EECS 4313 Assignment 3
Data Flow Testing, Slice-Based Testing and Mutation Testing

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- The data flow analysis you performed and the calculation of the coverage metrics. You must show which test cases are responsible for which dc-paths.
- A description of the test cases you added to improve coverage. If your coverage was already high, discuss how your testing was able to achieve this.
- The slices that you identified and the percentage of slices that your testing covers. You must show which test cases are responsible for which slices.
- A description of the test cases you added to improve slice coverage. If your coverage was already high, discuss how your testing was able to achieve this.
- Evaluate the effectiveness of your test cases using mutation testing. Discuss and address any issues if you have found in your written report.
- Attaching bug reports if bugs are discovered using your testing methods. You should use the same bug report format as in Assignment 1. Do not file these bug reports to the projects bug report system.
- An appendix with the specification of the methods you are testing

2 JPetStore

After exploring the JPetStore system, we came up with some realistic non-trivial test scenarios that can be carried out for load testing using JMeter. The following subsections cover each scenarios, description on how it was load tested and the result analysis of the load test.

Following are the system specifications for which the load test was conducted under:

- **Operating System**: Windows 10 Pro 64-bit (10.0, Build 16299)
- **Language**: English (Regional Setting: English)
- **System Manufacturer**: Hewlett-Packard
- **System Model**: HP 15 TouchSmart Notebook PC
- **BIOS**: F.10
- **Processor**: AMD A6-5200 APU with Radeon(TM) HD Graphics (4 CPUs), 2.0GHz
- **Memory**: 6144MB RAM
- **Java Version**: 1.8.0_151-b12

2.1 Scenario 1: Returning User

2.1.1 Overview

The first test scenario is for an existing user in the system. The testing scenario will consist of a returning user logging in, selecting one of each of the 5 possible items sold in JPetStore, adding the items to the cart, performing a checkout of the cart and finally logging out. The following describes an exact breakdown of the steps the load test will carry out:

- Access the JPetStore Homepage (`http://localhost:8080/jpetstore/`).
- Click *Enter the Store*.
- Click on the *Sign in* button.
- Enter sign-in credentials and click *Login* By default, we will be using *j2ee* user for this scenario.
- Go to the *Fish* section, select a fish item, add it to the cart and return to the main menu.
- Go to the *Dogs* section, select a dog item, add it to the cart and return to the main menu.
- Go to the *Reptiles* section, select a reptile item, add it to the cart and return to the main menu.
- Go to the *Cats* section, select a cat item, add it to the cart and return to the main menu.
- Go to the *Birds* section, select a bird item, add it to the cart.
- Proceed to checkout and follow the steps until the order has been placed.
- Return back to the main menu and sign out.

The following images depicts the Recording Controller for the test case scenario and the pages our load test will navigate through per each iteration:

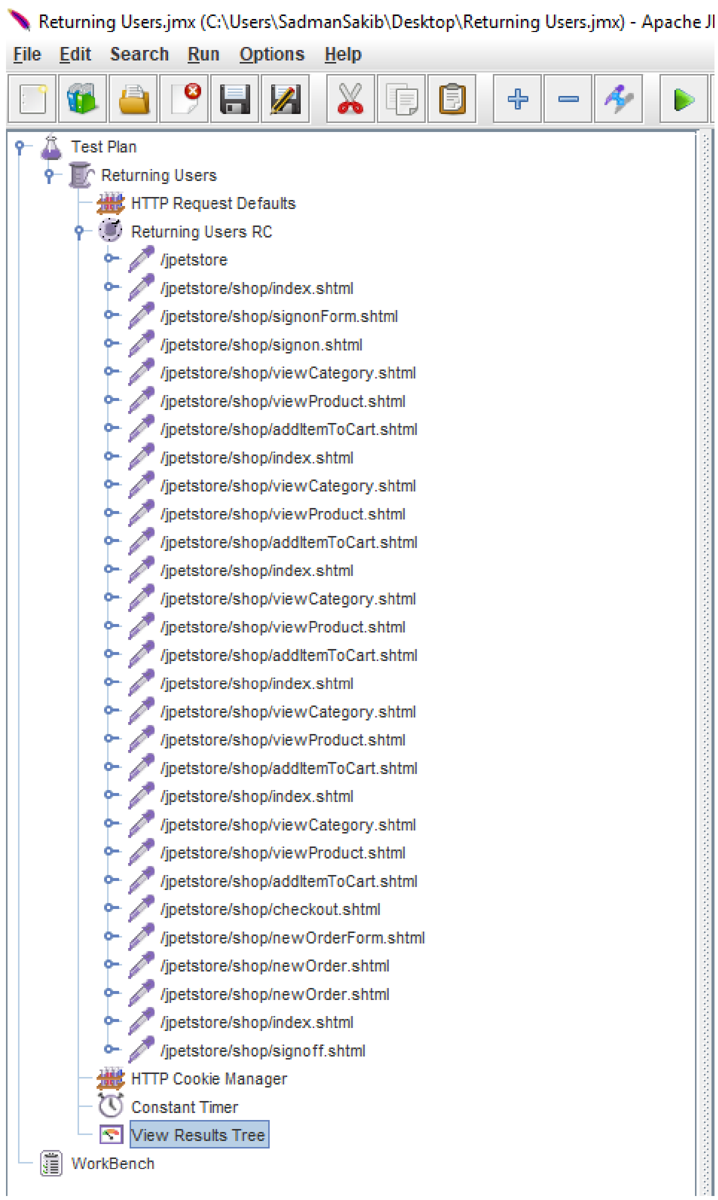

Figure 1: Recording Controller for Returning User Scenario

2.1.2 Load Test Properties

Following are the load test properties applied for testing this scenario:

- **Number of Thread (users)**: 5
- **Ramp-up Period (in seconds)**: 10
- **Loop Count**: 30
- **Thread Delay (in milliseconds)**: 1000

2.1.3 Executing Load Test

After setting up the load test plan using JMeter, we executed the test. The test run was for approximately 18 minutes completing all 30 iterations. The following diagrams show the result tree of the test run.

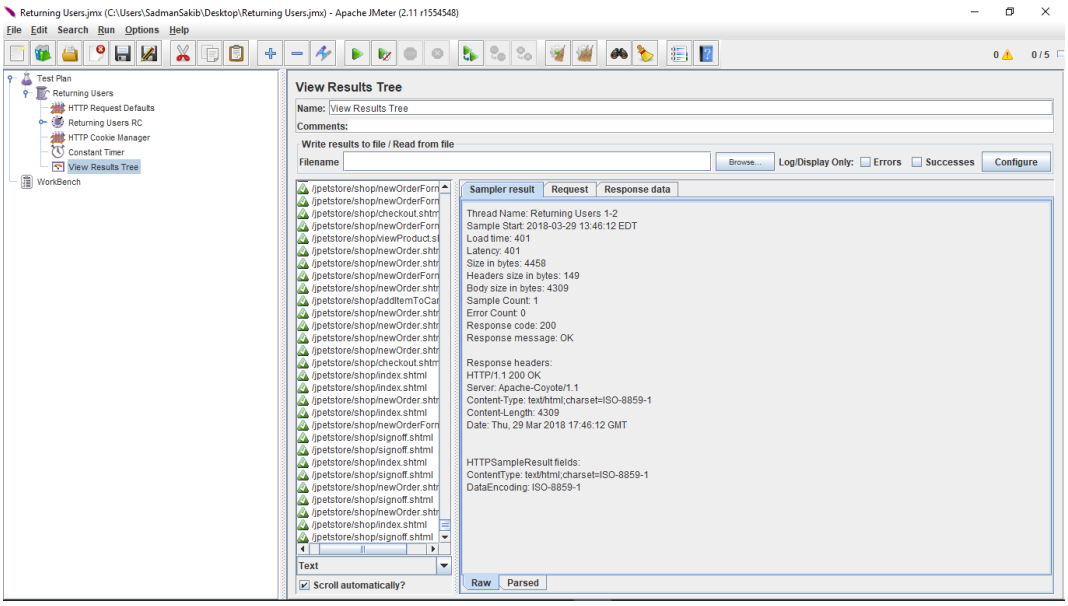

Figure 2: View Results Tree for Returning User Scenario

2.1.4 Analysing Load Test

The following statistics were gathered from the Apache access logs by simple shell-scripting methodology for this test scenario:

- **Test Duration**: Approximately 18 minutes
- **Total Number of Requests**: 4714
- **Number of GET Requests**: 4399 (93% of all requests)
- **Number of POST Requests**: 315 (7% of all requests)
- **Success HTTP Codes**: 200 (Success) and 302 (Found)
- **Failure HTTP Codes**: None

Following is a snapshot of the Apache access log:

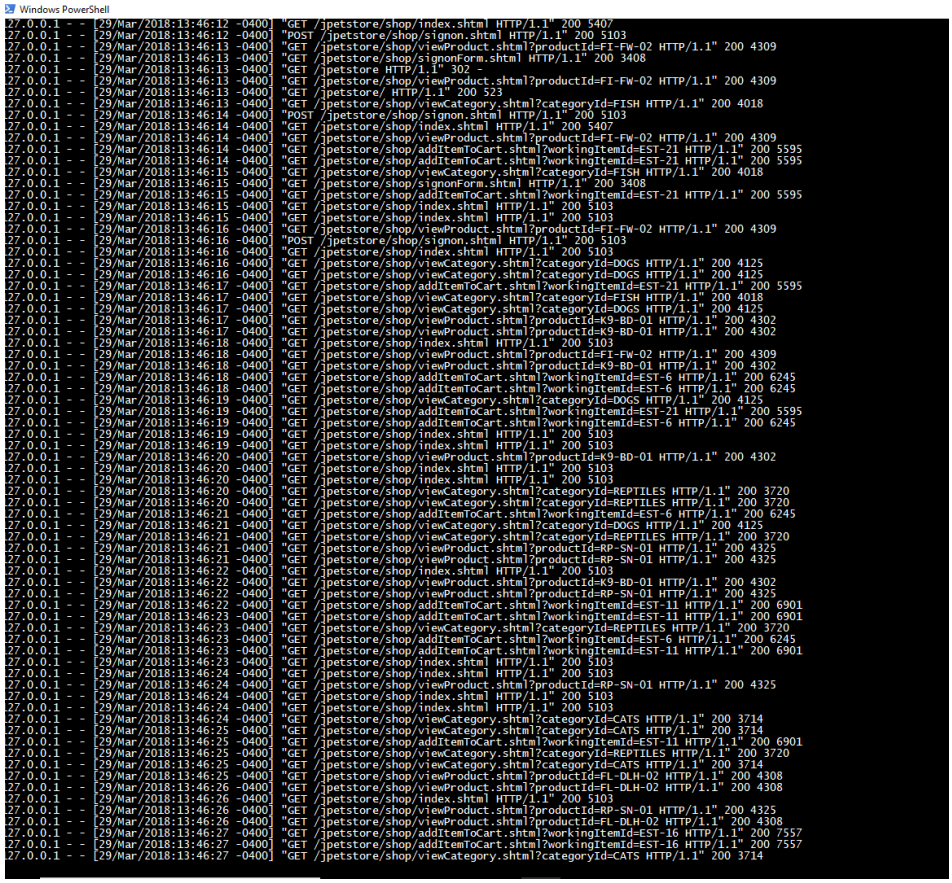

Figure 3: Apache Access Log Snapshot for Returning User Scenario

Following is a snapshot of the Windows Performance Monitor and Java Monitor Console during the load test execution:

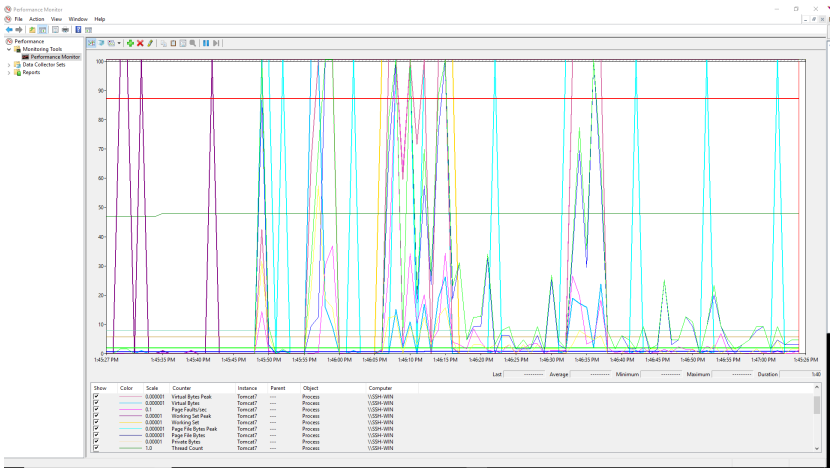

Figure 4: Windows Performance Monitor Snapshot for Returning User Scenario

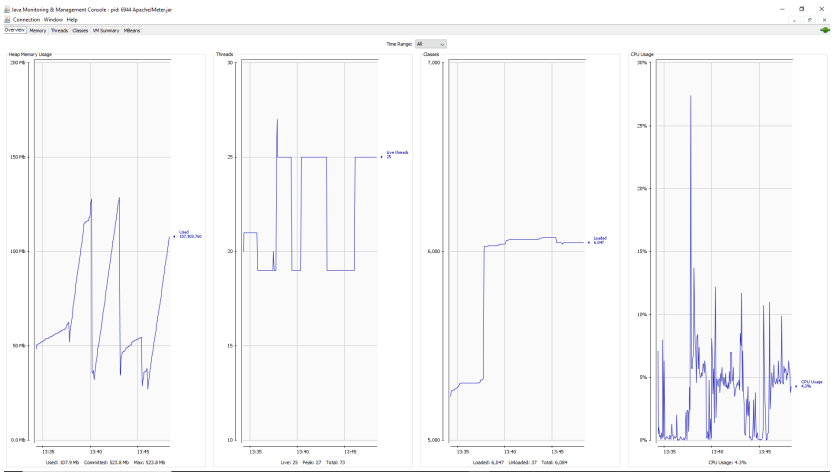

Figure 5: JConsole Snapshot for Returning User Scenario

Conclusion: The load test scenario for returning user made about 4714 request and the test ran for approximately 18 minutes. Despite some natural high spikes on the performance monitor and java monitor, the load test was carried out successfully without any crashes or unexpected behaviour in the application.

2.2 Scenario 2: New User

2.2.1 Overview

The second test scenario is for a new user in the system. The testing scenario will consist of registering a new user, selecting one of each of the 5 possible items sold in JPetStore, adding the items to the cart, performing a checkout of the cart and finally logging out. The following describes an exact breakdown of the steps the load test will carry out:

- Access the JPetStore Homepage (`http://localhost:8080/jpetstore/`).
- Click *Enter the Store*.
- Click on the *Sign in* button.
- Click *Register now*.
- Enter the sign-up credentials and click *Create Account*. The username and password for signing up would be loaded from a CSV file, whereas the other fields will be supplied the value of *abc*.
- Go to the *Fish* section, select a fish item, add it to the cart and return to the main menu.
- Go to the *Dogs* section, select a dog item, add it to the cart and return to the main menu.
- Go to the *Reptiles* section, select a reptile item, add it to the cart and return to the main menu.
- Go to the *Cats* section, select a cat item, add it to the cart and return to the main menu.
- Go to the *Birds* section, select a bird item, add it to the cart.
- Proceed to checkout and follow the steps until the order has been placed.
- Return back to the main menu and sign out.

The following images depicts the Recording Controller for the test case scenario and the pages our load test will navigate through per each iteration:

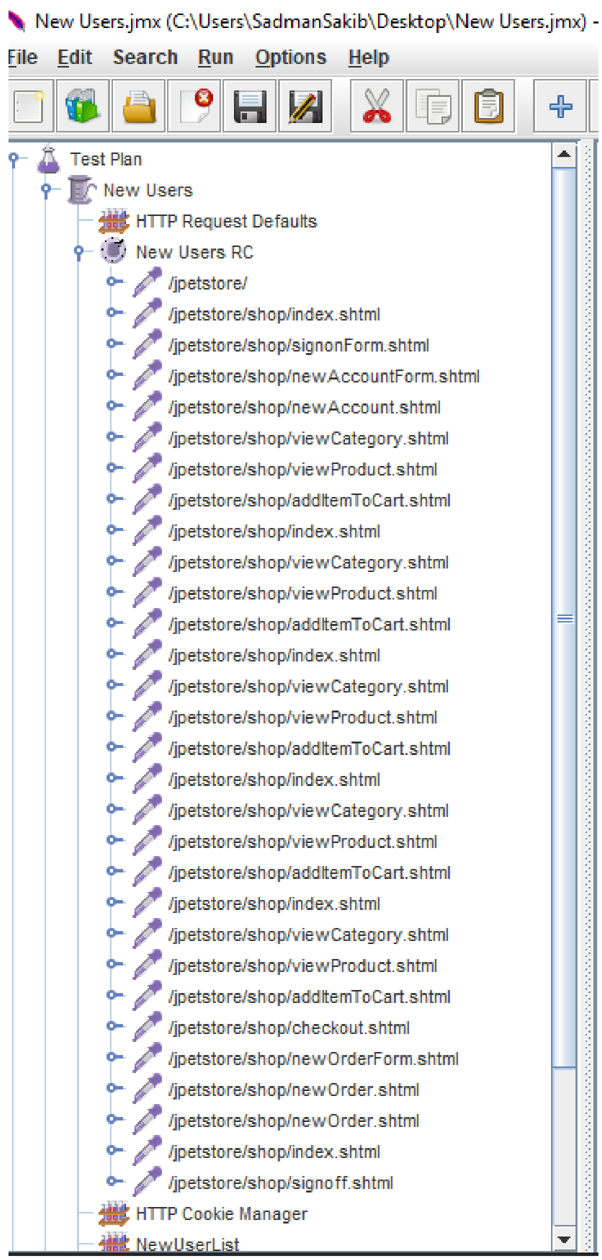

Figure 6: Recording Controller for New User Scenario

The following images depicts the snapshot of the CSV file containing usernames and password for registering new users. On the POST request for registering a new user we load the credentials and use them through variable names such as ${username} and ${password}.

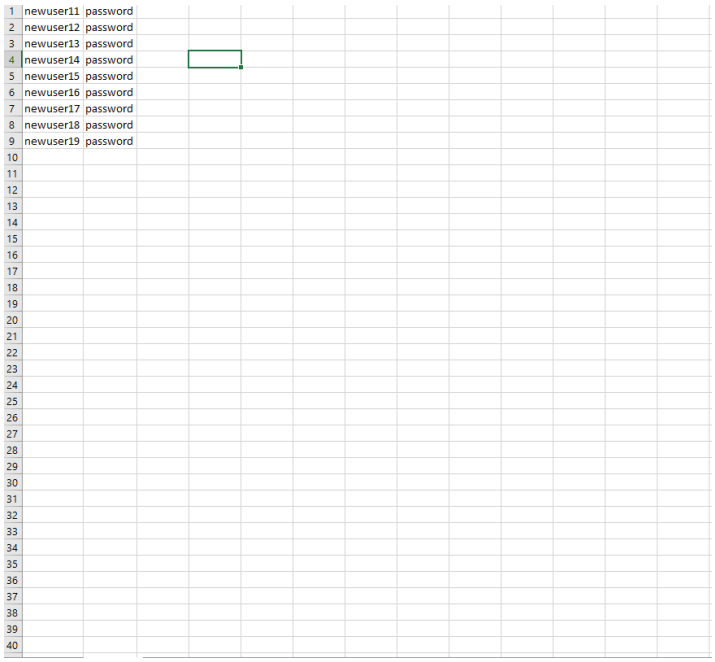

Figure 7: CSV Credential File for New User Scenario

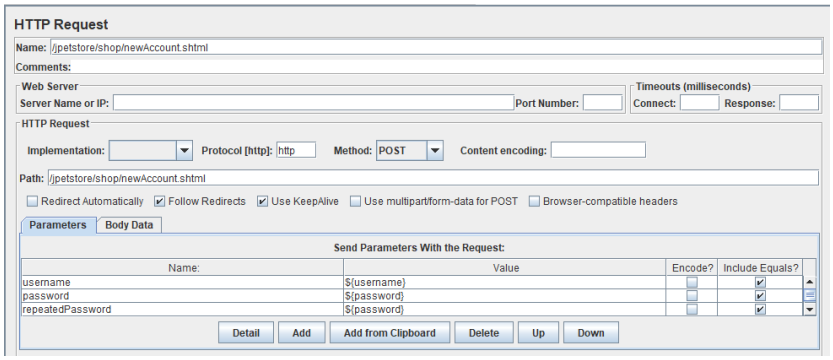

Figure 8: HTTP Post Request for New User Scenario

2.2.2 Load Test Properties

Following are the load test properties applied for testing this scenario:

- **Number of Thread (users)**: 5
- **Ramp-up Period (in seconds)**: 5
- **Loop Count**: 30
- **Thread Delay (in milliseconds)**: 1000

2.2.3 Executing Load Test

After setting up the load test plan using JMeter, we executed the test. The test run was for approximately 15 minutes completing all 30 iterations. The following diagrams show the result tree of the test run.

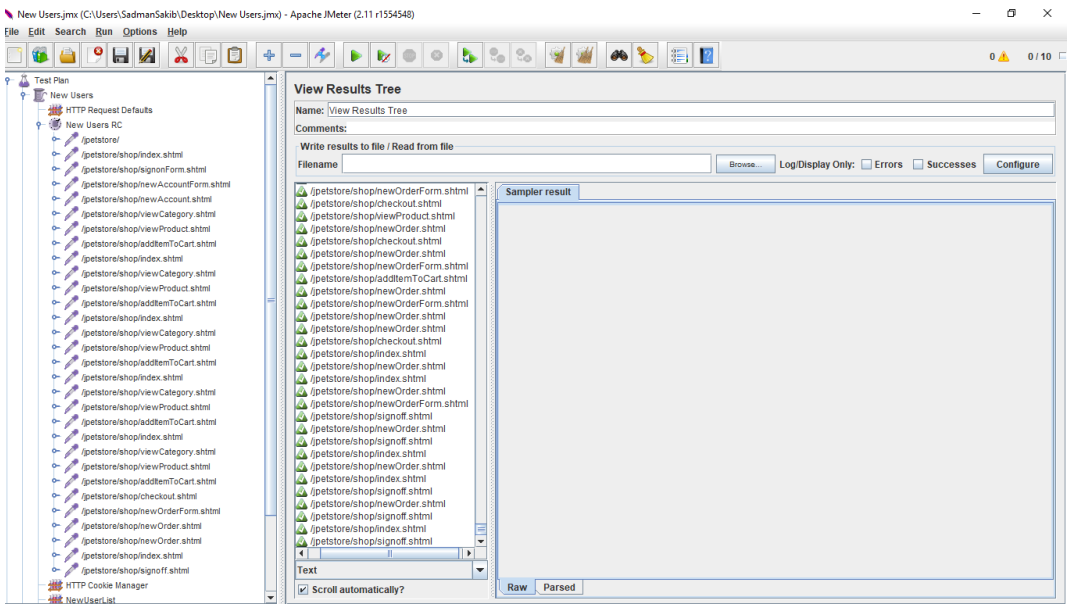

Figure 9: View Results Tree for New User Scenario

2.2.4 Analysing Load Test

The following statistics were gathered from the Apache access logs by simple shell-scripting methodology for this test scenario:

- **Test Duration**: Approximately 15 minutes
- **Total Number of Requests**: 7500
- **Number of GET Requests**: 7000 (93% of all requests)
- **Number of POST Requests**: 500 (7% of all requests)
- **Success HTTP Codes**: 200 (Success) and 302 (Found)
- **Failure HTTP Codes**: None

Following is a snapshot of the Apache access log:

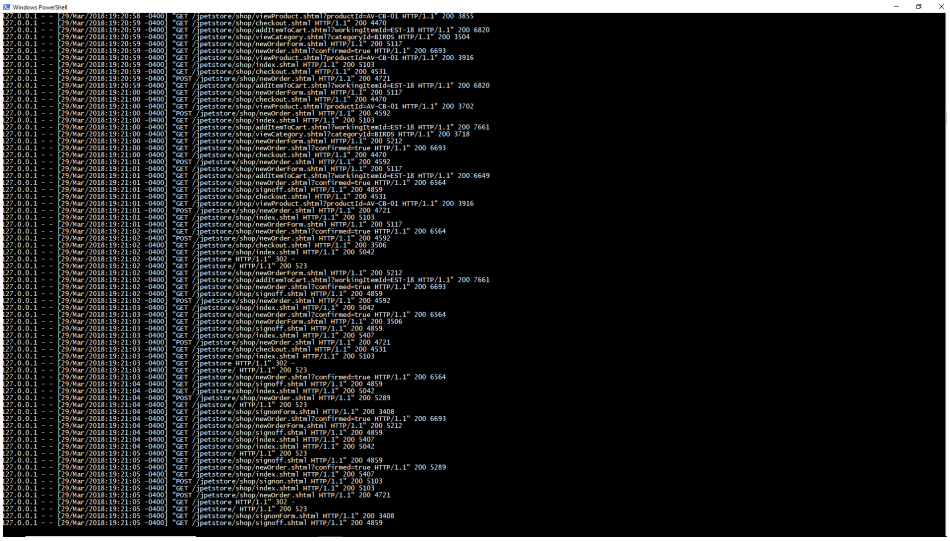

Figure 10: Apache Access Log Snapshot for New User Scenario

Following is a snapshot of the Windows Performance Monitor and Java Monitor Console during the load test execution:

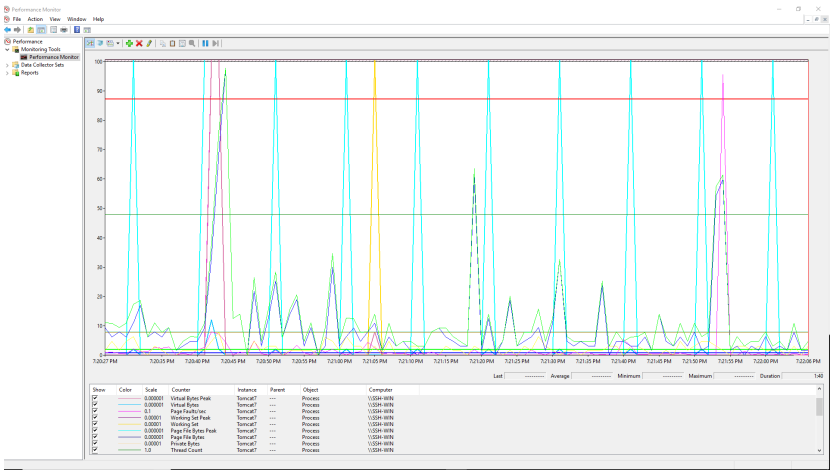

Figure 11: Windows Performance Monitor Snapshot for New User Scenario

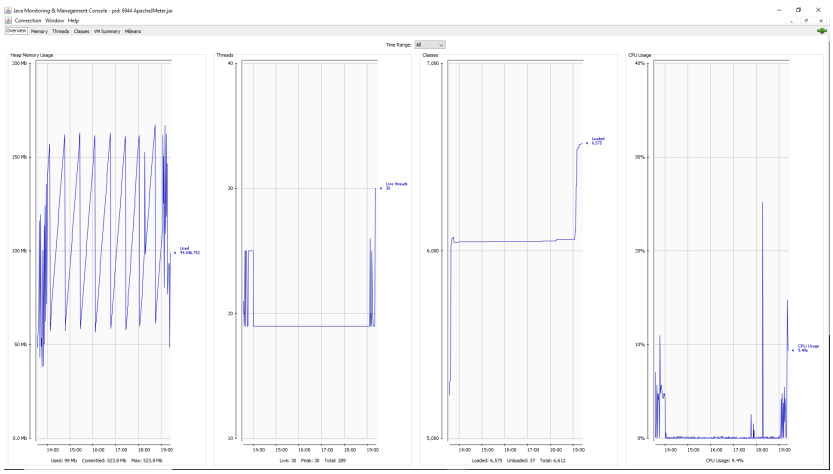

Figure 12: JConsole Snapshot for New User Scenario

Conclusion: The load test scenario for new user made about 7500 request and the test ran for approximately 15 minutes. Despite some natural high spikes on the performance monitor and java monitor, the load test was carried out successfully without any crashes or unexpected behaviour in the application.