Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code: MCAL51

Course Outcome for DCCC lab

CO	Course Outcome	PO / PSO MAPPING	Cognitive Level
CO1	Develop RPC and RMI on the given scenario.	PO1, PO 2, PO5	Applying
CO2	Analyze Clock Synchronization and Election algorithms	PO1, PO 2, PO4, PO5	Analyzing
CO3	Apply Shared memory and load balancing on the given situation	PO1, PO 2, PO5	Applying
CO4	Analyze various case studies on cloud computing	PO 2, PO5	Analyzing

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code: MCAL51

LABORATORY ASSESSMENT

STUDENT NAME: Hammad Ansari   ROLL NO: 2018450002

Very Good(1/2/0.5), Good(0.8),   Average(0.5) or Poor(0.3).

Exp No.	PI1 On-Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
1	0.5	1	0.8	1	0.6	0.5	4.4	
2	0.5	1	0.8	0.5	0.9	0.5	4.2	
3	0.5	1	0.8	0.8	1	0.5	4.6	
4	0.5	0.7	0.8	0.8	0.8	0.5	4.1	
5	0.5	1	0.8	0.8	1	0.5	4.6	
6	0.3	0.7	0.8	0.8	0.8	0.5	3.9	
7	0.5	1	1	0.7	0.8	0.5	4.5	
8	0.5	1	1	0.7	0.8	0.5	4.5	
Remark : Total = 34.8								

_____   _____

Faculty In-Charge   **Head of the Department**

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL INSTITUTE OF TECHNOLOGY
MUNSHI NAGAR, ANDHERI (WEST), MUMBAI – 400 058.
(Autonomous College Affiliated to University of Mumbai)
MASTER OF COMPUTER APPLICATIONS

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code**:** MCAL51

ROLL NO: 2018450002   **BATCH: A**

NAME: Hammad Ansari

EXPERIMENT NO: 01

EXPERIMENT TITLE: Implement Chat application using socket

Objective:

1. To study socket programming.

1.1. To Implement Single Client and Server Communication.
1.2. To Implement Multiple Client and Server Communication

DATE TURN 1: 04/08/2020   **DATE TURN 2:** 11/08/2020

PRACTICAL EVALUATION:

Sr. No.	PI1 On-Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
1.1	0.5	1	0.7	1	0.5	0.5	4.2	
1.2	0.5	1	0.9	1	0.7	0.5	4.6	
Total	0.5	1	0.8	1	0.6	0.5	4.4	

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OBSERVATIONS:

Socket Programming:

- Socket Programming is used for communication between the applications running on different JRE.
- The two major classes used are ServerSocket and Socket, where ServerSocket objects are responsible for creating a server, which will open the communication using parameters which may include port and IP address.
- The Socket object is then responsible for establishing a communication with the server using the correct IP and port number.
- To implement multi-client communication, we must use an inner class and a thread to handle the clients simultaneously.

Inner Class:

- In a multi-client application, we need to use an inner class and a thread.
- Creating an inner class for every thread is a very efficient way to handle socket individually.
- The inner class handles each socket that is connected to the server, creating an instance of the inner class on a separate thread.

REMARK

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

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ROLL NO. : 2018450002   **BATCH: A**

NAME: Hammad Ansari

EXPERIMENT NO: 02

EXPERIMENT TITLE: Implement Remote Procedure Call

Objective:

2.1 To Implement Arithmetic Calculator using RPC

2.2 To Implement Arithmetic Calculator using RMI

2.3 Client sends a number Server containing the date and time of the server.

2.4 The client should provide an equation to the server through an interface. The server will solve the

The expression is given by the client. $(a-b)2 = a2 - 2ab + b2$ using RMI and RPC

DATE TURN 1: 18/08/2020   **DATE TURN 2:** 25/08/2020

DATE TURN 3:   01/09/2020

PRACTICAL EVALUATION:

Sr.No.	PI1 On-Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
2.1	0.5	1	0.5	0.4	0.6	0.5	3.5	
2.2	0.5	1	1	0.6	1	0.5	4.6	
2.3	0.5	1	0.9	0.4	1	0.5	4.3	
2.4	0.5	1	0.8	0.6	1	0.5	4.4	
Total	0.5	1	0.8	0.5	0.9	0.5	4.2	

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

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OBSERVATIONS:

Difference between RMI and RPC

- RPC has a very typical way to communicate whereas RMI invokes the function through objects.
- In RPC we pass only simple arguments such as integers and doubles but in RMI we are passing objects.
- As per my understanding, RPC is procedural programming since it waits for each request to complete/fulfill whereas RMI is based on object-oriented programming and can invoke multiple objects at a time.
- RPC uses socket from java.net package whereas RMI uses bind/rebind functions from java.rmi
- RPC creates a server whereas RMI creates an API

REMARK

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code: MCAL51

ROLL NO. : 2018450002   **BATCH: A**

NAME: Hammad Ansari

EXPERIMENT NO: 03

EXPERIMENT TITLE: Implementation of Clock synchronization.

Objective:

> 3.1 To implement Cristian's Algorithm
>
> 3.2 To Implement Berkeley Algorithm
>
> 3.3 To implement Lamport Algorithm

DATE TURN 1: 08/09/2020   **DATE TURN 2:** 15/09/2020

PRACTICAL EVALUATION:

Sr.No.	PI1 On Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
3.1	0.5	1	0.7	0.9	1	0.5	4.6	
3.2	0.5	1	0.9	0.8	1	0.5	4.7	
3.3	0.5	1	0.8	0.7	1	0.5	4.5	
Total	0.5	1	0.8	0.8	1	0.5	4.6	

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

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OBSERVATIONS:

Implementation of Berkeley Algorithm:

- Berkeley algorithm chooses a master node from a pool of nodes and the rest of the nodes will be slaves.
- First of all, a leader/master has been selected through the election process and the rest of the clock synchronization will be done by Cristian's Algorithm.
- A master node finds the difference between all of the slaves and calculates its average.
- Then the master node adjusts the time of itself and all the slaves according to the new time which is calculated through average difference.

Implementation of Cristian Algorithm:

- Cristian's algorithm adjusts the time of the clock according to the new average difference.
- Cristian's algorithm is implemented through threads. So, it can run as per change in time with seconds.
- A thread can stop and recheck again and again for the change in time and also updates the time.

REMARK

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code: MCAL51

ROLL NO. : 2018450002   BATCH: A

NAME: Hammad Ansari

EXPERIMENT NO: 04

EXPERIMENT TITLE: Implementation of mutual exclusion algorithm

Objective:

4. To Implement at least one method for ME algorithm Centralized / Distributed [Lamport / Ricart / Maekawa / Token Ring]

DATE TURN 1: 22/09/2020   DATE TURN 2: 29/09/2020

PRACTICAL EVALUATION:

Sr.No.	PI1 On Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
4	0.5	0.7	0.8	0.8	0.8	0.5	4.1	
Total	0.5	0.7	0.8	0.8	0.8	0.5	4.1	

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code**:** MCAL51

OBSERVATIONS:

Token Ring:

- Token Ring algorithm achieves mutual exclusion in a distributed system by creating a bus network of processes.
- A logical ring is constructed with these processes and each process is assigned a position in the ring.
- Each process knows who is next in line after itself.
- For implementation, I have created a server and clients.
- Creating a logical ring between clients was a little bit difficult to handle but to overcome this issue I have used flags to construct a ring between clients.
- The client goes into a state of receiving mode if the flag is true otherwise it'll work for sending the data to the server.

Ricart Agrawala:

- Ricart Agarwala is a non-token based algorithm that uses the broadcast technique for mutual exclusion.
- Ricart Agrawala implementation was quite tough to understand
- Ricart Agrawala was implemented using thread and LinkedList.
- Where we need to start 4 servers and it connects each other otherwise sockets will be closed immediately.
- It displays all the servers connected.

REMARK

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Subject In charge: Nikhita Mangaonkar   Course Code**:** MCAL51

ROLL NO. : 2018450002   **BATCH: A**

NAME: Hammad Ansari

EXPERIMENT NO: 05

EXPERIMENT TITLE: Implementation of Election Algorithm

Objective: To implement the Bully /Ring Algorithm

DATE TURN 1:   06/10/2020

PRACTICAL EVALUATION:

Sr.No.	PI1 On Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
5	0.5	1	0.8	0.8	1	0.5	4.6	
Total	0.5	1	0.8	0.8	1	0.5	4.6	

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

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OBSERVATIONS:

1) **Bully Algorithm:**
   - The bully algorithm dynamically elects the coordinator from a set of processes and the process with the highest process ID number becomes the coordinator that is still active and not dead.
   - Bully algorithm implementation using Node Structure.
   - Took a node structure for active status and priority of the process.
   - There is a perform election function that works in such a way that until the while is over and it finds the highest process id as a coordinator.
   - Then passes the message to all the other processes in the batch.

2) **Ring Algorithm:**
   - The Ring Algorithm works unidirectionally and passes messages through every process.
   - To implement the ring algorithm here we have used a node-like structure for the process with id and its active status so that it will go in one direction.
   - It has functions to perform elections that are based on the active status of the process.
   - First of all, we take the initiator process and run the loop until it reaches the same process.
   - The initiator passes the message to all the processes until it finds the coordinator.
   - When the initiator finds the coordinator then it will send another message to all the processes that there is a new coordinator and ends the election process.

REMARK

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code: MCAL51

ROLL NO.: 2018450002   BATCH: A

NAME: Hammad Ansari

EXPERIMENT NO: 06

EXPERIMENT TITLE: Implementation of Shared memory

 Objective:

6. 1 Implement shared memory and load balancing

6.2 Implement load balancing

DATE TURN 1:   13/10/2020   DATE TURN 2: 20/10/2020

PRACTICAL EVALUATION:

Sr.No.	PI1 On Time	PI2 Preparedness & Debugging	PI3 Experimental procedure	PI4 Effort	PI5 Results	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
6.1	0.2	0.6	0.7	0.9	0.6	0.5	3.5	
6.2	0.4	0.8	0.9	0.7	1	0.5	4.3	
Total	0.3	0.7	0.8	0.8	0.8	0.5	3.9	

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code**:** MCAL51

OBSERVATIONS:

Both of the programs were given and we needed to run and explain how it works.

Load Balancing:

- Load balancing is a very important and critical part of distributed and cloud computing to overcome traffic issues.
- Load balancing is the process of distributing the load among various nodes of a distributed system to improve both job response time and resource utilization while also avoiding a situation where some of the nodes are heavily loaded while other nodes are idle or lightly loaded.
- The load balancing program has two servers, one load balancing daemon and we can run multiple clients simultaneously.
- Daemon maintains the loads between servers and transfers clients to one another.

Shared Memory:

- Shared memory is a memory that may be simultaneously accessed by multiple programs with an intent to provide communication among them or avoid redundant copies. Shared memory is an efficient means of passing data between programs.
- In the program, we can run the server and as many clients as we can want till 50.
- There is a counter which keeps the count of each client which is connected to the server.
- Clients can interact with the server by giving input "show" and the client gets terminated.
- The server keeps the count and gives a response to the client with how many clients are remaining to stay connected to the server.

REMARK

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code: MCAL51

ROLL NO. : 2018450002   **BATCH: A**

NAME: Hammad Ansari

EXPERIMENT NO: 07

EXPERIMENT TITLE: Study of Virtualization Technologies

 Objective: Study of Virtualization Technologies

DATE TURN 1:   27/10/2020

PRACTICAL EVALUATION:

Sr. No.	PI1 On Time	PI2 Analysis (Terminologies)	PI3 Analysis (In-Depth)	PI4 Analysis (Well Explained)	PI5 (Writing relative to content)	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
8	0.5	1	1	0.7	0.8	0.5	4.5	
Total	0.5	1	1	0.7	0.8	0.5	4.5	

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code**:** MCAL51

OBSERVATIONS:

Virtualization Case Study Summary:
- In this case study, we learn about AWS and get a little insight into Azure as well.
- Virtualization is the creation of virtual servers, infrastructures, devices, and computing resources.
- According to the NIST definition, there are three models (SaaS, PaaS, and IaaS)
- Virtualization changed the old way of a single server, and application model, in which most servers are vastly underutilized with westing costs.
- Amazon EC2 provides users with different types of EC2 instance launch types according to their load and budget.
- Instance and Types
    - General-Purpose
    - Compute-Optimized
    - Memory-Optimized
    - Storage-Optimized
    - Micro Instances
    - GPU Instances
- Essential factors are for network infrastructure, server capacity, storage, CPU, and memory.
- Windows Server has the option of running Windows Server in VMs on Azure for customers with Software Assurance coverage on their Windows Server licenses are eligible for Azure Hybrid Benefits.
- Support use of up to two VMs where a single VM instance has cores between one and sixteen Windows Server core licenses to Azure.
- Steps to create an IaaS on AWS
    - The system admin specifies the required parameters for AWS services and launches the AWS CloudFormation stack.
    - EC2 instances have automatic zone availability.
    - Admin chooses storage such as S3, EFS.
    - Admin can monitor and submit jobs
    - Lunch workstation with remote desktops and application streaming
    - Configure IAM, groups, and security.
    - Admin can launch AWS Lambda serverless computing (can use any programming language)

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Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

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- ○ Admin can run Amazon ElasticSearch Service used for analytics logs and using visualization.
  - ○ Elastic Load Balancing to ensure high availability across Availability Zones.
- Windows' azure virtual machine provides high scalability and on-demand services.
- All Azure resources are distributed over numerous geographical regions around the world.
- A hybrid cloud is a computing environment that combines an open cloud and a private cloud by permitting information sharing between them.
- AWS and Azure provide excellent options for infrastructure needs for cloud computing that provides flexibility and high availability based on- demand.

REMARK

Academic Year – 2020-21

Class: T.Y.MCA Semester: V   Subject: Distributed computing and Cloud Computing Lab

Subject In charge: Nikhita Mangaonkar   Course Code**:** MCAL51

ROLL NO. : 2018450002   **BATCH: A**

NAME: Hammad Ansari

EXPERIMENT NO: 08

EXPERIMENT TITLE: Study of Cloud Technologies

 Objective:

To study Cloud Technology

DATE TURN 1:   10/11/2020

PRACTICAL EVALUATION:

Sr. No.	PI1 On Time	PI2 Analysis (Terminologies)	PI3 Analysis (In-Depth)	PI4 Analysis (Well Explained)	PI5 (Writing relative to content)	PI6 Lab ethics	Marks Per Experiment	Sign
	0.5	1	1	1	1	0.5	5	
8	0.5	1	1	0.7	0.8	0.5	4.5	
Total	0.5	1	1	0.7	0.8	0.5	4.5	

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OBSERVATIONS:

Document Summary:
- Facebook, WhatsApp, Instagram, and various kinds of applications are available through cloud computing and now cloud computing is the primary target of hackers.
- Data privacy is required when millions of people have stored their data in the cloud.
- Data security has become a serious issue. Different data is distributed in different storage devices and machines including PCs, servers, IoT devices, and smartphones.
- The cloud has become a very important tool for large-scale purposes.
- Data Security in Cloud(Attacks) such as data breach, malware injection attack, cookie poisoning, and many more.
- Authentication Management and Authorization: Identity and access management (IAM) is the most important set of security controls.
- Identity and access management (IAM) is all about roles and access privilege through IAM tools.
- Identity analytics (IA): will allow security teams to detect and stop risky identity behaviors.
- Single sign-on (SSO) is a session and user authentication service that permits a user to use one set of login credentials.
- AAA model (Authentication, Authorization, Accounting) is a standard-based framework used to control who is permitted to use network resources.
- Benefits of Cloud Storage: 1) Total Cost of Ownership 2) Time to Deployment 3) Information Management.
- Types of cloud storage 1) Object Storage 2) File Storage 3) Block Storage

Video Summary:
- What is cloud computing? Cloud computing is an on-demand service of store, compute and database, application, or its resource through a cloud service platform via the internet with pay-as-go pricing.
- Advantages of cloud computing -
  - Pay as you consume
  - Stop guessing about capacity
  - Increase speed and agility
  - Stop using data centers
  - Go global in minutes
- Types of cloud computing with examples:

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- ○ Infrastructure-as-a-Service such as Amazon EC2 where we can manage physical and virtual operating systems
  ○ Platform-as-a-Service (PaaS) such as Elastic Beanstalk and Lightsail where we don't have to worry about security, patches, or operating systems.
  ○ Software-as-a-Service (SaaS) such as Gmail, Facebook, Instagram, or various applications like that where they provide all the services and takes care of data centers
- Types of cloud computing deployments
  ○ Public Cloud: AWS, GCP, DigitalOcean, Azure, Alibaba
  ○ Hybrid Cloud: Mixture of public and private
  ○ Private Cloud(On-Premises): You manage it, in your data center
- Data center's locations are not usually disclosed and have different electricity providers
- Some of the most used services of AWS
  ○ Amazon S3
  ○ Amazon EC2 [Elastic Compute Cloud]
  ○ AWS Lambda
  ○ AWS Cloudfront
  ○ DynamoDB
  ○ AWS RDS
- IAM: Identity and Access Management Features
  ○ Centralized Control of AWS
  ○ Enhanced Security
  ○ Granular Control
  ○ Identity Federation
  ○ Multi-Factor Authentication
  ○ Temporary Credentials
  ○ Seamless Integration with AWS
  ○ Password Rotation Policy
- IAM Users: An AWS Identity and Access Management (IAM) a user is an entity that you create in AWS to represent the person or application that uses it to interact with AWS.
- IAM Group: is a collection of IAM users. Groups let you specify permissions for multiple users, which can make it easier to manage the permissions for those users.
- There are specific roles and policies available for each user
- Demonstrated how to create an IAM user with roles and privacy with groups and permissions

BHARATIYA VIDYA BHAVAN'S

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(Autonomous College Affiliated to University of Mumbai)
MASTER OF COMPUTER APPLICATIONS

Academic Year – 2020-21

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- We can download .csv files as well
- You can retrieve and store any amount of data anywhere anytime. It's object-oriented (object: photos, doc) Have unlimited capacity.
- Types of S3 Storage:
  - S3 Standard: When you upload any file in S3, by default it's saved as S3 standard. It has 99.99% availability
  - S3 Standard IA: Data that is not frequently accessed. Store data in multiple availability zones.Can recover data
  - S3 Standard one zone IA: Data stored only in one availability zone.Cannot recover data.
  - S3 Standard Intelligent Tiering: This uses ML and checks how often the data is accessed and categorizes it and moves it accordingly.
  - S3 Glacier: For archival data. Get access data within an hour
  - S3 Deep Archive: Get access to archival data within 12 hours.
  - S3 features: Simple to use, durable, scalable, secure, available, easy to manage, and integrated with other AWS Services.
- Change policies: Effect: Allow/Deny
- Amazon S3 servers: Amazon Simple Storage Service (S3) DEMO
  - Choose S3 buckets and click on create a bucket. Write a bucket name and change the region accordingly. Click on next to create a new one.
  - Then configure access options. (public/private) and click on the create bucket.
  - Upload an object(file).
- Versioning:
  - Users can keep multiple copies of an object in the same bucket.
  - Used to preserve, retrieve, and restore every version of every object stored in the Amazon S3 bucket. Once enabled, it cannot be disabled.
- Encryption:
  - In transit encryption: a file in an S3 bucket and someone wants access to it. The file is encrypted while accessing it.
  - Client-side encryption: User manages the key
  - Server-side encryption: AWS manages the key
- DEMO INSTANCE:
  - Compute section choose EC2
  - If no instance is created, create one by launching an instance

Academic Year – 2020-21

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- Choose amazon machine image (OS software)
- Configure instance details
- Add storage
- Add tags
- Configure security group (Virtual Firewall)
- Review instance launch

REMARK