National College of Ireland

Configuration Manual

MSc Research Project
Msc Cloud Computing

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MSc Project Submission Sheet

School of Computing

Student Name: Jayant Umesh Shah

Student ID: 21219583

Programme: Msc Cloud Computing **Year:** Jan 2023

Module: Msc Research Project

Lecturer: Aqeel Kazmi

Submission Due Date: 14/12/2023

Project Title: Optimizing the load balancing efficiency using enhanced genetic algorithm in cloud computing

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I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.
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Signature: Jayant Umesh Shah

Date: 14/12/2023

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

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Configuration Manual

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1 Introduction

Using an enhanced Firefly algorithm, load balancing is implemented as shown in this Configuration Manual.

2 Prerequisites

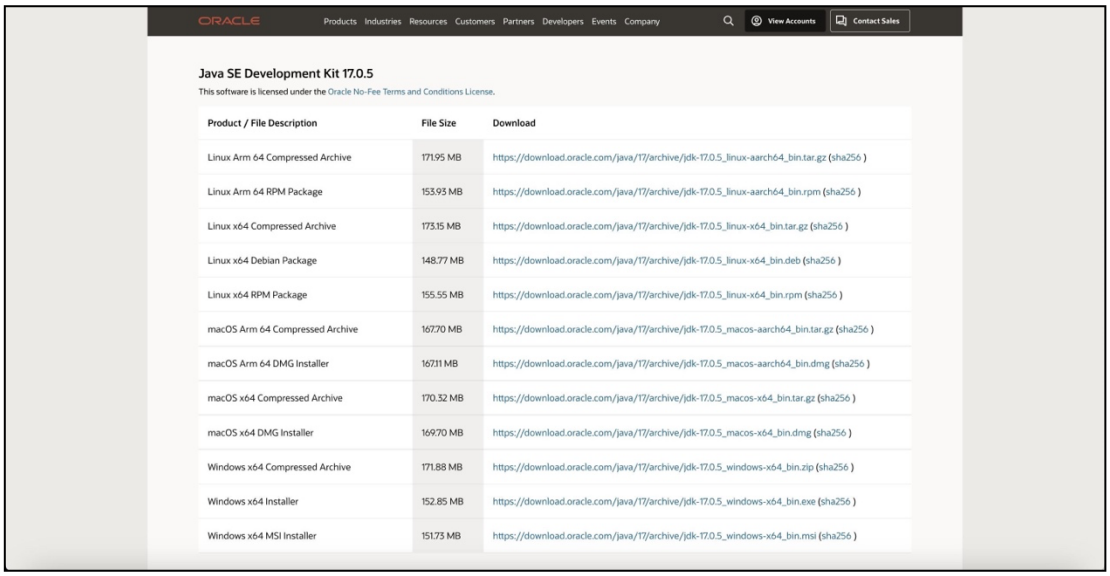
1. Java JDK 17
2. Eclipse IDE
3. CloudSim 3.0.3 Framework

Note: Please follow the specific instruction for your OS to install the prerequisites as these prerequisites were installed and ran on MacOS (M1 edition).

3 Prerequisite Installation

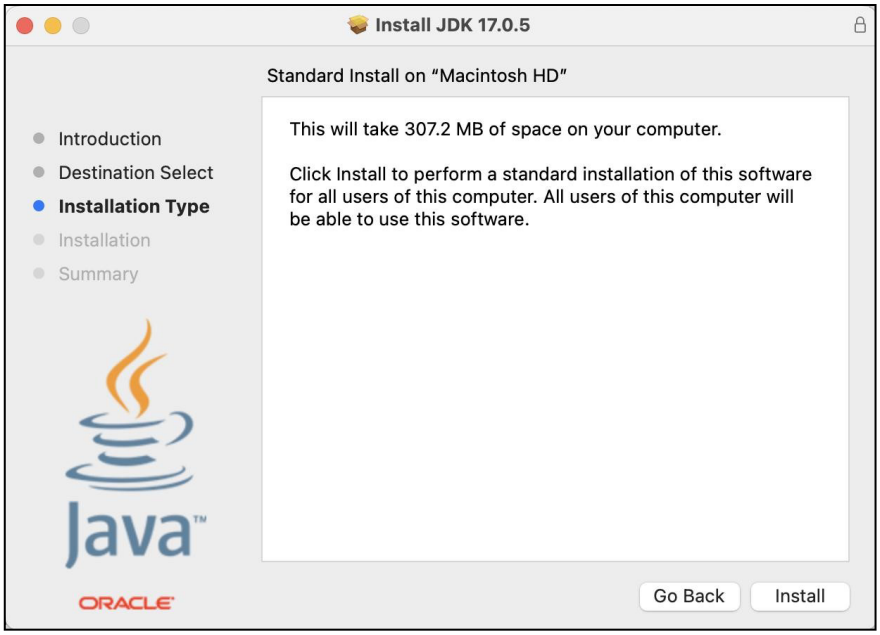
3.1 Java JDK 17

Step 1: Download Java JDK 17.0.5 for your appropriate OS.
https://www.oracle.com/java/technologies/javase/jdk17-archive-downloads.html



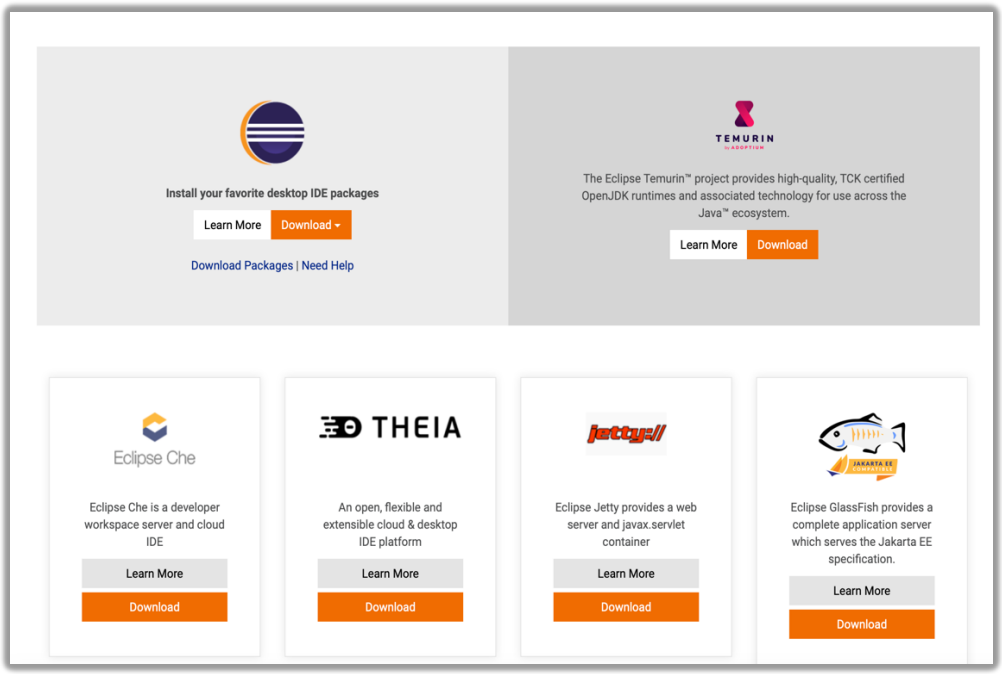
Step 2: Install JDK

Step 3: Click on "**Install**" to install JDK.

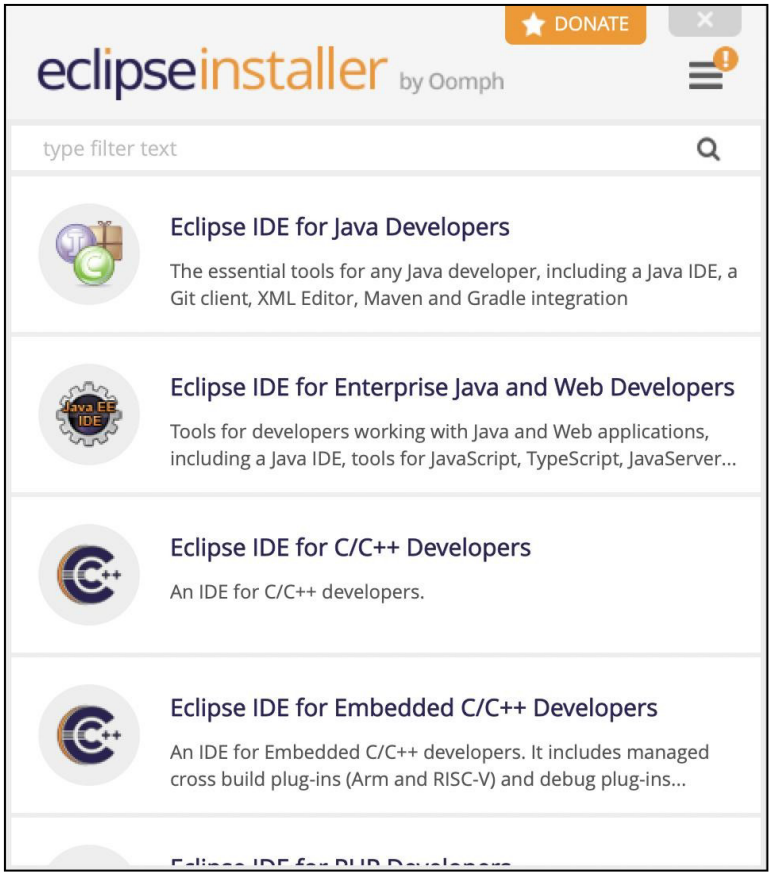


3.2 Eclipse IDE

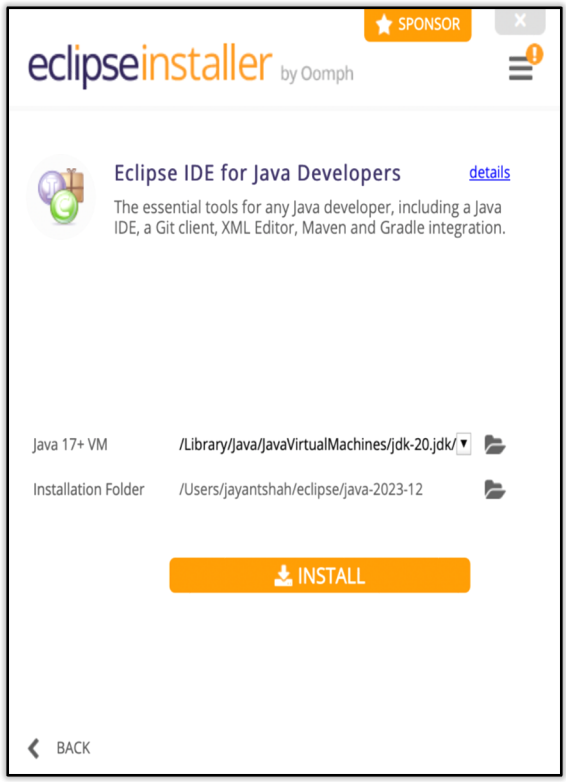
Step 1: Download Eclipse IDE from the following link.
https://www.eclipse.org/downloads/



Step 2: Select "**Eclipse IDE for Java Developers**".

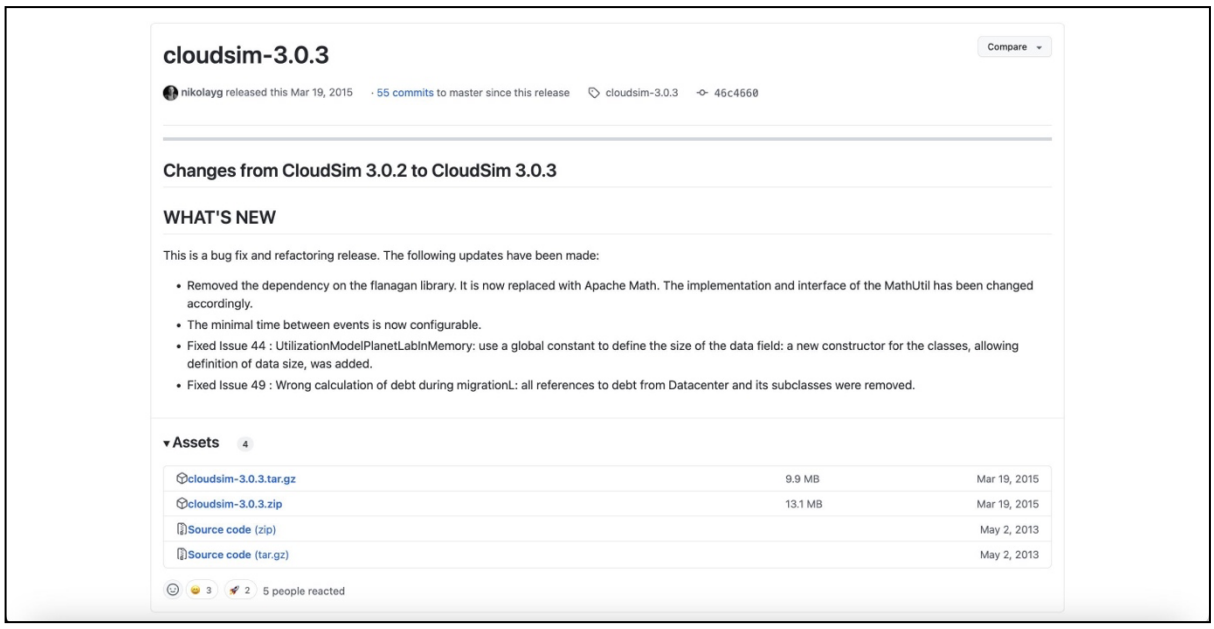


Step 3: Select the JDK path where you installed the Java JDK and the installation folder. Click on install to install.



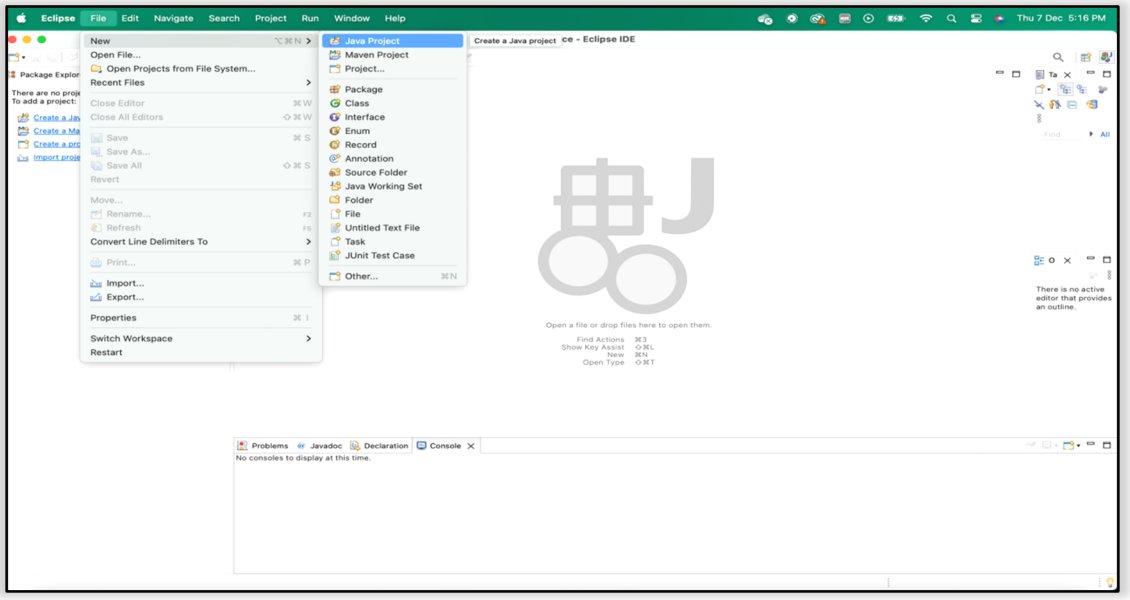
3.3 CloudSim v3.0.3

Step 1: Download CloudSim v3.0.3 from the following link.
https://github.com/Cloudslab/cloudsim/releases/tag/cloudsim-3.0.3

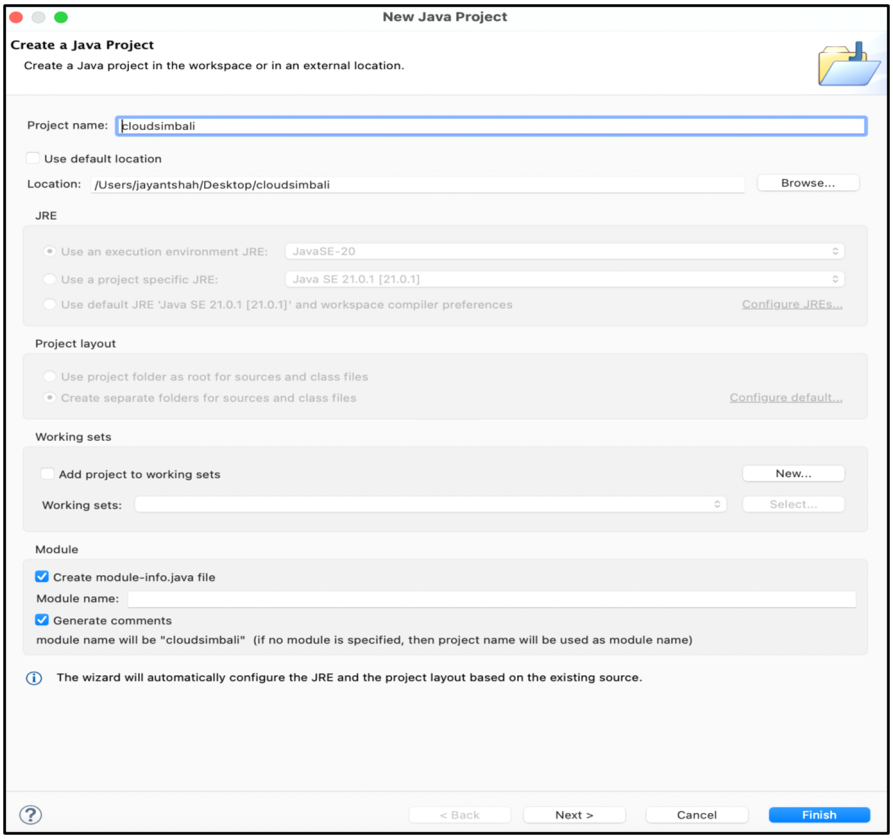


4 Running the proposed code

Step 1: Create a new Java Project. Click on **“File” → “New” → “Java Project”**.

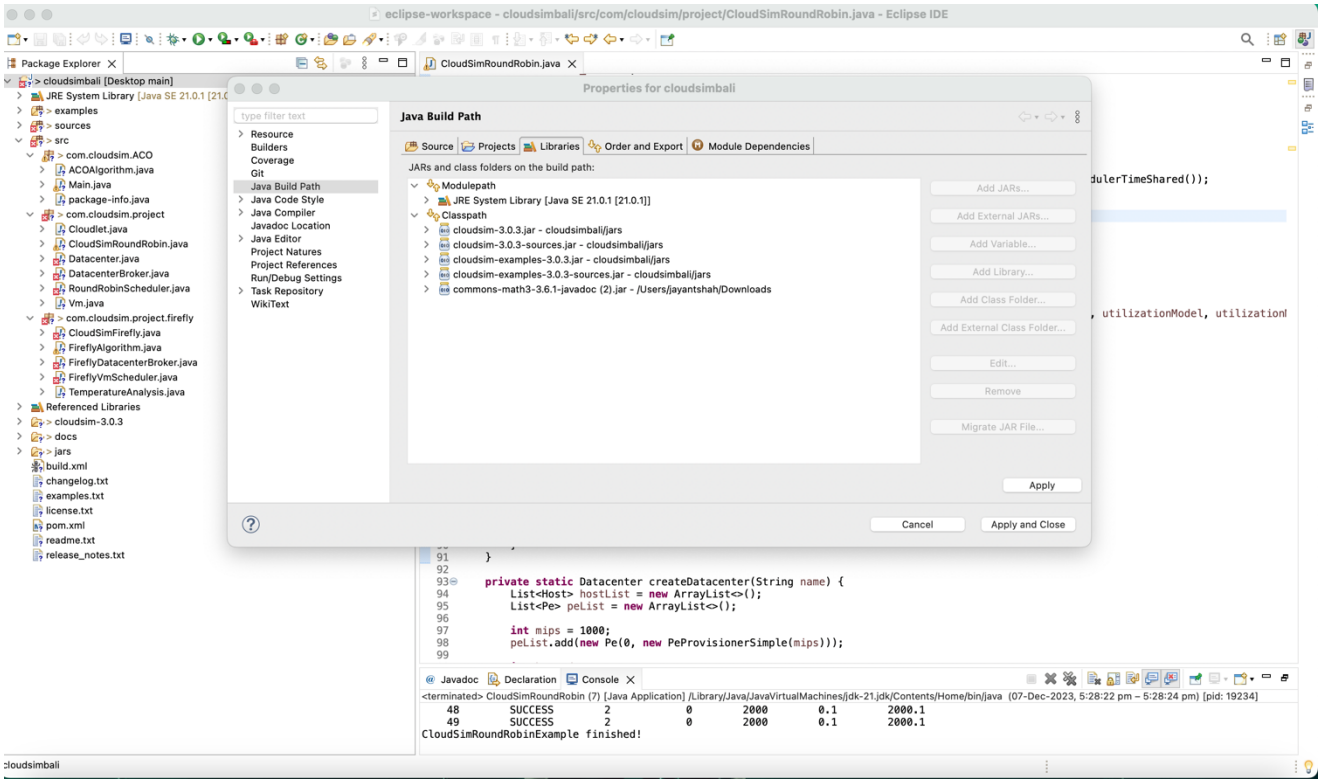


Step 2: Give your project a name in the field **“Project Name”** and untick the option **“Use default location”**. Click on **“Browse”** to select the path where you have download CloudSim v3.0.3. Then click on **“Finish”**.



Step 3: Double click on **files** to open them.

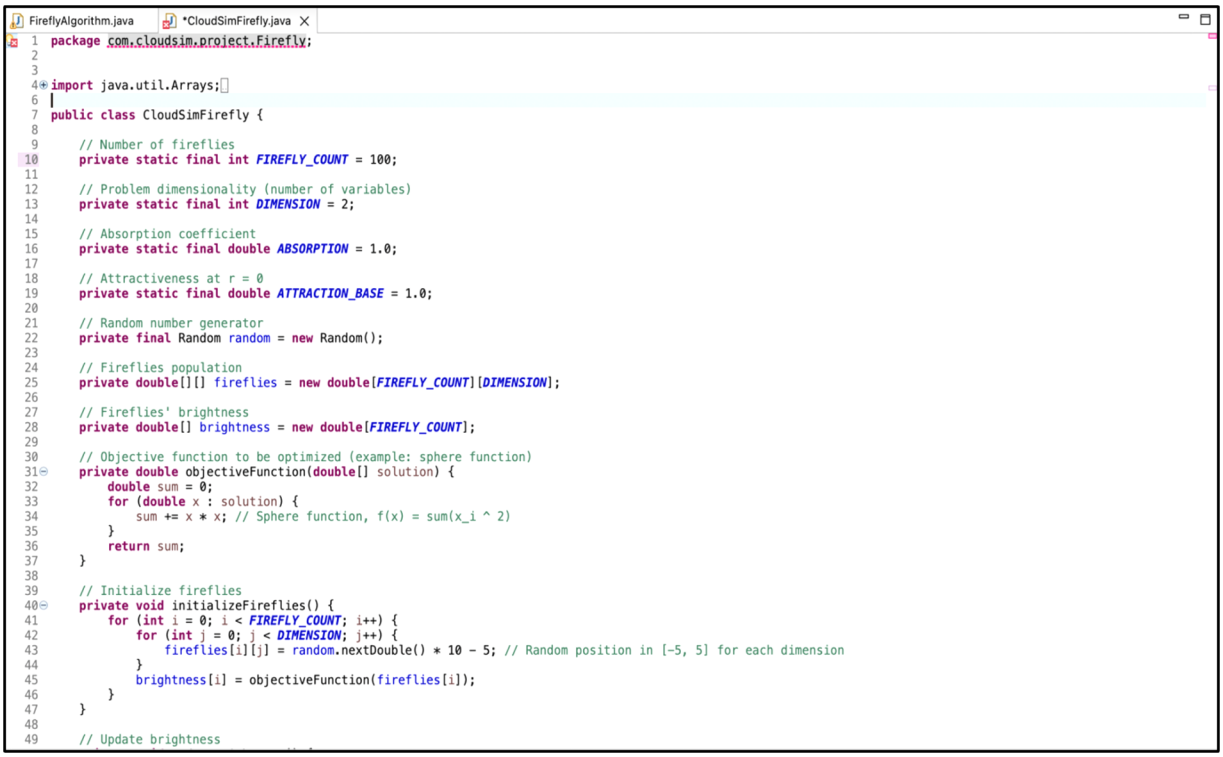
Step 4 : Add the .jar file, open the file and go to properties. And Click on Java Build Path and add the **commons-math3-3.6.1-javadoc.jar.**



Step 5: For RRA , open the file and go to line 64. Here you define the number of cloudlets.

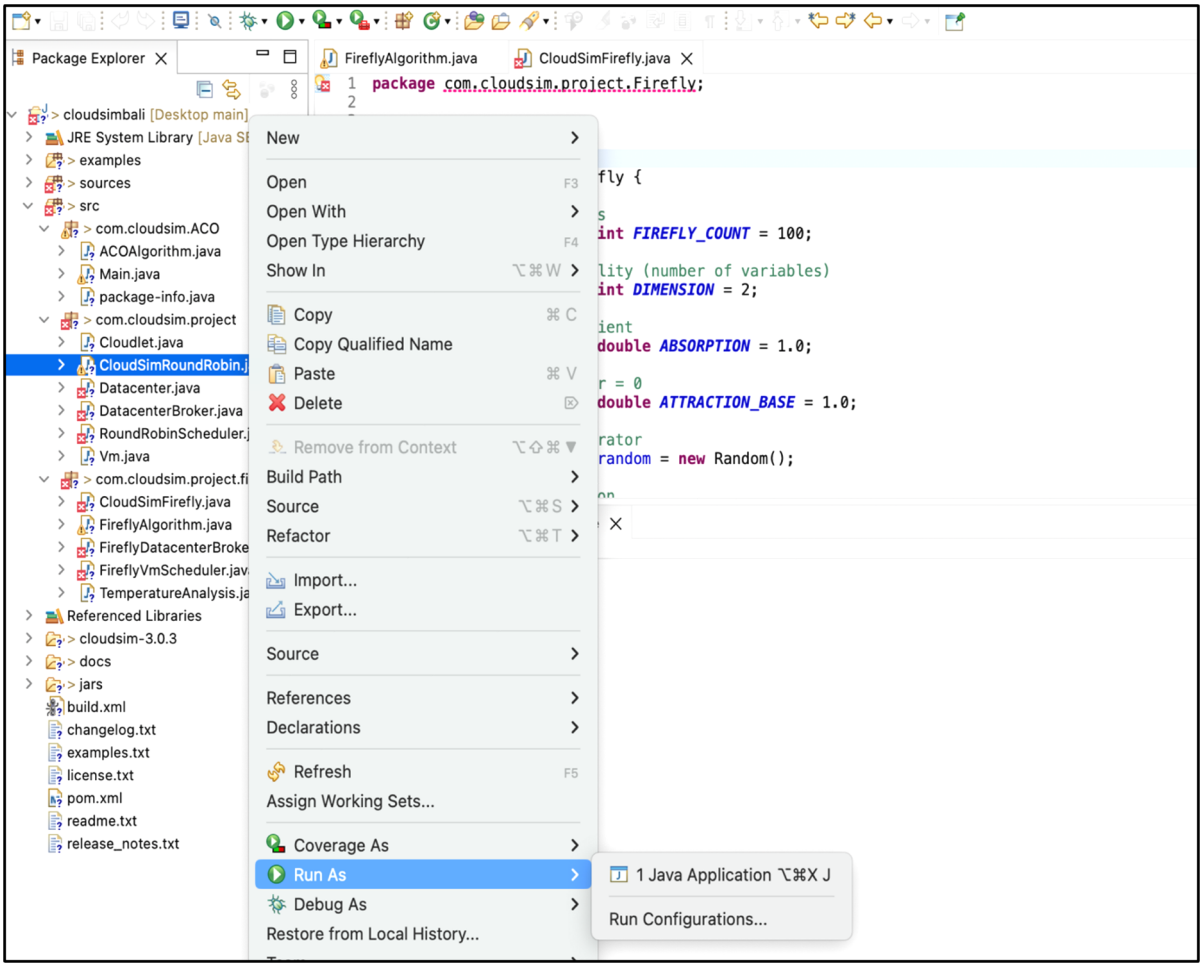
```
CloudSimRoundRobin.java
34          Log.printLine("Starting CloudSimRoundRobinExample...");
35
36          try {
37              int num_user = 1;
38              Calendar calendar = Calendar.getInstance();
39              boolean trace_flag = false;
40
41              CloudSim.init(num_user, calendar, trace_flag);
42
43              Datacenter datacenter0 = createDatacenter("Datacenter_0");
44
45              DatacenterBroker broker = createBroker();
46              int brokerId = broker.getId();
47
48              vmList = new ArrayList<>();
49              cloudletList = new ArrayList<>();
50
51              int num_vms = 5;
52              int mips = 1000;
53              long size = 10000;
54              int ram = 512;
55              long bw = 1000;
56              int pesNumber = 1;
57              String vmm = "Xen";
58
59              for (int vmId = 0; vmId < num_vms; vmId++) {
60                  Vm vm = new Vm(vmId, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
61                  vmList.add(vm);
62              }
63
64              int num_cloudlets = 50;
65              long length = 40000;
66              long fileSize = 300;
67              long outputSize = 300;
68              UtilizationModel utilizationModel = new UtilizationModelFull();
69
70              for (int cloudletId = 0; cloudletId < num_cloudlets; cloudletId++) {
71                  Cloudlet cloudlet = new Cloudlet(cloudletId, length, pesNumber, fileSize, outputSize, utilizationModel, utilizationModel, utilizationModel);
72                  cloudlet.setUserId(brokerId);
73                  cloudletList.add(cloudlet);
74              }
75
76              broker.submitVmList(vmList);
77              broker.submitCloudletList(cloudletList);
78
79              CloudSim.startSimulation();
80
81              List<Cloudlet> newList = broker.getCloudletReceivedList();
```

Step 6: For EFA, open the file and go to line 10. Here you define the number of Firefly_Count.

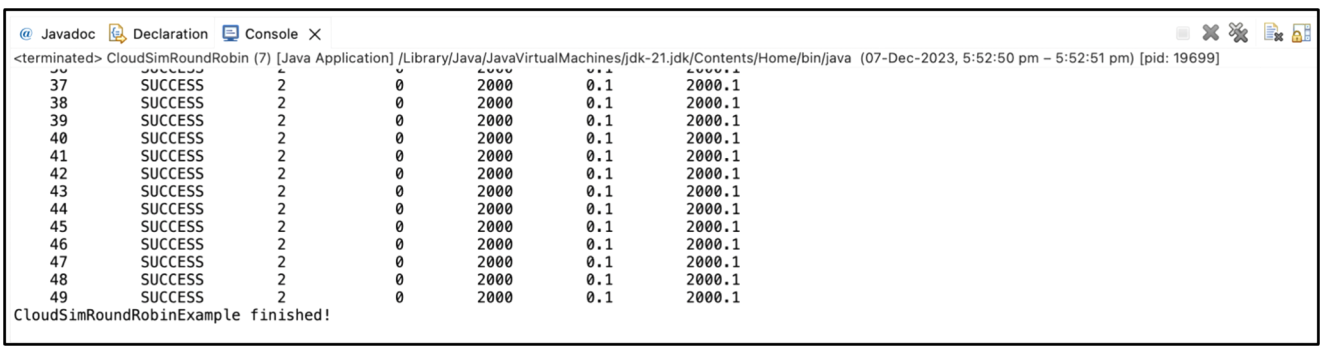


```
FireflyAlgorithm.java   *CloudSimFirefly.java
1  package com.cloudsim.project.Firefly;
2
3
4  import java.util.Arrays;
6
7  public class CloudSimFirefly {
8
9      // Number of fireflies
10     private static final int FIREFLY_COUNT = 100;
11
12     // Problem dimensionality (number of variables)
13     private static final int DIMENSION = 2;
14
15     // Absorption coefficient
16     private static final double ABSORPTION = 1.0;
17
18     // Attractiveness at r = 0
19     private static final double ATTRACTION_BASE = 1.0;
20
21     // Random number generator
22     private final Random random = new Random();
23
24     // Fireflies population
25     private double[][] fireflies = new double[FIREFLY_COUNT][DIMENSION];
26
27     // Fireflies' brightness
28     private double[] brightness = new double[FIREFLY_COUNT];
29
30     // Objective function to be optimized (example: sphere function)
31     private double objectiveFunction(double[] solution) {
32         double sum = 0;
33         for (double x : solution) {
34             sum += x * x; // Sphere function, f(x) = sum(x_i ^ 2)
35         }
36         return sum;
37     }
38
39     // Initialize fireflies
40     private void initializeFireflies() {
41         for (int i = 0; i < FIREFLY_COUNT; i++) {
42             for (int j = 0; j < DIMENSION; j++) {
43                 fireflies[i][j] = random.nextDouble() * 10 - 5; // Random position in [-5, 5] for each dimension
44             }
45             brightness[i] = objectiveFunction(fireflies[i]);
46         }
47     }
48
49     // Update brightness
```

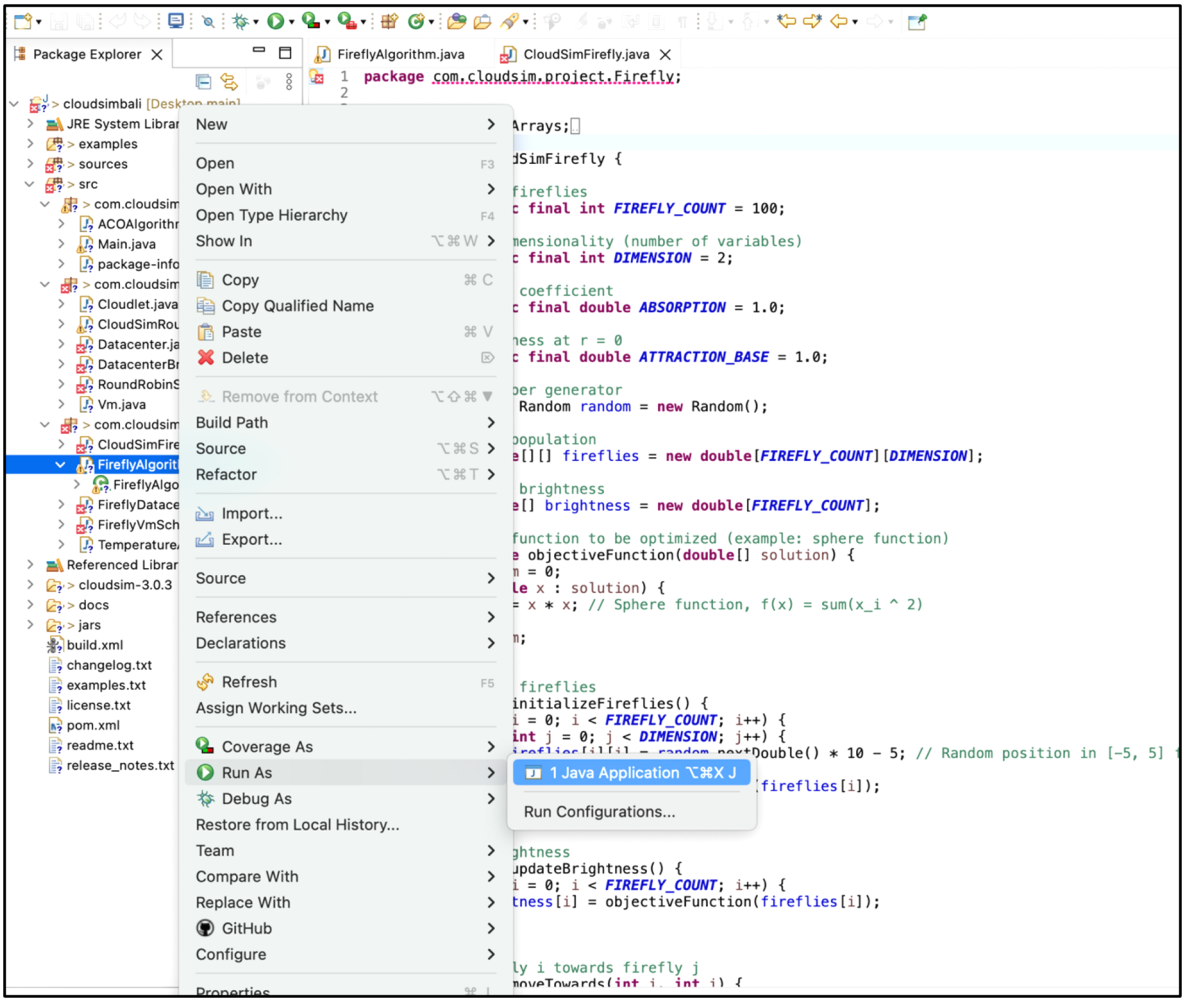
Step 7: Click on **"Run"** → **"Run"** to run the code for RRA.



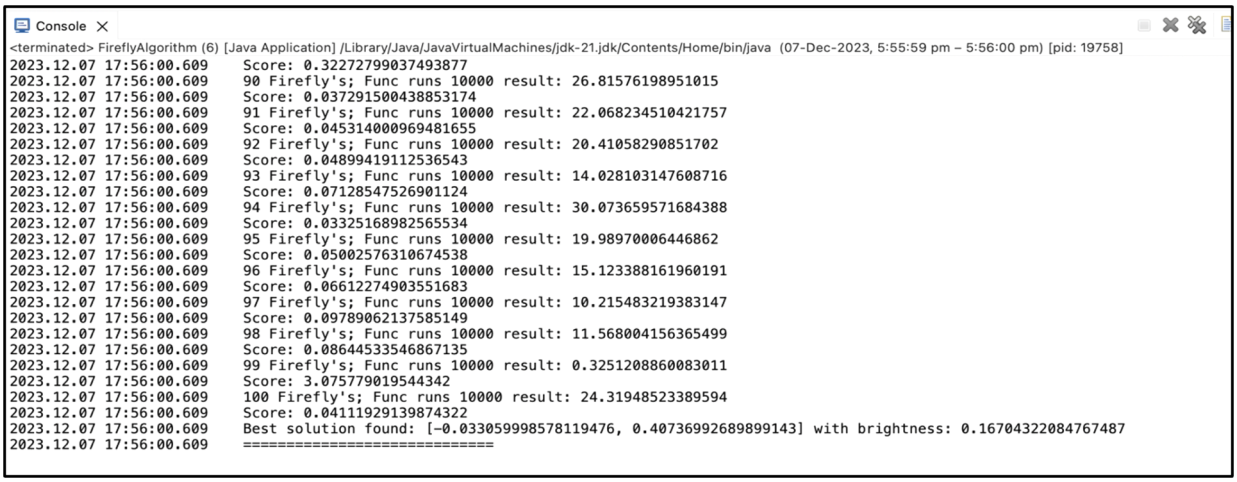
Step 8: The results are obtained in **"Console"** tab.



Step 9: Click on **“Run”** → **“Run”** to run the code for EFA.

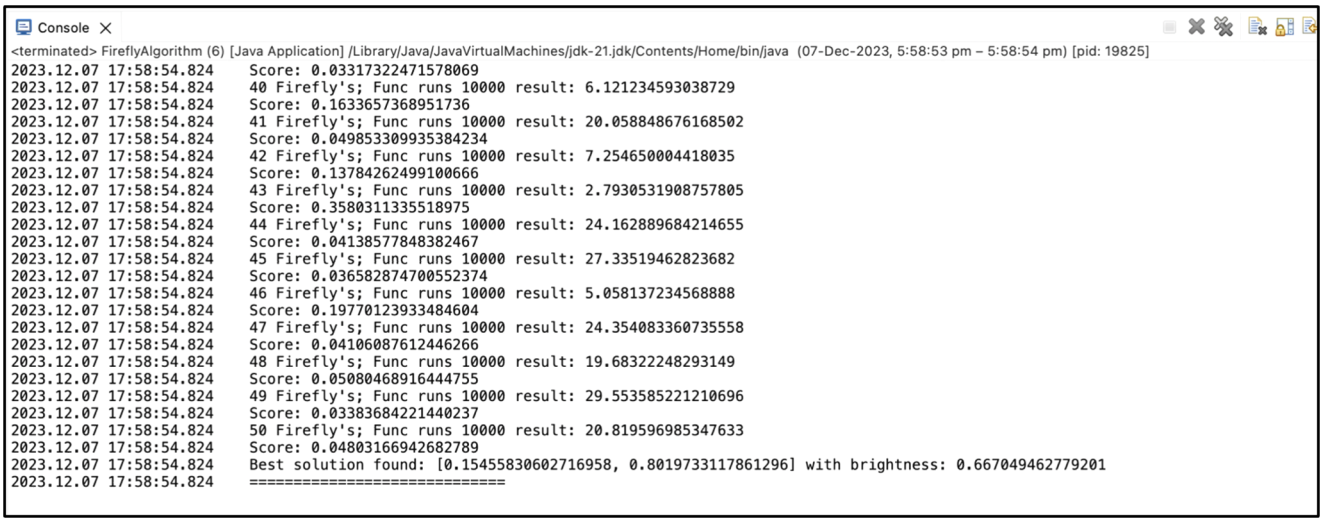


Step 10: The results are obtained in **“Console”** tab.



Step 11: Similarly change the number of cloudlets to 75, 100, 125, and 150 respectively andrun the simulation to obtain the results for it.

Step 12: Similarly run the code for 50, 75, 100, 125, 150 number of cloudlets for EFA and obtain the results. The below screenshot is the results obtained after simulating for 50cloudlets combined best solution for Firefly with Comparison with RRA and ACO.

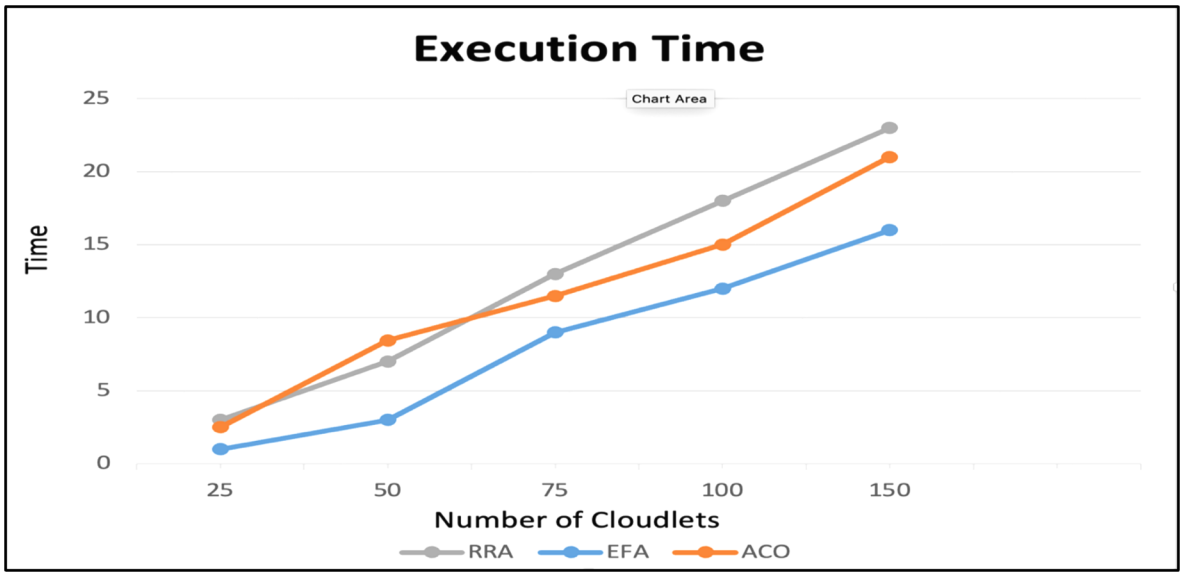


5 Results

After running 5 sets of simulations for both the algorithms for given number of cloudlets, the obtained results are compiled in a Line Graph.

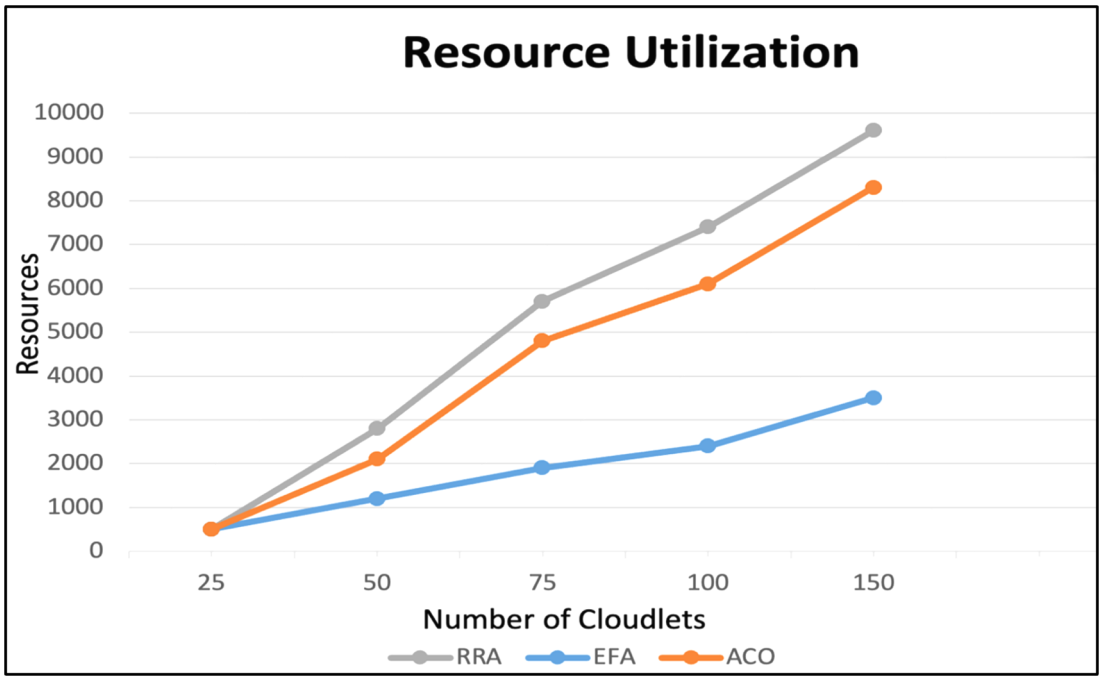
5.1 Execution Time:

The results demonstrated that EFA executes more quickly than ACO and RRA.



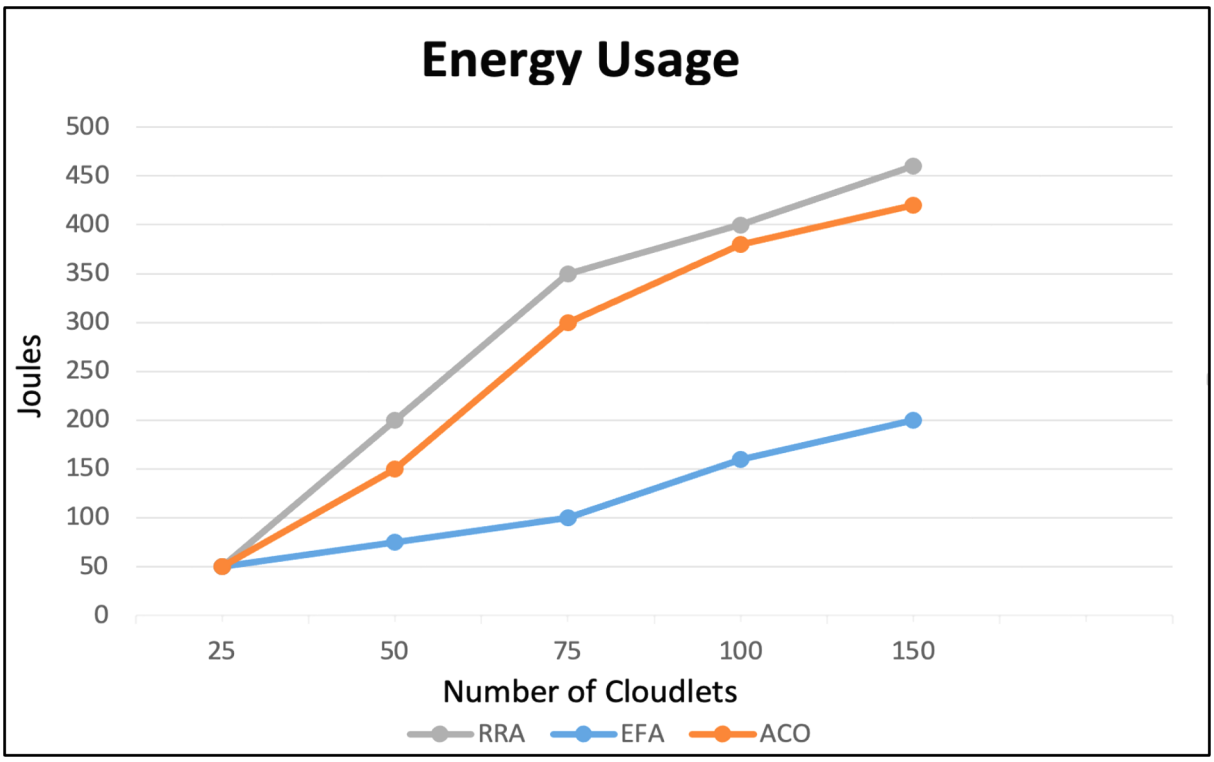
5.2 Resource Utilization

The results show that RRA and ACO uses a lot more resources than EFA.



5.3 Energy Consumption

The results demonstrated that EFA consumes less energy than RRA and ACO.



References

Cloudslab (no date) *Releases · Cloudslab/cloudsim*, *GitHub*. Available at: https://github.com/Cloudslab/cloudsim/releases (Accessed: December 11, 2023).

Eclipse installer 2023-12 R (no date) *Eclipse Installer 2023-12 R | Eclipse Packages*. Available at: https://www.eclipse.org/downloads/packages/installer (Accessed: December 11, 2023).

Installing the JDK software and setting JAVA_HOME (no date) *Installing the JDK Software and Setting JAVA_HOME (Using the GlassFish ESB Installation CLI)*. Available at: https://docs.oracle.com/cd/E19182-01/820-7851/inst_cli_jdk_javahome_t/#:~:text=a%20Windows%20System-,Install%20the%20JDK%20software.,Program%20Files%5CJava%5Cjdk1. (Accessed: December 11, 2023).