University of Ruhuna - Faculty of Technology

Bachelor of Information & Communication Technology Honours Degree
Level 3 (Semester II) Examination, November/December 2023
Academic Year 2021/2022
Course Unit: ICT3253 – Distributed and Cloud Computing (Written)

Answer **all four (04)** questions **Time Allowed: 2 hours**

IMPORTANT INSTRUCTIONS

- This paper contains **four (04)** questions on five (05) pages.
- The medium of this examination is **English.**
- This is a **closed-book** examination.
- You are allowed to use non-programmable calculators in this examination.

Question 01 **[100 marks]**

a) "While both distributed systems and parallel systems are widely available these days, but distributed systems are increasingly popular than parallel systems."

[20 marks]

i) Write down **four (04)** reasons for popularity of the distributed systems than parallel systems.

ii) Distinguish **three (03)** differences between the centralized systems and distributed systems.

b) "A parallel system contains more than one processor having direct memory access to the shared memory that can form a common address space."

[44 marks]

i) Differentiate between Uniform Memory Access (UMA) Parallel System and Non-uniform Memory Access (NUMA) Parallel System with the aid of suitable diagrams.

ii) State formula for Amdahl's law and define its parameters.

iii) A system is composed of two (02) components and it needs to be improved. After analysis, it realizes that the components should be improved their overall speedups as follows.

- Component 01: The performance of 5% of the system can be doubled.
- Component 02: The performance of 20% of the system can be improved by 80%.

Apply Amdahl's law to calculate the overall speedups gained by the enhancements.

iv) Identify which component is most worthy to work on to get the maximum overall improvement according to the calculations in part (b) (iii).

c) "A deadlock is a condition in a system where a set of processes or threads have requests for resources that can never be satisfied."

[36 marks]

i) List down **four (04)** conditions which cause to create a deadlock situation in the distributed system and briefly describe **two (02)** of them.

ii) In distributed deadlock avoidance, some conflicts may occur due to the distributed nature of the transaction. Write down **two (02)** algorithms which are used to handle this situation.

iii) Assume that there are two transactions, T1 and T2, where T1 tries to lock a data item which is already locked by T2. Apply **two (02)** algorithms stated in part (c) (ii) on transaction T1 and T2.

Question 02

[100 marks]

a) "Web service is a standardized medium to propagate communication between the client and the server applications on the WWW (World Wide Web)."

[24 marks]

i) List down **three (03)** features of a web service.

ii) Briefly explain the terms "WSDL" and "UDDI".

iii) State **two (02)** types of web services and briefly discuss **two (02)** characteristics per each type.

b) "Business Process Management (BPM) is a management authority that improves the performance of business and builds the operational solutions for Service-Oriented Architecture (SOA)."

[18 marks]

i) Write down **three (03)** benefits of Business Process Management (BPM).

ii) List down **four (04)** types of components of Business Process Management (BPM) and briefly describe **two (02)** of them.

c) "Remote Procedure Call (RPC) is a powerful inter-process communication mechanism for building distributed applications. It allows client programs to call remote procedures on servers located anywhere on the network."

[24 marks]

i) Briefly discuss the term "Marshalling".

ii) Illustrate the process of Remote Procedure Call (RPC) with the aid of a suitable diagram.

d) "In distributed computing, network communication is one of the essential part of any system. It can be done through High-level connection mechanism as well as Low-level data exchange."

[34 marks]

i) Distinguish **two (02)** differences between Synchronous communication and Asynchronous communication.

ii) The socket API is a collection of socket calls (system calls) that enable to perform different primary communication functions between application programs. Examine the Figure Q2 which is given below and identify the suitable system calls for the blanks **(from A to M)** from the pool of system calls given below.

Pool of System Calls

bind(), close(), connect(), socket(), listen(), read(), write(), accept()

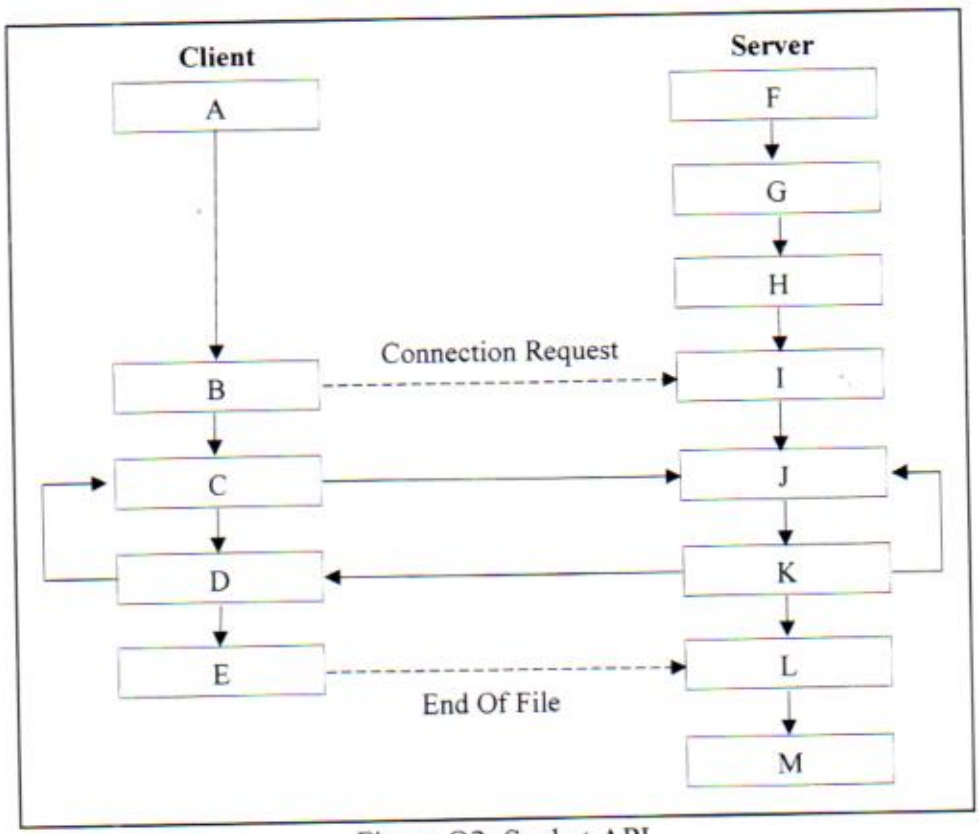

Figure Q2: Socket API

Question 03

[100 marks]

a) "Falcon" is a globally recognized organization with strong customer base. In working environment of this organization consists with number of minicomputers and multiple workstations interconnected by a communication network. Not only that some departments such as Research and Development (R & D) of the organization often perform their tasks which need massive computation and processing power and they have a better utilization of processing power among the each distributed nodes (branches). Furthermore, they have a large number of computer users only performing simple interactive tasks and executing small programs and also they give guaranteed response to interactive jobs allowing them to be more processed in local workstations of the users.

[39 marks]

i) Analyze the above given scenario and identify the Distributed Computing System Model which is used by the above mentioned organization.

ii) Justify your answer for the above part (a)(i) while highlighting **three (03)** characteristics of the relevant selected distributed computing system model.

iii) 3-Tier Architecture is used as the underlying architecture for the client-server communications of the distributed nodes of the above mentioned organization. Briefly describe **three (03)** layers of 3-Tier Architecture.

b) Consider the same organization mentioned in part (a). The higher management of the organization decided to move to the distributed databases for the each branches instead of the centralized database. When setting up a distributed database environment, they want the same Database Management System (DBMS) and operating system across all the remote databases and each remote database is aware of all other databases to co-operatively process the user requests.

[25 marks]

i) Choose a suitable distributed database environment for the above mentioned organization.

ii) Justify your answer for the above part (b)(i) while explaining **three (03)** characteristics of the relevant selected distributed database environment.

c) Distributed system needs additional security than centralized system because there are many users, diversified data and multiple sites.

[36 marks]

i) Differentiate security threats and attacks.

ii) Briefly describe the terms "Active attacks" and "Passive attacks".

iii) Distinguish **three (03)** differences between Active attacks and Passive attacks.

Question 04 **[100 marks]**

a) Briefly define Cloud Computing.

[20 marks]

b) List down **four (04)** essential characteristics of cloud and briefly explain them.

[24 marks]

c) Differentiate the private cloud and public cloud.

[24 marks]

d) "Although affordability and ease of use are two of the many benefits of cloud computing, there are significant risks to consider when moving critical applications and sensitive data to public and shared cloud settings". Do you agree with this statement? Explain with **four (04)** risks that are related to cloud computing.

[32 marks]

---------- **End of the Paper**----------