

# Configuration Manual

MSc Research Project  
Cloud Computing

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**National College of Ireland**  
**MSc Project Submission Sheet**  
**School of Computing**



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**Programme:** .....MSc Cloud Computing..... **Year:** .....2023

**Module:** .....MSc Research Project.....

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**Project Title:** .....Cost Optimization in Hybrid Cloud Architecture

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# Configuration Manual

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## 1 Introduction

This manual describes how to set up and run the CloudSim-based project, which blends Q-learning with the ACO and HCOC algorithms for comparisons and compares the outcomes for cloud computing simulations. It provides instructions for academics and students on how to install required software and operate the CloudSimACO project.

## 2 Required Software Tools

The following software tools are required for the CloudSimACO project's execution:

- Eclipse IDE: This tool is used for the implementation of java code for this research project.
- CloudSim Toolkit: A simulation framework for cloud computing environments.
- JDK 17 version: It consists of Java libraries that are required for running the suggested algorithm.

## 3 Hardware Requirements

- Operating system: Windows/ Mac/ Linux (We can use any OS).
- RAM: Minimum 4GB / 8GB or more than needed.
- Processor: Any Processor from the Intel Core is suitable.

## 4 Step by Step Software Installation

The steps for the installation of software and tools are shown below.

### 4.1 JDK Installation

- Java Development Kit (JDK)
- Download JDK 17.0.9 version from the specified Link [1].

Operating System / Architecture	File Size	Download URL
Linux x64 RPM Package	173.73 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_linux-x64_bin.rpm">https://download.oracle.com/java/17/archive/jdk-17.0.9_linux-x64_bin.rpm (sha256 )</a>
macOS Arm 64 Compressed Archive	168.18 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-aarch64_bin.tar.gz">https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-aarch64_bin.tar.gz (sha256 )</a>
macOS Arm 64 DMG Installer	167.60 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-aarch64_bin.dmg">https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-aarch64_bin.dmg (sha256 )</a>
macOS x64 Compressed Archive	170.62 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-x64_bin.tar.gz">https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-x64_bin.tar.gz (sha256 )</a>
macOS x64 DMG Installer	170.03 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-x64_bin.dmg">https://download.oracle.com/java/17/archive/jdk-17.0.9_macos-x64_bin.dmg (sha256 )</a>
Windows x64 Compressed Archive	172.42 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.zip">https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.zip (sha256 )</a>
<b>Windows x64 Installer</b>	<b>153.51 MB</b>	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.exe">https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.exe (sha256 )</a>
Windows x64 MSI Installer	152.30 MB	<a href="https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.msi">https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.msi (sha256 )</a>

Figure 1: Download Java Development Kit (JDK)

- Install the JDK 17.0.9 Version into the system.



Figure 2: JDK Installation

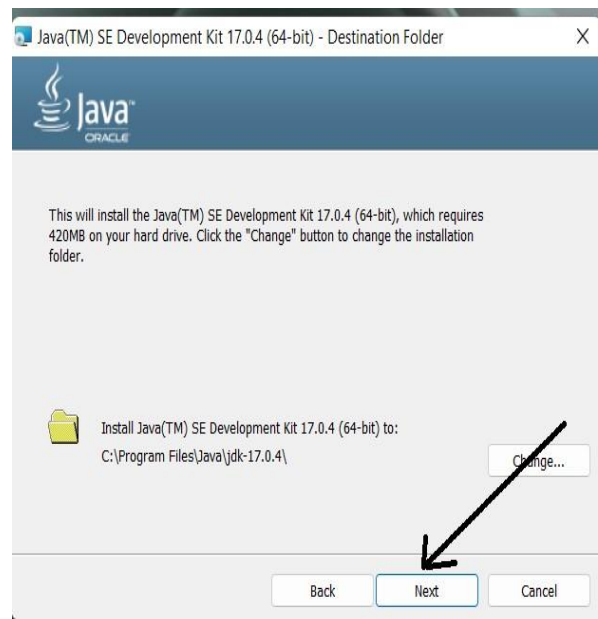


Figure 3: Installation of JDK

## 4.2 Eclipse IDE Installation

- Download the Eclipse Integrated Development Environment 2022-06 from the given link [2]

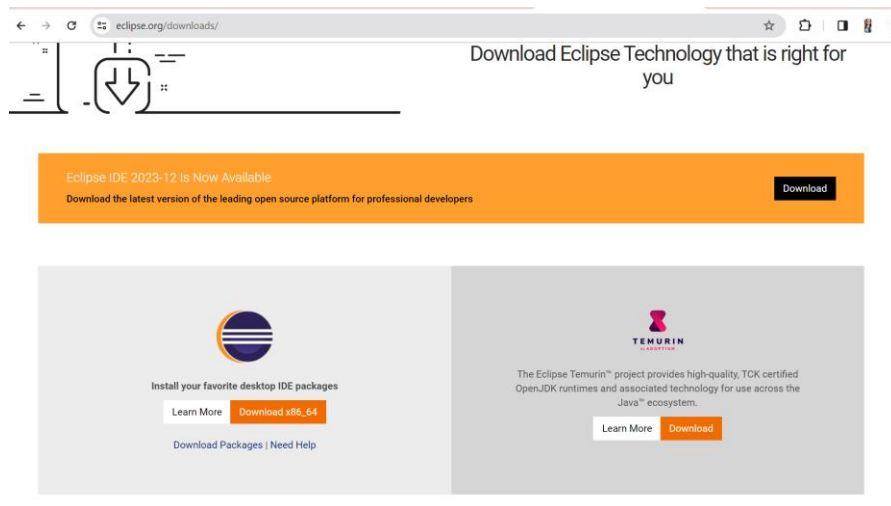


Figure 4:- Download Eclipse

- Install the download Eclipse IDE 2022-06 in system

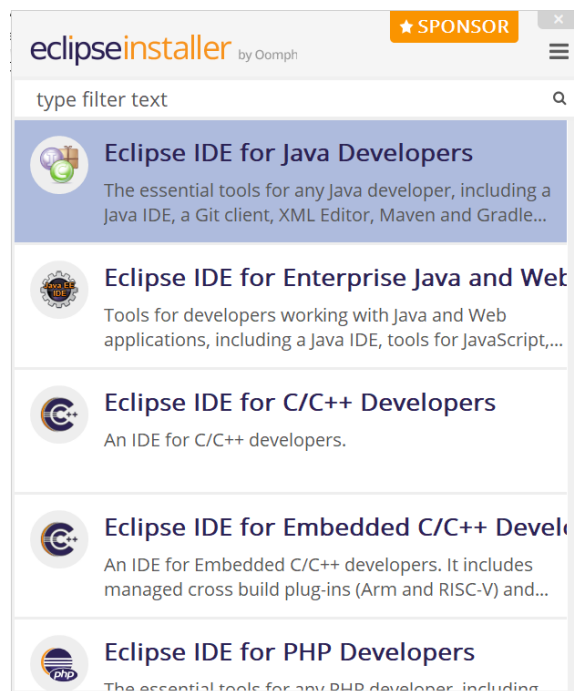


Figure 5: Install Eclipse

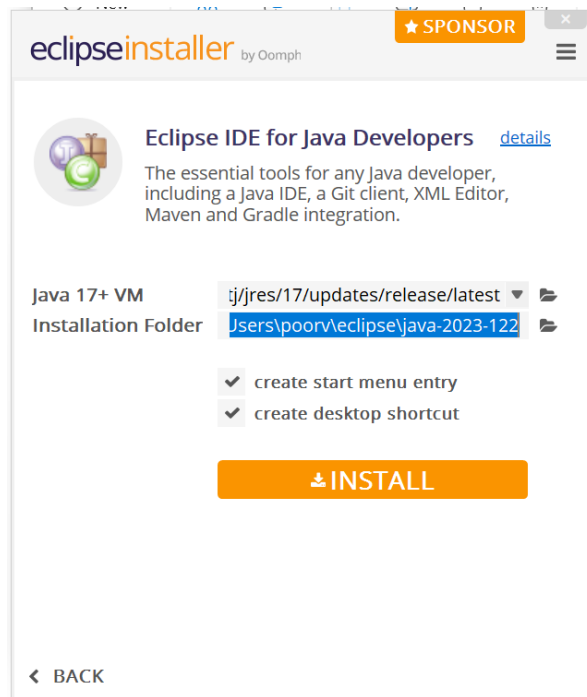


Figure 6: Final step in Eclipse Installation

- Make Sure the java JDK version before installing Eclipse IDE
- Now open the Eclipse and create a workspace.

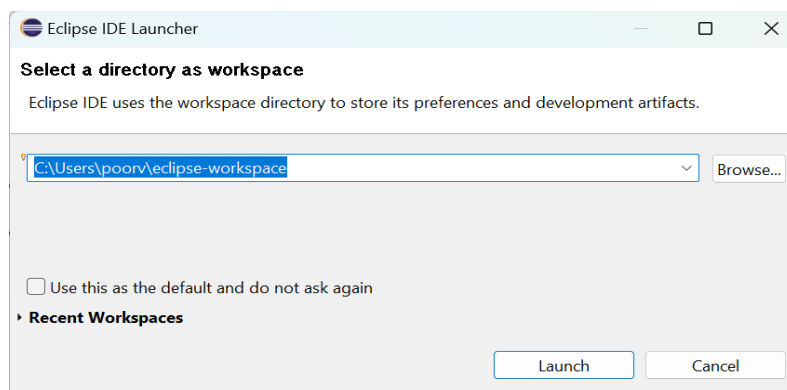


Figure 7:- Workspace Creation for Eclipse IDE

- The created workspace shouldn't be changed. Otherwise, the work done will not be available.
- Now create a new Java project in Eclipse IDE

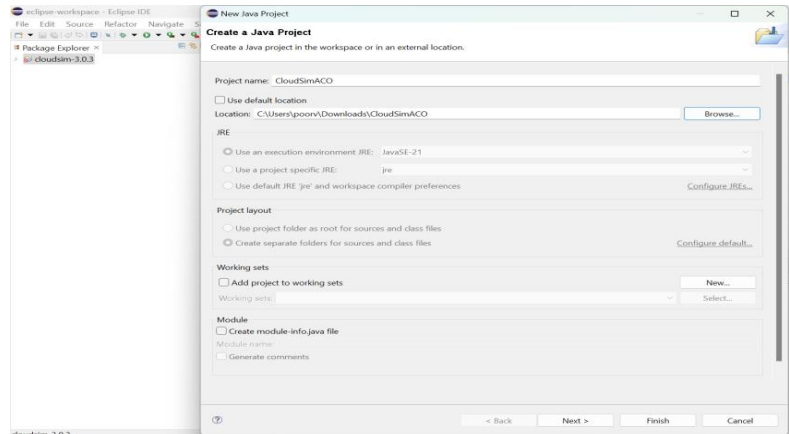


Figure 8: The new project creation in Eclipse IDE

- Make sure the Java Version and name a project of your interest.

### 4.3 Installation of 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>

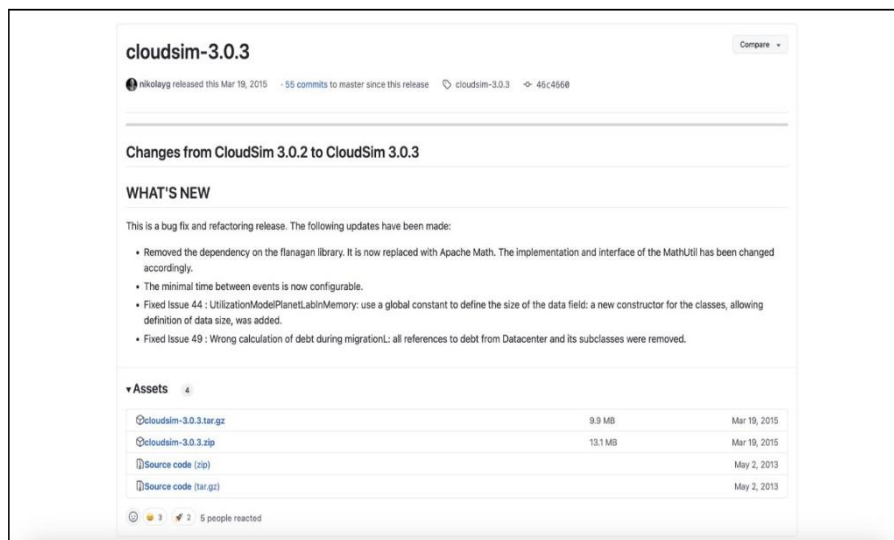


Figure 9: Download the CloudSim

- Importing the downloaded file into Eclipse.

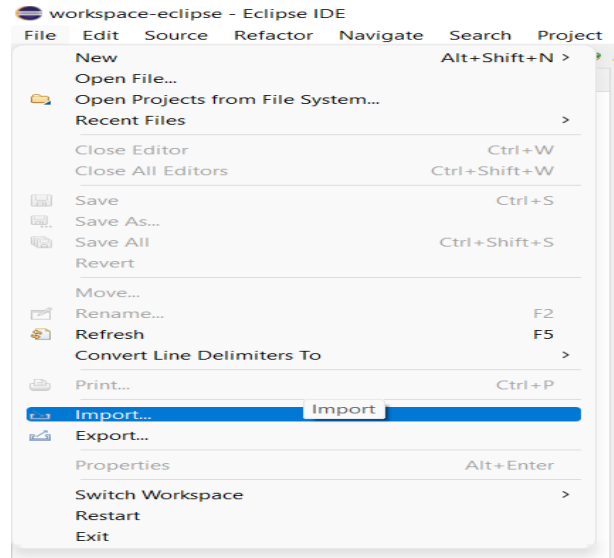
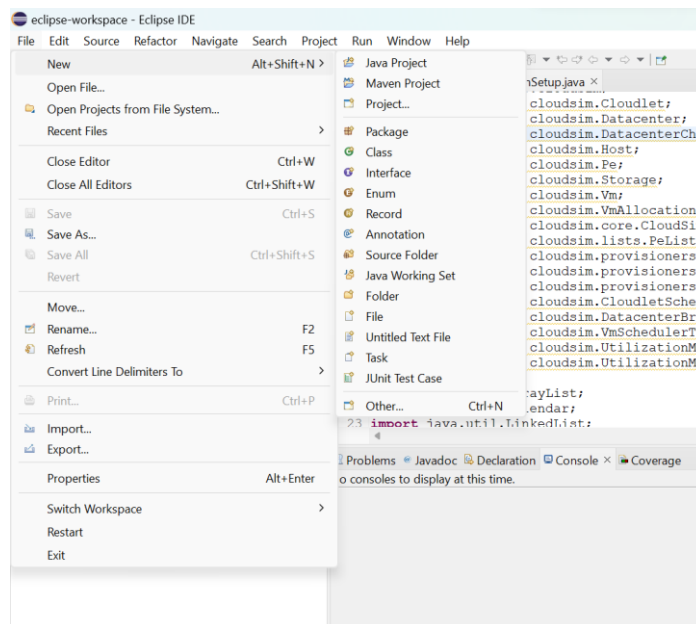


Figure 10: Import option in Eclipse IDE

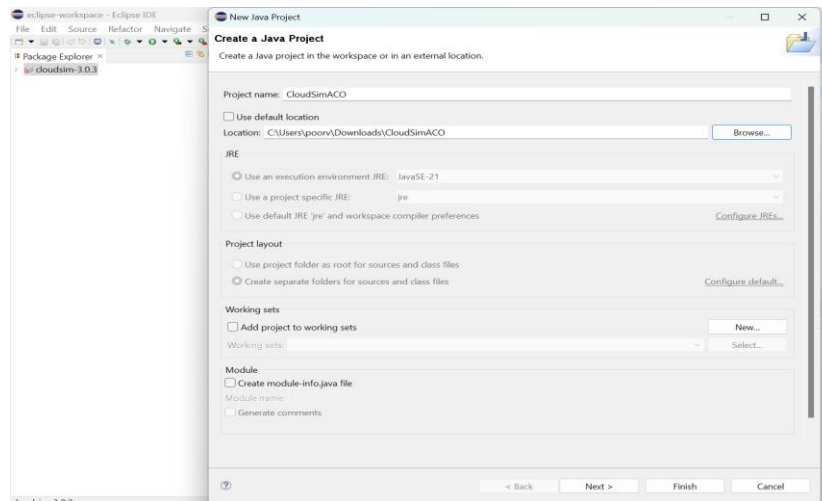
## 5 Running the Proposed Algorithm

**Step 1:** To create a new java project, click on **File** → **New** → **Java Project**.

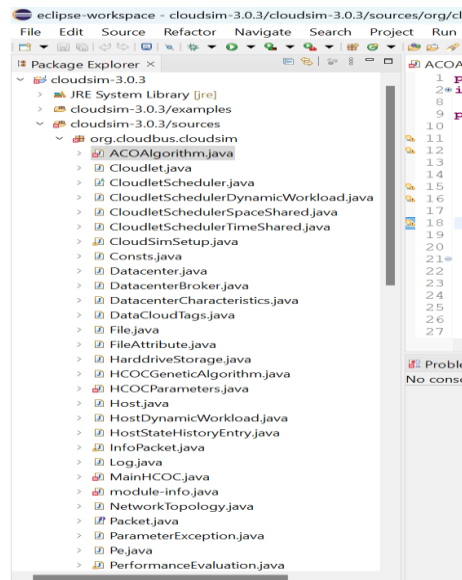


**Step 2:** Give your project a name in the field **“Project Name”** and untick the option **“Use default location”**. Click on **“Browse”** to select the path where you have downloaded CloudSimv3.0.3. Then click on **“Finish”**.

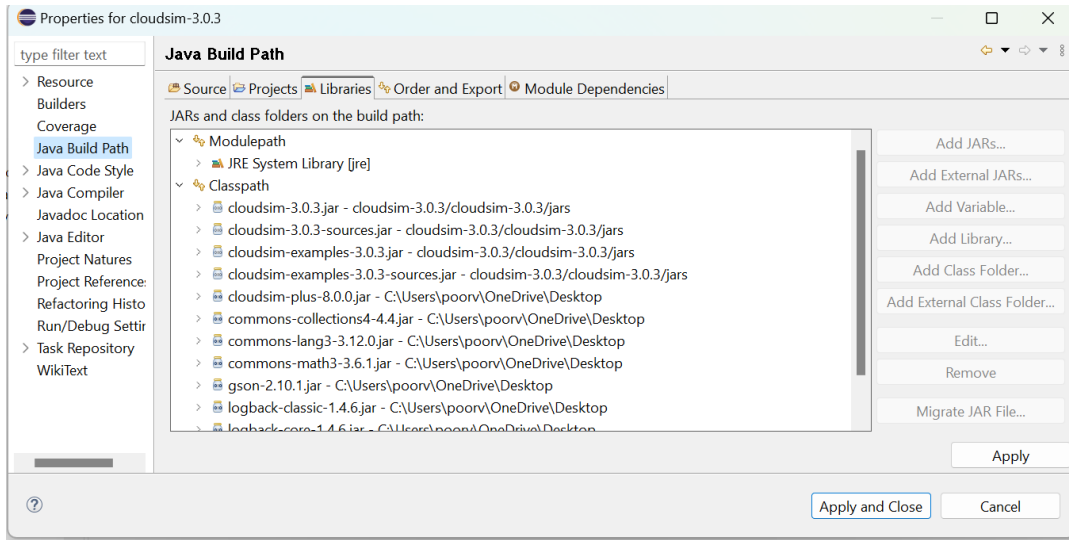




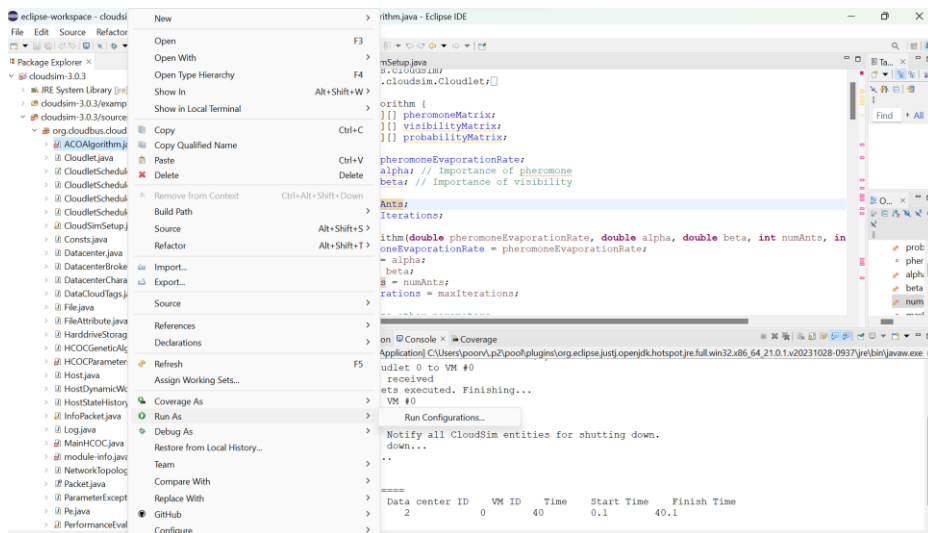
**Step 3:** Double click on files to open them.



**Step 4 :** Add the .jar file, open the file and go to properties. Click on Java Build Path and add the required .jar files.



**Step 5:** For running the algorithms, click on the Algorithm file name and run to get the simulation output.



**Step 6:** The output will be shown in console.

```

eclipse-workspace - cloudsim-3.0.3/cloudsim-3.0.3/sources/org/cloudbus/cloudsim/ACOAlgorithm.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Console x
<terminated> CloudSimSetup [Java Application] C:\Users\poorv.p2\poo\plugins\org.eclipse.justi.openjdk.hotspot.jre.full.win32.x86_64_21.0.1.v20231028-0937\jre\bin\javaw.exe (11-
Initialising...
Starting CloudSim version 3.0
Datacenter_0 is starting...
Broker is starting...
Entities started.
0.0: Broker: Cloud Resource List received with 1 resource(s)
0.0: Broker: Trying to Create VM #0 in Datacenter_0
0.1: Broker: VM #0 has been created in Datacenter #2, Host #0
0.1: Broker: Sending cloudlet 0 to VM #0
40.1: Broker: Cloudlet 0 received
40.1: Broker: All Cloudlets executed. Finishing...
40.1: Broker: Destroying VM #0
Broker is shutting down...
Simulation: No more future events
CloudInformationService: Notify all CloudSim entities for shutting down.
Datacenter_0 is shutting down...
Broker is shutting down...
Simulation completed.

===== OUTPUT =====
Cloudlet ID STATUS Data center ID VM ID Time Start Time Finish Time
0 SUCCESS 2 0 40 0.1 40.1
Simulation completed.

```

**Step 7:** Note the execution time for the algorithm by checking the “start time” and “finish time.” Repeat the same process by changing number of VMs and Cloudlets in the code.

**Step 8:** Repeat the same process for another algorithm and note the execution time.

**Step 9:** Run the Performance Evaluation file which shows the comparison of both the algorithm when integrated with Q-learning.

```

eclipse-workspace - cloudsim-3.0.3/cloudsim-3.0.3/sources/org/cloudbus/cloudsim/PerformanceEvaluation.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer x
ACOAlgorithm.java CloudSimSetup.java PerformanceEvaluation.java x
1 package org.cloudbus.cloudsim;
2 import java.util.Arrays;
3
4 public class PerformanceEvaluation {
5
6     public static void compareResults(int[] acoSolution, int[] hcooSolution) {
7         // Analyze and compare the results of ACO and HCOO simulations
8         double acoFitness = evaluateFitness(acoSolution);
9         double hcooFitness = evaluateFitness(hcooSolution);
10
11         System.out.println("Performance Evaluation:");
12         System.out.println("ACO Fitness: " + acoFitness);
13         System.out.println("HCOO Fitness: " + hcooFitness);
14
15         // Determine which algorithm performs better
16         if (acoFitness > hcooFitness) {
17             System.out.println("ACO performs better in the given context.");
18         } else if (acoFitness < hcooFitness) {
19             System.out.println("HCOO performs better in the given context.");
20         } else {
21             System.out.println("ACO and HCOO have similar performance in the given context.");
22         }
23     }
24
25     private static double evaluateFitness(int[] solution) {
26         // Implement your fitness evaluation logic here
27         // Modify this part based on your specific algorithm implementation
28         return Math.random(); // Placeholder for demonstration purposes
29     }
30
31     public static void main(String[] args) {
32         // Example: Assume you have results from ACO and HCOO simulations
33         int[] acoSolution = {0, 1, 0, 1, 1, 0, 1, 0, 1, 1}; // Replace with actual results
34         int[] hcooSolution = {1, 0, 1, 0, 0, 1, 0, 1, 0, 0}; // Replace with actual results
35
36         // Compare the results
37         compareResults(acoSolution, hcooSolution);
38     }
39 }

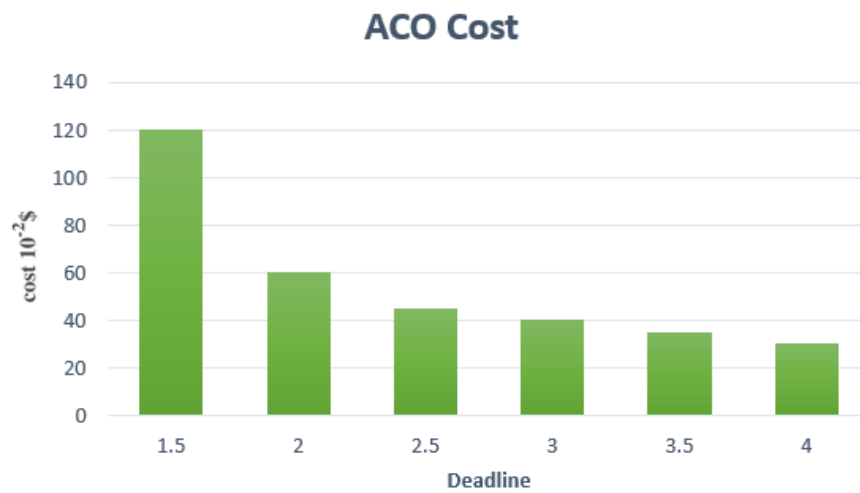
```

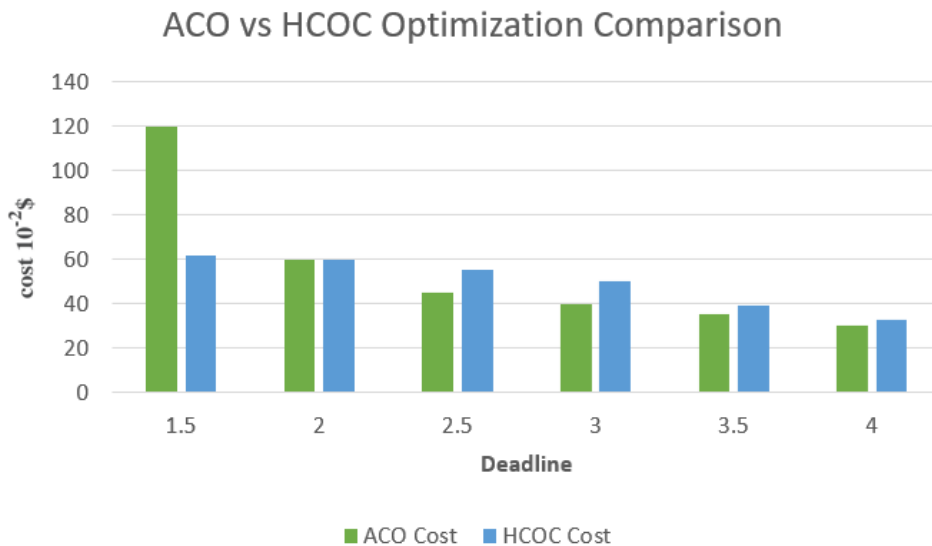
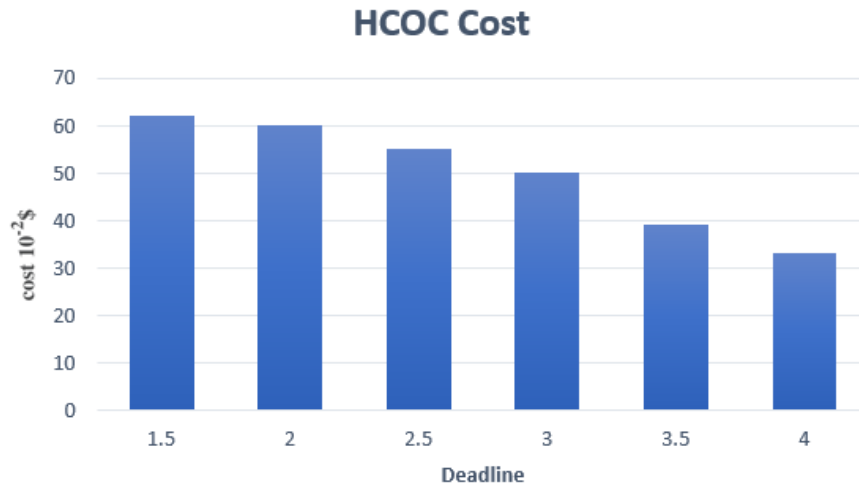
**Step 10:** The results are obtained in “Console” tab.

```
Console ×
<terminated> PerformanceEvaluation [Java Application] C:\Users\poorv\.p2\pool\plugins\
Performance Evaluation:
ACO Fitness: 0.9486055397516925
HCOC Fitness: 0.761250165506294
ACO performs better in the given context.
```

## Results

After running simulations for both the algorithms for given number of cloudlets, the obtained average execution time is used for calculating the execution cost of the algorithms. The results are then compiled in Graphs.





## References

- [1] “Oracle,” [Online]. Available: [https://download.oracle.com/java/17/archive/jdk-17.0.9\\_windows-x64\\_bin.exe](https://download.oracle.com/java/17/archive/jdk-17.0.9_windows-x64_bin.exe) (sha256) [Accessed August 2022].
- [2] “Eclipse Foundation,” Eclipse, [Online]. Available: <https://www.eclipse.org/downloads/aca>.
- [3] “CloudSim: A Framework For Modeling And Simulation Of Cloud Computing Infrastructures And Services,” The Cloud Computing and Distributed Systems (CLOUDS) Laboratory, University of Melbourne, [Online]. Available: <http://www.cloudbus.org/cloudsim/>. [Accessed June 2022].