytest\Palindrome>pytest --cov=C:\Users\BISHU\Documents\pytest\Palindrome
=====
test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\Palindrome
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_palindrome.py . [100%]

----- coverage: platform win32, python 3.9.13-final-0 -----
Name           Stmts   Miss  Cover
-----
palindrome.py      10      0  100%
test_palindrome.py    14      1  93%
-----
TOTAL            24      1  96%

===== 1 passed in 0.74s =====

(base) C:\Users\BISHU\Documents\pytest\Palindrome>

```

Figure 158: Palindrome Code

10.8 Write a program to find out the sum of two arrays.

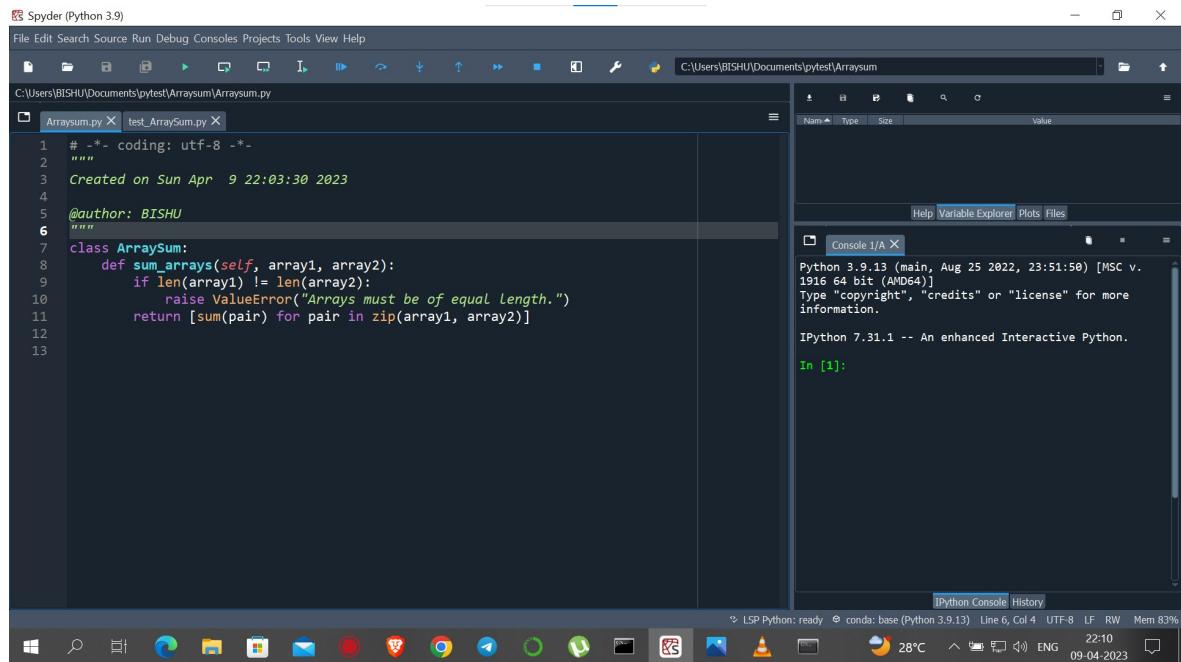


Figure 159: PyCOV Screenshot

The screenshot shows an Anaconda Prompt window with the following command history and output:

```

Administrator: Anaconda Prompt (anaconda3)
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\Arraysum
plugins: asyncio-3.5.0, cov-4.0.0
collected 1 item

test_ArraySum.py .

===== 1 passed in 0.07s =====

(base) C:\Users\BISHU\Documents\pytest\Arraysum>pytest --cov=C:\Users\BISHU\Documents\pytest\Arraysum\
===== test session starts =====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\Arraysum
plugins: asyncio-3.5.0, cov-4.0.0
collected 1 item

test_ArraySum.py .

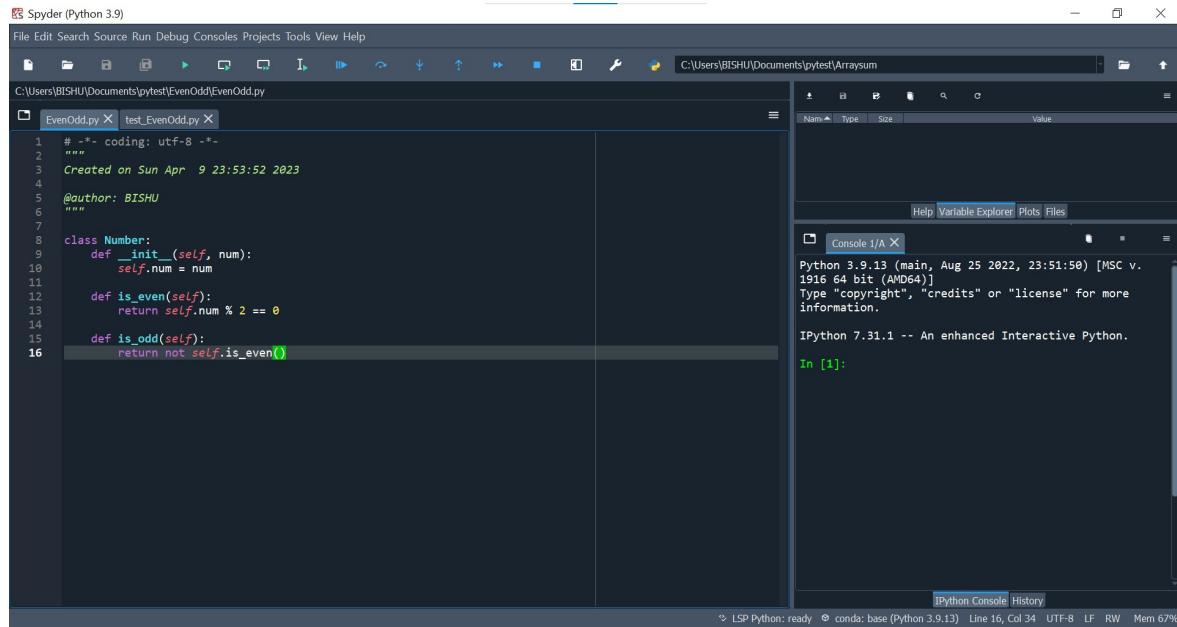
----- coverage: platform win32, python 3.9.13-final-0 -----
Name           Stmts   Miss  Cover
Arraysum.py       6      0  100%
test_ArraySum.py    14      2   86%
-----TOTAL          20      2   90%
===== 1 passed in 0.14s =====

(base) C:\Users\BISHU\Documents\pytest\Arraysum>

```

Figure 160: Sum of Array Code

10.9 Write a program to check whether the number is even or odd.



The screenshot shows the Spyder Python IDE interface. The left pane displays two files: `EvenOdd.py` and `test_EvenOdd.py`. The `EvenOdd.py` file contains the following code:

```

1  # -*- coding: utf-8 -*-
2 """
3 Created on Sun Apr  9 23:53:52 2023
4
5 @author: BISHU
6 """
7
8 class Number:
9     def __init__(self, num):
10         self.num = num
11
12     def is_even(self):
13         return self.num % 2 == 0
14
15     def is_odd(self):
16         return not self.is_even()

```

The right pane shows the IPython console output:

```

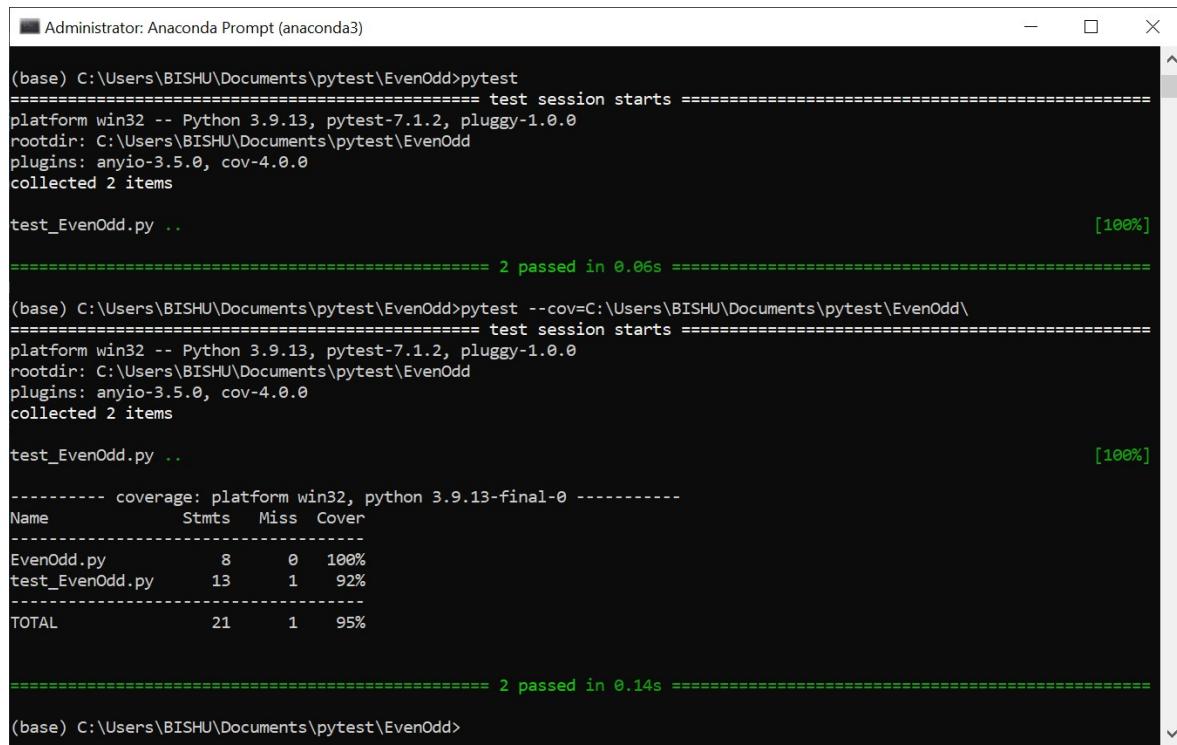
Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v. 1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.31.1 -- An enhanced Interactive Python.

In [1]:

```

Figure 161: PyCOV Screenshot



The screenshot shows an Anaconda Prompt window with the following command history and output:

```

(base) C:\Users\BISHU\Documents\pytest\EvenOdd>pytest
=====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\EvenOdd
plugins: anyio-3.5.0, cov-4.0.0
collected 2 items

test_EvenOdd.py .. [100%]

===== 2 passed in 0.06s =====

(base) C:\Users\BISHU\Documents\pytest\EvenOdd>pytest --cov=C:\Users\BISHU\Documents\pytest\EvenOdd\
=====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\EvenOdd
plugins: anyio-3.5.0, cov-4.0.0
collected 2 items

test_EvenOdd.py .. [100%]

----- coverage: platform win32, python 3.9.13-final-0 -----
Name      Stmts  Miss  Cover
-----
EvenOdd.py       8      0   100%
test_EvenOdd.py  13      1    92%
-----
TOTAL          21      1    95%

===== 2 passed in 0.14s =====

(base) C:\Users\BISHU\Documents\pytest\EvenOdd>

```

Figure 162: Odd or Even Code

10.10 Write a program for binary to hexadecimal conversion.

The screenshot shows the Spyder Python IDE interface. On the left, there are two tabs: 'binarytohex.py' and 'test_binarytohex.py'. The 'binarytohex.py' tab contains the following code:

```

1  # -*- coding: utf-8 -*-
2 """
3 Created on Sun Apr  9 22:03:30 2023
4
5 @author: BISHU
6 """
7 class BinaryToHex:
8     def __init__(self, binary):
9         self.binary = binary
10
11    def convert(self):
12        decimal = int(self.binary, 2)
13        hexadecimal = hex(decimal)[2:].upper()
14        return hexadecimal
15

```

The 'test_binarytohex.py' tab is currently active. On the right side of the interface, there is an IPython console window with the following output:

```

Python 3.9.13 (main, Aug 25 2022, 23:51:50) [MSC v.
1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more
information.

IPython 7.31.1 -- An enhanced Interactive Python.

In [1]:

```

Figure 163: PyCOV Screenshot

The screenshot shows an Anaconda Prompt window with the title 'Administrator: Anaconda Prompt (anaconda3)'. It displays the following command-line session:

```

(base) C:\Users\BISHU\Documents\pytest\binarytohex>pytest
=====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\binarytohex
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_binarytohex.py . [100%]

===== 1 passed in 0.05s =====

(base) C:\Users\BISHU\Documents\pytest\binarytohex>pytest --cov=C:\Users\BISHU\Documents\pytest\binarytohex\
=====
platform win32 -- Python 3.9.13, pytest-7.1.2, pluggy-1.0.0
rootdir: C:\Users\BISHU\Documents\pytest\binarytohex
plugins: anyio-3.5.0, cov-4.0.0
collected 1 item

test_binarytohex.py . [100%]

----- coverage: platform win32, python 3.9.13-final-0 -----
Name           Stmts   Miss  Cover
-----
binarytohex.py      8      0  100%
test_binarytohex.py  12      0  100%
-----
TOTAL            20      0  100%

===== 1 passed in 0.18s =====

(base) C:\Users\BISHU\Documents\pytest\binarytohex>

```

Figure 164: Binary to Hexadecimal Code

11 Previous Year Lab Exam Questions

1. Test page opening of Zimbra mail and perform login operation for Zimbra using Selenium IDE.
2. Test page opening of Zimbra mail and perform login operation for Zimbra using Selenium RC server.
3. Test page opening of Zimbra mail and perform login operation for Zimbra using Selenium Web-driver.
4. Write a specification for the annotations-Input.xml file given in samples of TCASES. Generate Test cases in Junit, reduce the test cases, and save results in HTML format.
5. Write a specification for the Tcases-Input.xml file given in samples of TCASES. Generate Test cases in Junit, reduce the test cases, and save results in HTML format.
6. Write a program for generating a Fibonacci number and generate test cases for the Junit framework and then test it using the Jumble tool and modify test cases to get a better mutation score.
7. Write a program to check whether two arrays are equal or not and generate test cases for it using the Junit framework and then test it using the Jumble tool and modify test cases to get better mutation score.
8. Write a program for binary to decimal conversion and generate test cases for the given program and find coverage achieved by your test cases using JaButi.
9. Write a program for checking whether the given no. is prime or not. Generate the test cases for the given program and find the coverage achieved by your test cases using Jabuti.
10. Write a program for a given number is palindrome or not and generate test cases using Jcute. Assemble the report also.
11. Write a program for checking whether the given string is palindrome or not and generate test cases using Jcute. Assemble the coverage report also.
12. Calculate the statement and branch coverage of individual modules in a calculator program using PyCov/Coverage.py
13. Calculate the statement and branch coverage of individual modules in a bubble sort program using PyCov/Coverage.py
14. Calculate the type and name of the bugs using findBugs for the calculator program and create a report for it in two types.
15. Calculate the type and name of the bugs using findBugs for a selection sort program and create a report for it in two types.
16. Create a script using Jmeter to record visiting any website and play it with 200 threads and 3 loops per thread and view the results using View Results Tree.
17. Create a JMeter Test Script to test the load on www.facebook.com with 300 users and 3 loops each.
18. Write a program to find the max element form array and generate test cases for it using the Junit framework and then calculate coverage using the Eclemma tool.
19. Write a program to find the second minimum element from the array and generate test cases for it using the Junit framework and then calculate coverage using the Eclemma tool.
20. Fuzz the image files available in the sample folder and find the number of faults using the Peach tool.

21. Using the Selenium webdriver, open an e-commerce website perform login operation, and add some items to your cart.
22. Create a JMeter Test script that will raise a warning when the response from the server gets longer by 2000 milliseconds.