**CS3551-DISTRIBUTED COMPUTING**

**UNIT-1 INTRODUCTION**

**PART A(2 Marks)**

**1. What is a distributed system?**

A distributed system is one in which components located at networked computerscommunicate and coordinate their actions only by passing messages. Thecomponents interact with each other in order to achieve a common goal.

**2.What do you mean by message passing?**

Message passing is a fundamental mechanism for communication in distributedsystems. It enables processes or nodes to exchange messages and coordinate theiractions. There are several types of message-passing models, includingsynchronous, asynchronous, and hybrid approaches.

**3.Define Distributed Program?**

A computer program that runs within a distributed system is called a distributedprogram, and distributed programming is the process of writing such programs.

**4.What do you mean by synchronous and asynchronous execution?**

Asynchronous is a non-blocking architecture, so the execution of one task isn't dependent on another. Tasks can run simultaneously. Synchronous is a blocking architecture, so the execution of each operation depends on completing the one before it. Each task requires an answer before moving on to the next iteration.

**5.List out the features of distributed systems?**

* Performance.
* Scalability. ...
* High availability. ...
* Data integrity. ...
* High reliability. ...
* Security. ...
* User mobility.

**6.Write down the principles of distributed systems?**

Distributed file systems are an important part of any organization's data storage and access needs. The design of the system should be based on the principles of scalability, availability, reliability, performance, and security.

**7.State the objectives of resource sharing model?**

The primary objective of resource sharing is to maximize the resource base,i.e., collection, staff, infrastructure, as well as services of the participating libraries. They would be benefited by the resources of other libraries adding to their own resources.

**8.What are the significant consequences of distributed systems?**

The components of a distributed system interact with one another in order to achieve a common goal. Three significant challenges of distributed systems are: maintaining concurrency of components, overcoming the lack of a global clock, and managing the independent failure of components.

**9.What is the need of openness in distributed system?**

Openness: The openness of the distributed system is determined primarily by the degree to which new resource-sharing services can be made available to the users.

Open systems are characterized by the fact that their key interfaces are published

**10.List any two resources of hardware and software, which can be shared in distributed systems with examples**

Five types of hardware resource and five types of data or software resource that can usually be shared are printer,plotter,storage space,cd drive,dvd drive,processing power. For example printer which takes graphics and texts from the computer and later it gets transferred into a paper which is of standard size.

**UNIT-II LOGICAL TIME AND GLOBAL STATE**

**PART-A**

**1. What are the issues in distributed system?**

There is no global time in a distributed system, so the clocks on different computers do not necessarily give the same time as one another. All communication between processes is achieved by means of messages. Message communication over a computer network can be affected by delays, can suffer from a variety of failures and is vulnerable to security attacks.

**2.What is meant by group communication in distributed system?**

Group Communication occurs when a single source process simultaneously attempts to communicate with numerous functions. A group is an abstract collection of interrelated operations. This abstraction hides the message passing such that the communication seems to be a standard procedure call.

**3.What is meant by asynchronous programming?**

Asynchronous programming provides opportunities for a program to continuerunning other code while waiting for a long -running task to complete.

**4.Write application of casual order?**

The causal ordering of messages describes the causal relationship between a message send event and a message receive event. For example, if send(M1) ->send(M2) then every recipient of both the messages M1 and M2 must receive the message M1 before receiving the message M2.

**5.What is synchronous order?**

Synchronous execution means the first task in a program must finish processing before moving on to executing the next task.

**6.Define Scalar Time?**

scalar time are independent (i.e., they are notcausally related), they can be ordered using any. arbitrary criterion without violating the causality. relation . Therefore, a total order is consistent with the. causality relation .

**7.What is clock shew?**

Clock skew (sometimes called timing skew) is a phenomenon in synchronous digital circuit systems (such as computer systems) in which the same sourced clock signal arrives at different components at different times due to gate or, in more advanced semiconductor technology, wire signal propagation delay.

**8.What is clock drift rate?**

Clock Drift: As mentioned, no two clocks would have the same clock rate of oscillations i.e; clock rate would be different. The difference of clock rate is called clock drift.

**9.What is clock tick?**

Clock Tick: after a predefined number of oscillations, the timer will generate a clock tick. This clock tick generates a hardware interrupt that causes the computer's operating system to enter a special routine in which it can update the software clock and run the process scheduler.

**10.What is logical Clock?**

Logical Clocks refer to implementing a protocol on all machines within your distributed system, so that the machines are able to maintain consistent ordering of events within some virtual timespan. A logical clock is a mechanism for capturing chronological and causal relationships in a distributed system.

**UNIT-III DISTRIBUTED MUTEX AND DEADLOCK**

**PART-A**

**1. What is clock synchronization?**

Nodes in distributed system to keep track of current time for various purposes such as calculating the time spent by a process in CPU utilization ,disk I/O etc so that the corresponding user can be charged. Clock synchronization means the time difference between two nodes should be very small.

**2.Explain the term mutual exclusion**

A program object that blocks multiple users from accessing the same shared variable or data at the same time. With a critical section, a region of code in which multiple processes or threads access the same shared resource, this idea is put to use in concurrent programming.

**3.What is deadlock?**

A Deadlock is a situation where a set of processes are blocked because each process is holding a resource and waiting for another resource occupied by some other process. When this situation arises, it is known as Deadlock

**4.Name the two types of messages used in Ricart-Agrawala's algorithm**

The algorithm uses two types of messages: REQUEST and REPLY. A process sends a REQUEST message to all other processes to request their permission to enter the critical section. A process sends a REPLY message to a process to give its permission to that process.

**5.What are the conditions for deadlock?**

The four necessary conditions for a deadlock situation are mutual exclusion, no preemption, hold and wait, and circular set. There are four methods of handling deadlocks - deadlock avoidance, deadlock prevention, deadline detection and recovery, and deadlock ignorance.

**6.Which are the three basic approaches for implementing distributed mutual exclusion?**

* Token-based approach.
* Non-token-based approach.
* Quorum-based approach.

**7.What are the requirements of mutual exclusion algorithms?**

* No Deadlock: Two or more site should not endlessly wait for any message that will

never arrive.

* No Starvation: Every site who wants to execute critical section should get an opportunity to execute it in finite time.

**8.What is response time?**

Response time includes the time taken to transmit the inquiry, process it by the computer, and transmit the response back to the terminal.

**9.What is wait for graph?**

A wait-for graph in computer science is a directed graph used for deadlock detection in operating systems and relational database systems.

**10.What do you mean by deadlock avoidance?**

Deadlock avoidance is another technique used in operating systems to deal with deadlocks. Unlike deadlock prevention, which aims to eliminate the possibility of deadlocks, deadlock avoidance focuses on dynamically detecting and avoiding situations that could lead to deadlocks.

**UNIT-IV CONSENSUS AND RECOVERY**

PART-A

**1. What do you mean by clock skew and clock drift?**

* Clock skew – Instantaneous difference between the readings of any two clocks is called clock skew. Skew occurs since computer clocks like any others tends not be perfect at all times.
* Clock drift – Clock drift occursin crystal based clocks which countstime at different rates and hence they diverge. The drift rate is the change in the offset between the clock and a nominal perfect reference clock per unit of time measured by the reference clock.

**2. What do you mean by Coordinated Universal Time?**

Coordinated Universal Time generally abbreviated as UTC is an

international standard for timekeeping. It is based on atomic time. UTC signals are synchronized and broadcast regularly from land based radio stations and satellites covering many parts of the world.

**3. Define External Synchronization.**

Generally it is necessary to synchronize the processes’ clocks Ci with

an authoritative external source of time. It is called as External

Synchronization. For a synchronization bound D>0, and for a source S of

UTC time, | S(t) – Ci(t)|<D for i=1,2..N for all real times t in I where I is the time interval.

**4. When an object is considered to be garbage?**

An object is considered to be garbage if there are no longer any references to it anywhere in the distributed system. The memory taken up by the object can be reclaimedonce it is known to be garbage. The technique used here is distributed garbage collection.

**5. What do you meant by Distributed debugging?**

In general, distributed systems are complex to debug.A special care

needs to be taken in establishing what occurred during the execution.

Consider an application with a variable xi(i=1,2..N) and the variable changes

as the program executes but it is always required to be within a value $ of one other. In that case, relationship must be evaluated for values of the variables that occur at the same time.

**6. Define marker receiving rule.**

Snapshot algorithm designed by Chandy and Lamport is used for

determining global states of distributed systems. This algorithm is defined through two rules namely marker sending rule and marker receiving rule. Marker receiving rule obligates a process that has not recorded its state to do so.

**7. Define marker sending rule.**

Snapshot algorithm designed by Chandy and Lamport is used for

determining global states of distributed systems. This algorithm is defined through 2 rules namely marker sending rule and marker receiving rule. Marker sending rule obligates processes to send a marker after they have recorded their state ,but before they send any other messages.

**8.Define the characteristics of serial equivalent transactions.**

For any pair of transactions, it is possible to determine the order of

pairs of conflicting operations on objects accessed by both of them. Read and write are the operations generally considered. For two transactions to be serially equivalent it is necessary and sufficient that all pairs of conflicting operations of the two transactions be executed in the same order at all of the objects they both access.

**9. What are the advantages of nested transactions?**

The outermost transaction in a set of nested transactions is called top level

transaction. Transactions other than the top level transaction are called

subtransactions.

Advantages of nested transactions are:

* Subtransactions at one level may run concurrently with other

subtransactions at the same level in the hierarchy. This can allow

additional concurrency in a transaction.

* Subtransactions can commit or abort independently.

**10.What are the rules of committing nested transactions?**

Rules for committing of nested transactions are:

* A transaction may commit or abort only after its child transactions have

completed.

* When a subtransaction completes, it makes an independent decision either to commitprovisionally or to abort.
* When a parent aborts, all of its transactions are aborted.
* When a subtransaction aborts, the parent can decide whether to abort or not

**UNIT-V CLOUD COMPUTING**

PART-A

**1.What is cloud service?**

Cloud services are infrastructure, platforms, or software that are hosted by third-party providers and made available to users through the internet. Cloud services facilitate the flow of user data from front-end clients (e.g., users’ servers, tablets, desktops, laptops—anything on the users’ ends), through the internet, to the provider’s systems, and back.

**2.What is public cloud?**

The public cloud is defined as computing services offered by third-party

providers over the public Internet, making them available to anyone who wants to use or purchase them. They may be free or sold on-demand, allowing customers to pay only per usage for the CPU cycles, storage, or bandwidth they consume.

**3.What is private cloud?**

A private cloud is a cloud computing environment dedicated to a single

organization. Any cloud infrastructure has underlying compute resources like CPU and storage that you provision on demand through a self-service portal.

In a private cloud, all resources are isolated and in the control of one

organization.

**4.What is Virtual Machine?**

A virtual machine (VM) is a digital version of a physical computer. Virtual machine software can run programs and operating systems, store data, connect to networks, and do other computing functions, and requires maintenance such as updates and system monitoring.

**5. Characteristics of Cloud Computing**

1. On-demand self-services: The Cloud computing services does not

require any human administrators, user themselves are able to provision,

monitor and manage computing resources as needed.

2. Broad network access: The Computing services are generally provided

over standard networks and heterogeneous devices.

3. Rapid elasticity: The Computing services should have IT resources that

are able to scale out and in quickly and on as needed basis. Whenever the user require services it is provided to him and it is scale out as soon as its requirement gets over.

**6. Cloud infrastructure components:**

1. Computing

2. Networking

3. Storage

**7.What is Hypervisor?**

Hypervisor :

Hypervisor is a firmware or a low level program which is a key to enable

virtualization. It is used to divide and allocate cloud resources between several customers. As it monitors and manages cloud services/resources that’s why hypervisor is called as VMM (Virtual Machine Monitor) or (Virtual Machine Manager).

**8. Characteristics of IAAS:**

* Resources-as-a-service. ...
* Pay-as-you-go pricing model. ...
* Scalable services. ...
* Automated administrative tasks. ...
* Platform virtualization.

**9.What is IAAS?**

IaaS, or Infrastructure as a Service, is a cloud computing model that provides on- demand access to computing resources such as servers, storage, networking, and virtualization. IaaS is attractive because acquiring computing resources to run applications or store

data the traditional way requires time and capital. Organizations must purchase equipment through procurement processes that can take months. They must invest in physical spaces, typically specialized rooms with power and cooling.

**10.Define Cloud Model?**

In cloud computing, a **Cloud Model** refers to the structure and deployment methods of cloud services. There are three primary models:

1. **Public Cloud**: This is where services are delivered over the internet by third-party providers. Examples include Microsoft Azure, Amazon Web Services (AWS), and Google Cloud Platform (GCP). They offer scalability and cost-efficiency but may have security and privacy concerns for sensitive data.
2. **Private Cloud**: This cloud model is exclusively used by a single organization. It offers greater control and security since the infrastructure is hosted on-premises or in a dedicated data center. It's ideal for organizations with strict regulatory and compliance requirements.
3. **Hybrid Cloud**: This model combines elements of both public and private clouds. It allows organizations to leverage the benefits of both models, providing flexibility and scalability for varying workloads while maintaining control over sensitive data.