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ASSIGNMENT – 6 (CLOUDSIM)

Introduction:-

- CloudSim is a widely used toolkit for modeling and simulating cloud computing infrastructures and services.
- It helps in simulating data centers, virtual machines, cloud providers, and energy-efficient cloud management.
- A brief overview of its use cases:
 - Research in cloud computing
 - Resource allocation and scheduling algorithms
 - Performance evaluation
 -

CloudSim is an open-source simulation framework used for modeling and simulating cloud computing environments and services. It allows researchers, developers, and engineers to experiment with and evaluate cloud infrastructure, resource management, and scheduling algorithms in a cost-effective and time-efficient way. The framework abstracts complex cloud environments into manageable components, enabling simulations of cloud data centers, virtual machines (VMs), cloudlets (tasks), and resource allocation policies.

Here are the steps to install the Cloudsim. Follow the below steps to go through ---

```
Activities  Terminal  Nov 21 12:15  deep@deep-VirtualBox: ~

deep@deep-VirtualBox:~$ sudo apt install default-jdk -y
[sudo] password for deep:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  apport-symptoms
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ca-certificates-java default-jdk-headless default-jre default-jre-headless fonts-dejavu-extra java-common libatk-wrapper-java
  libatk-wrapper-java-jni libice-dev libpthread-stubs0-dev libsm-dev libx11-dev libxau-dev libxcb1-dev libxdmcp-dev libxt-dev
  openjdk-11-jdk openjdk-11-jdk-headless openjdk-11-jre openjdk-11-jre-headless x11proto-dev xorg-sgml-doctools xtrans-dev
Suggested packages:
  libice-doc libsm-doc libx11-doc libxcb-doc libxt-doc openjdk-11-demo openjdk-11-source visualvm fonts-ipafont-gothic
  fonts-ipafont-mincho fonts-wqy-microhei | fonts-wqy-zenhei
The following NEW packages will be installed:
  ca-certificates-java default-jdk default-jdk-headless default-jre default-jre-headless fonts-dejavu-extra java-common
  libatk-wrapper-java libatk-wrapper-java-jni libice-dev libpthread-stubs0-dev libsm-dev libx11-dev libxau-dev libxcb1-dev
  libxdmcp-dev libxt-dev openjdk-11-jdk openjdk-11-jdk-headless openjdk-11-jre openjdk-11-jre-headless x11proto-dev
  xorg-sgml-doctools xtrans-dev
0 upgraded, 24 newly installed, 0 to remove and 124 not upgraded.
Need to get 122 MB of archives.
After this operation, 276 MB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 java-common all 0.72build2 [6,782 B]
Ign:2 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openjdk-11-jre-headless amd64 11.0.25+9-1ubuntu1-22.04
Get:3 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 default-jre-headless amd64 2:1.11-72build2 [3,042 B]
Ign:4 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 ca-certificates-java all 20190909ubuntu1.2
Get:5 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openjdk-11-jre amd64 11.0.25+9-1ubuntu1-22.04 [216 kB]
Get:6 http://security.ubuntu.com/ubuntu jammy-updates/main amd64 openjdk-11-jre-headless amd64 11.0.25+9-1ubuntu1-22.04 [42.6 MB]
Err:6 http://security.ubuntu.com/ubuntu jammy/main amd64 default-jre amd64 2:1.11-72build2
 400 Bad Request [IP: 185.125.190.82 80]
Get:7 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openjdk-11-jdk-headless amd64 11.0.25+9-1ubuntu1-22.04 [73.7 MB]
6% [2 openjdk-11-jre-headless 2,075 kB/42.6 MB 5%] [7 openjdk-11-jdk-headless 2,815 kB/73.7 MB 4%]
```

```
deep@deep-VirtualBox:~$ sudo apt update
Hit:1 http://in.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
Get:5 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [565 kB]
Get:6 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [2,174 kB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [1,952 kB]
28% [6 Packages 1,182 kB/2,174 kB 54%] [7 Packages 524 kB/1,952 kB 27%]
```

```
deep@deep-VirtualBox:~$ sudo apt install default-jdk
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
default-jdk is already the newest version (2:1.11-72build2).
The following package was automatically installed and is no longer required:
  apport-symptoms
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 142 not upgraded.
deep@deep-VirtualBox:~$
```

```
deep@deep-VirtualBox:~$ java --version
openjdk 11.0.25 2024-10-15
OpenJDK Runtime Environment (build 11.0.25+9-post-Ubuntu-1ubuntu122.04)
OpenJDK 64-Bit Server VM (build 11.0.25+9-post-Ubuntu-1ubuntu122.04, mixed mode, sharing)
deep@deep-VirtualBox:~$
```

```
deep@deep-VirtualBox:~$ sudo apt install maven
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  apport-symptoms
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  libaopalliance-java libapache-pom-java libatinject-jsr330-api-java libcdi-api-java libcommons-cli-java libcommons-io-java
  libcommons-lang3-java libcommons-parent-java libgeronimo-annotation-1.3-spec-java libgeronimo-interceptor-3.0-spec-java
  libguava-java libguice-java libhawtjni-runtime-java libjansi-java libjansi-native-java libjsr305-java libmaven-parent-java
  libmaven-resolver-java libmaven-shared-utils-java libmaven3-core-java libplexus-cipher-java libplexus-classworlds-java
  libplexus-component-annotations-java libplexus-interpolation-java libplexus-sec-dispatcher-java libplexus-utils2-java
  libsisu-inject-java libsisu-plexus-java libslf4j-java libwagon-file-java libwagon-http-shaded-java libwagon-provider-api-java
Suggested packages:
  libaopalliance-java-doc libatinject-jsr330-api-java-doc libel-api-java libcommons-io-java-doc libcommons-lang3-java-doc
  libasm-java libcglib-java libjsr305-java-doc libmaven-shared-utils-java-doc liblogback-java libplexus-classworlds-java-doc
  libplexus-sec-dispatcher-java-doc libplexus-utils2-java-doc junit4 testng libcommons-logging-java liblog4j1.2-java
The following NEW packages will be installed:
  libaopalliance-java libapache-pom-java libatinject-jsr330-api-java libcdi-api-java libcommons-cli-java libcommons-io-java
  libcommons-lang3-java libcommons-parent-java libgeronimo-annotation-1.3-spec-java libgeronimo-interceptor-3.0-spec-java
  libguava-java libguice-java libhawtjni-runtime-java libjansi-java libjansi-native-java libjsr305-java libmaven-parent-java
  libmaven-resolver-java libmaven-shared-utils-java libmaven3-core-java libplexus-cipher-java libplexus-classworlds-java
  libplexus-component-annotations-java libplexus-interpolation-java libplexus-sec-dispatcher-java libplexus-utils2-java
  libsisu-inject-java libsisu-plexus-java libslf4j-java libwagon-file-java libwagon-http-shaded-java libwagon-provider-api-java
  maven
0 upgraded, 33 newly installed, 0 to remove and 142 not upgraded.
Need to get 10.2 MB of archives.
After this operation, 13.3 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

```
deep@deep-VirtualBox:~$ mvn --version
Apache Maven 3.6.3
Maven home: /usr/share/maven
Java version: 11.0.25, vendor: Ubuntu, runtime: /usr/lib/jvm/java-11-openjdk-amd64
Default locale: en_IN, platform encoding: UTF-8
OS name: "linux", version: "6.8.0-40-generic", arch: "amd64", family: "unix"
deep@deep-VirtualBox:~$
```

```
deep@deep-VirtualBox:~$ git clone https://github.com/Cloudslab/cloudsim.git
Cloning into 'cloudsim'...
remote: Enumerating objects: 20742, done.
remote: Counting objects: 100% (1738/1738), done.
remote: Compressing objects: 100% (355/355), done.
remote: Total 20742 (delta 1437), reused 1383 (delta 1383), pack-reused 19004 (from 1)
Receiving objects: 100% (20742/20742), 8.10 MiB | 865.00 KiB/s, done.
Resolving deltas: 100% (5264/5264), done.
deep@deep-VirtualBox:~$
```

```
deep@deep-VirtualBox:~$ cd cloudsim/
deep@deep-VirtualBox:~/cloudsim$ ls
changelog.md cloudsim7.uml custom_log.properties documentation modules pom.xml README.md
deep@deep-VirtualBox:~/cloudsim$
```

```
deep@deep-VirtualBox:~/cloudsim$ mvn clean install
[INFO] Scanning for projects...
[INFO]
[INFO] Reactor Build Order:
[INFO]
[INFO] cloudsim-package [pom]
[INFO] cloudsim [jar]
[INFO] cloudsim-examples [jar]
[INFO]
[INFO] -----< org.cloudbus.cloudsim:cloudsim-package >-----
[INFO] Building cloudsim-package 7.0.0-alpha [1/3]
[INFO] -----[ pom ]-----
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-clean-plugin/2.5/maven-clean-plugin-2.5.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-clean-plugin/2.5/maven-clean-plugin-2.5.pom (3.9 kB at 901 B/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-plugins/22/maven-plugins-22.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-plugins/22/maven-plugins-22.pom (13 kB at 145 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-parent/21/maven-parent-21.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/maven-parent/21/maven-parent-21.pom (26 kB at 290 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/apache/10/apache-10.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/apache/10/apache-10.pom (15 kB at 176 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-clean-plugin/2.5/maven-clean-plugin-2.5.jar
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-clean-plugin/2.5/maven-clean-plugin-2.5.jar (25 kB at 254 kB/s)
```

```

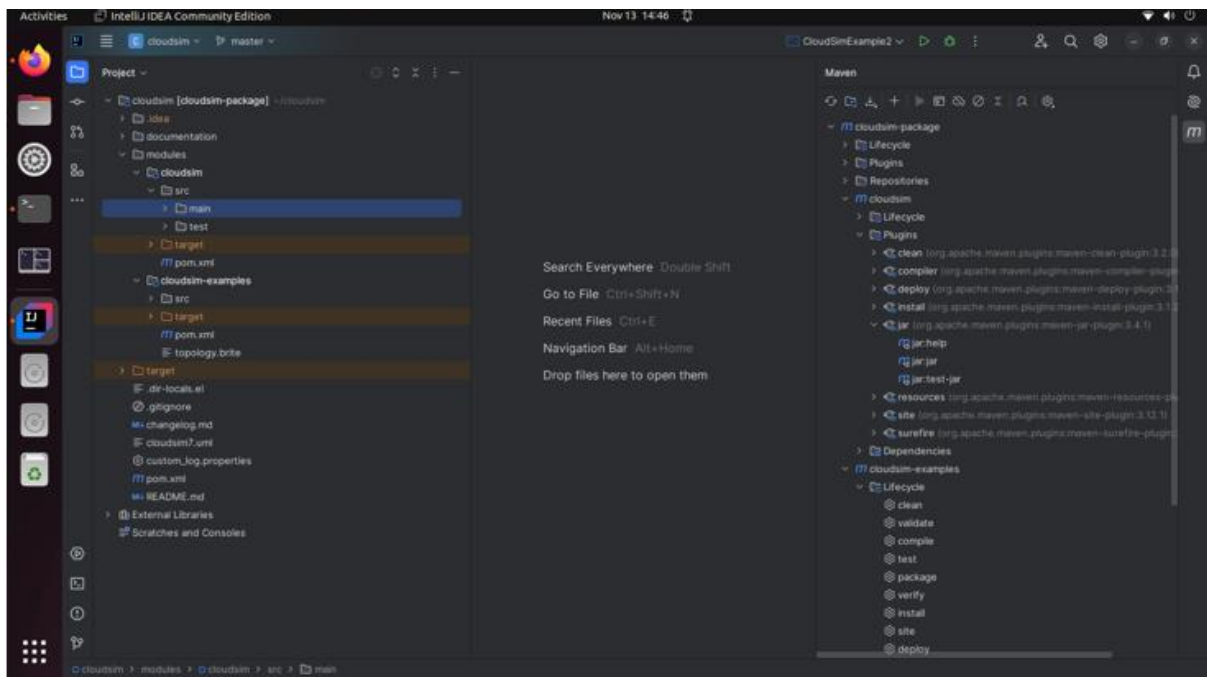
-----
T E S T S
-----
Running org.cloudbus.cloudsim.HostDynamicWorkloadTest
Tests run: 6, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.819 sec
Running org.cloudbus.cloudsim.CloudletTest
Tests run: 6, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.002 sec
Running org.cloudbus.cloudsim.power.PowerSelectionPolicyMaximumCorrelationTest
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.315 sec
Running org.cloudbus.cloudsim.power.models.PowerModelSqrtTest
Tests run: 5, Failures: 0, Errors: 0, Skipped: 1, Time elapsed: 0.011 sec
Running org.cloudbus.cloudsim.power.models.PowerModelSpecPowerIbmX3550XeonX5675Test
Tests run: 3, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0 sec
Running org.cloudbus.cloudsim.power.models.PowerModelLinearTest
Tests run: 5, Failures: 0, Errors: 0, Skipped: 1, Time elapsed: 0.006 sec
Running org.cloudbus.cloudsim.power.models.PowerModelCubicTest
Tests run: 5, Failures: 0, Errors: 0, Skipped: 1, Time elapsed: 0.001 sec
Running org.cloudbus.cloudsim.power.models.PowerModelSquareTest
Tests run: 5, Failures: 0, Errors: 0, Skipped: 1, Time elapsed: 0.003 sec
Running org.cloudbus.cloudsim.power.PowerHostTest
Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.006 sec
Running org.cloudbus.cloudsim.CloudletSchedulerSingleServiceTest
Tests run: 15, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.149 sec
Running org.cloudbus.cloudsim.util.WorkloadFileReaderTest
Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 6.107 sec
Running org.cloudbus.cloudsim.util.HistoryStatTest
HistoryStat: 2802528, utilizationHistory: 42181441
HistoryStat: 1779474, utilizationHistory: 71110972
HistoryStat: 1330008, utilizationHistory: 52945912
HistoryStat: 2757428, utilizationHistory: 50115534
HistoryStat: 6585838, utilizationHistory: 38024596

[INFO] --- maven-resources-plugin:2.6:testResources (default-testResources) @ cloudsim-examples ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /home/mitsu/cloudsim/modules/cloudsim-examples/src/test/resources
[INFO]
[INFO] --- maven-compiler-plugin:3.1:testCompile (default-testCompile) @ cloudsim-examples ---
[INFO] No sources to compile
[INFO]
[INFO] --- maven-surefire-plugin:2.12.4:test (default-test) @ cloudsim-examples ---
[INFO] No tests to run.
[INFO]
[INFO] --- maven-jar-plugin:2.4:jar (default-jar) @ cloudsim-examples ---
[INFO] Building jar: /home/mitsu/cloudsim/modules/cloudsim-examples/target/cloudsim-examples-7.0.0-alpha.jar
[INFO]
[INFO] --- maven-install-plugin:2.4:install (default-install) @ cloudsim-examples ---
[INFO] Installing /home/mitsu/cloudsim/modules/cloudsim-examples/target/cloudsim-examples-7.0.0-alpha.jar to /home/mitsu/.m2/repository/org/cloudbus/cloudsim/cloudsim-examples/7.0.0-alpha/cloudsim-examples-7.0.0-alpha.jar
[INFO] Installing /home/mitsu/cloudsim/modules/cloudsim-examples/pom.xml to /home/mitsu/.m2/repository/org/cloudbus/cloudsim/cloudsim-examples/7.0.0-alpha/cloudsim-examples-7.0.0-alpha.pom
[INFO]
[INFO] -----
[INFO] Reactor Summary for cloudsim-package 7.0.0-alpha:
[INFO]
[INFO] cloudsim-package ..... SUCCESS [ 9.025 s]
[INFO] cloudsim ..... SUCCESS [01:10 min]
[INFO] cloudsim-examples ..... SUCCESS [ 10.313 s]
[INFO]
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 01:20 min

```

After the successful download. We can go through the next processes.

Then we should go to the IntelliJidea download page to continue download the ide.



Importing CloudSim into Idea IDE:-

1. Open the **CloudSim** project in Eclipse.
2. Navigate to the sample simulation file (typically in the examples folder).
3. Right-click on the sample class (e.g., CloudSimExample3.java),
4. Add 2 hosts in the data center in the createDatacenter() function


```

191
192 // 2. A Machine contains one or more PEs or CPUs/Cores.
193 // In this example, it will have only one core.
194 List<Pe> peList = new ArrayList<>();
195
196 int mips = 1000;
197
198 // 3. Create PEs and add these into a list.
199 peList.add(new Pe(id: 1, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
200 peList.add(new Pe(id: 2, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
201 peList.add(new Pe(id: 3, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
202 peList.add(new Pe(id: 4, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
203 peList.add(new Pe(id: 5, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
204 peList.add(new Pe(id: 6, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
205 peList.add(new Pe(id: 6, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
206 peList.add(new Pe(id: 7, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
207
208 //4. Create Hosts with its id and list of PEs and add them to the list of machines
209 int hostId=0;
210 int ram = 16 * 1024; //host memory (MB)
211 long storage = 1024 * 1024; //host storage
212 int bw = 10000;

```

```

227
228 peList2.add(new Pe(id: 0, new PeProvisionerSimple(mips)));
229 peList2.add(new Pe(id: 1, new PeProvisionerSimple(mips)));
230 peList2.add(new Pe(id: 2, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
231 peList2.add(new Pe(id: 3, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
232 peList2.add(new Pe(id: 4, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
233 peList2.add(new Pe(id: 5, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
234 peList2.add(new Pe(id: 6, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
235 peList2.add(new Pe(id: 7, new PeProvisionerSimple(mips))); // need to store Pe id and MIPS Rating
236

```

5. Add 4 vms and 6 cloudlets into the datacenters

```

83         //VM description
84         int vmid = 0;
85         int mips = 250;
86         long size = 100 * 1024; //image size (MB)
87         int ram = 4 * 1024; //vm memory (MB)
88         long bw = 1000;
89         int pesNumber = 2; //number of cpus
90         String vmm = "Xen"; //VMM name
91
92         //create two VMs
93         Vm vm1 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
94
95         //the second VM will have twice the priority of VM1 and so will receive twice CPU time
96         vmid++;
97         Vm vm2 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
98
99         vmid++;
100        Vm vm3 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
101
102        vmid++;
103        Vm vm4 = new Vm(vmid, brokerId, mips, pesNumber, ram, bw, size, vmm, new CloudletSchedulerTimeShared());
104
105        //add the VMs to the vmList
106        vmList.add(vm1);
107        vmList.add(vm2);
108        vmList.add(vm3);
109        vmList.add(vm4);
110

```

Output

```

Starting CloudSimExample3...
Initialising...
Starting CloudSim version 7.0
0.0: Datacenter_0 is starting...
0.0: Broker is starting...
Entities started.
0.0: Broker: Cloud Resource List received with 1 datacenter(s)
0.0: Broker: Trying to Create Vm #0 in Datacenter_0
0.0: Broker: Trying to Create Vm #1 in Datacenter_0
0.0: Broker: Trying to Create Vm #2 in Datacenter_0
0.0: Broker: Trying to Create Vm #3 in Datacenter_0
0.0: Datacenter_0.vmAllocator: .vmAllocator]: Vm #0 has been allocated to Host #0
0.0: Datacenter_0.vmAllocator: .vmAllocator]: Vm #1 has been allocated to Host #1
0.0: Datacenter_0.vmAllocator: .vmAllocator]: Vm #2 has been allocated to Host #0
0.0: Datacenter_0.vmAllocator: .vmAllocator]: Vm #3 has been allocated to Host #1
0.01: Broker: Vm #0 has been created in Datacenter #2, Host #0
0.01: Broker: Vm #1 has been created in Datacenter #2, Host #1
0.01: Broker: Vm #2 has been created in Datacenter #2, Host #0
0.01: Broker: Vm #3 has been created in Datacenter #2, Host #1
0.01: Broker: Sending Cloudlet #0 to Vm #0
0.01: Broker: Sending Cloudlet #1 to Vm #1
0.01: Broker: Sending Cloudlet #2 to Vm #2
0.01: Broker: Sending Cloudlet #3 to Vm #3
0.01: Broker: Sending Cloudlet #4 to Vm #0
0.01: Broker: Sending Cloudlet #5 to Vm #1
100.01: Broker: Cloudlet #0 return received
100.01: Broker: The number of finished Cloudlets is:1
100.01: Broker: Cloudlet #4 return received
100.01: Broker: The number of finished Cloudlets is:2
100.01: Broker: Cloudlet #2 return received
100.01: Broker: The number of finished Cloudlets is:3
100.01: Broker: Cloudlet #1 return received

```

```
160.01: Broker: The number of finished Cloudlets is:3
160.01: Broker: Cloudlet #1 return received
160.01: Broker: The number of finished Cloudlets is:4
160.01: Broker: Cloudlet #5 return received
160.01: Broker: The number of finished Cloudlets is:5
160.01: Broker: Cloudlet #3 return received
160.01: Broker: The number of finished Cloudlets is:6
160.01: Broker: All Cloudlets executed. Finishing...
160.01: Broker: Destroying Vm #0
160.01: Broker: Destroying Vm #1
160.01: Broker: Destroying Vm #2
160.01: Broker: Destroying Vm #3
160.01: Broker is shutting down...
160.01: Simulation: No more future events
160.01: CloudInformationService is shutting down...
160.01: CloudInformationService: Notify all CloudSim entities for shutting down.
160.01: Datacenter_0 is shutting down...
160.01: Broker is shutting down...
Simulation completed.
Simulation completed.

***** OUTPUT *****
Cloudlet ID   STATUS   Data center ID   VM ID   Time   Start Time   Finish Time
0            SUCCESS      2              0      160      0.01      160.01
4            SUCCESS      2              0      160      0.01      160.01
2            SUCCESS      2              2      160      0.01      160.01
1            SUCCESS      2              1      160      0.01      160.01
5            SUCCESS      2              1      160      0.01      160.01
3            SUCCESS      2              3      160      0.01      160.01
CloudSimExample3 finished!

Process finished with exit code 0
```