Q1 Discuss the key challenges that one needs to address in the design and development of distributed systems or applications.

Q2 Discuss any two architectural models for construction of distributed systems. Explain the suitable application scenarios for each.

Q3 Describe five types of attacks (on processes, communication channels, services) that might occur in the Internet.

Q4 What are the advantages of using multiple threads over multiple processes? Explain the difference between a worker pool thread model and a thread-per-object model, including details concerning what concurrency control and queueing is required in each case.

Q5 Consider a server process that has a single TCP server socket, bound and listening on port 4444. For this scenario answer the following: (A.) While listening for an incoming TCP connection on port 4444, can the process also receive UDP packets on port 4444? Explain your answer. (B.) While the server is using the TCP connection on port 4444 for sending command messages to the client, can the same server process use another TCP connection on port 2000 for sending control messages to the client? Explain your answer. (C.) Is it possible for the server process to receive 5 concurrent TCP connections from clients on the same port? Explain your answer. (D.) Is it possible for a client to connect from TCP port 4444 to the server process? Explain your answer. (E.) To reduce the load of a server

process, can another server process be added to the same host with a TCP socket bound on port 4444? Explain your answer.

Q6 What is an idempotent operation? Some of the primitive operations for a typical flat file service interface for a Distributed File System are shown below (UFID stands for Unique File Identifier). Which of the following primitives of the interface are not idempotent? Explain your answer. (A.) Read(UFID, i, n): Reads up to n items from position i in the file. (B.) Write(UFID, i, Data): Writes the data starting at position i in the file. The file is extended if necessary. (C.) Create(): Creates a new file of length 0 and returns a UFID for it. (D.) Delete(UFID): Removes the file from the file store/system.

Q7 Discuss the architecture of a microkernel-based operating system. Comment on how well this architectural model supports the creation of extensible operating systems.

Q8 Why is symmetric encryption used for session encryption, rather than asymmetric encryption? Explain how asymmetric keys are used in digital signatures.

Q9 Discuss the secure socket layer (SSL) with Transport Level Security (TLS) protocol stack architecture and its components.

Q10 Discuss the model architecture of a distributed file system. Illustrate how comprehensive it is by comparing it to the NFS implementation.

Q11 Write a simple Java RMI program that demonstrates the invocation of remote object services. Implement a service which offers dictionary services. It should support 3 operations/services (a) “ADD” which adds a new word and its meaning to the dictionary; (b) “SEARCH” which returns the meaning of a word passed as an argument. (c) DELETE which deletes word passed as an argument from the dictionary. Write both server and client programs.

Q12 Multiple Choice Questions. Each sub-question carries 0.5 mark.

Q12.1 The “Openness” challenge of Distributed System means the following:

0.

Choice 1 of 4:
Ability to easily open source the code base

Choice 2 of 4:
Ability to easily extend the existing system

Choice 3 of 4:
Ability to change the current system

Choice 4 of 4:
Ability to make system accessible to all

Q12.2 Which of the following creates a TCP/IP socket listening on port 123 in Java?

0.

Choice 1 of 4:
new Socket(123)

Choice 2 of 4:
new ServerSocket(123)

Choice 3 of 4:
new DatagramSocket(123)

Choice 4 of 4:
None of these

Q12.3 In Java Threads, which of the following methods execute threads without blocking?

0.

Choice 1 of 4:
Thread.run()

Choice 2 of 4:
Thread.join()

Choice 3 of 4:
Thread.start()

Choice 4 of 4:
Thread.interrupt()

Q12.4 Which of the following is NOT a fundamental model to formally describe common properties of distributed systems?

0.

Choice 1 of 4:

Interaction Model

Choice 2 of 4:
Failure Model

Choice 3 of 4:
Security Model

Choice 4 of 4:
Super Model

Q12.5 The kernel design philosophy followed in the Linux Operating System is:

0.

Choice 1 of 4:
Monolithic

Choice 2 of 4:
Microkernel

Choice 3 of 4:
Layered

Choice 4 of 4:
Hierarchical

Q12.6 Which of the following is not true?

0.

Choice 1 of 4:
A new thread is spawned via the start method of class Thread.

Choice 2 of 4:
Two threads can simultaneously execute a synchronized non-static method of different instances of the same Java class.

Choice 3 of 4:
Two threads can simultaneously execute a synchronized non-static method of the same instance of the same Java class.

Choice 4 of 4:
The sleep method of the class Thread is static and it puts the "current" thread to sleep.

Q12.7 Which one of the following is the best definition of “network latency”?

0.

Choice 1 of 4:
The time from the method call of the sending process to the time when the last byte of the message is transferred to the destination.

Choice 2 of 4:
The length of the message being transmitted divided by the bandwidth of the host.

Choice 3 of 4:
The time from the start of message transmission by the sending process to the beginning of its receipt by the receiving process.

Choice 4 of 4:
The number of network hops between the sender and the receiver.

Q12.8 Which of the following technology supports dynamic negotiation of encryption and authentication algorithms?

0.

Choice 1 of 4:
Secure Socket Layer

Choice 2 of 4:
Kerberos

Choice 3 of 4:
Firewall

Choice 4 of 4:
Certificate Authority

Q12.9 Domain Name System is organised as a:

0.

Choice 1 of 4:
hierarchical system

Choice 2 of 4:
centralized system

Choice 3 of 4:
master-slave system

Choice 4 of 4:
peer-to-peer system

Q12.10 Which of the following does not provide an overlay network?

0.

Choice 1 of 4:
Client-server socket applications

Choice 2 of 4:
Peer-to-peer file sharing systems (such as Bit torrent)

Choice 3 of 4:
A virtual private network (VPN)

Choice 4 of 4:
Skype peer-to-peer application