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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
FOURTH YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE
(SPECIAL EXAMINATION)

KCS 409 TRANSACTION PROCESSING AND DISTRIBUTED SYSTEM

DATE: 14TH AUGUST, 2024

TIME: 11:30 AM – 1:30 PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

- a) Describe the following examples of distributed system
 - i. World-Wide Web (2 marks)
 - ii. Cloud Computing (2 marks)
 - iii. Mobile Computing (2 marks)
 - iv. Ubiquitous computing (2 marks)
- b) Describe the main disadvantage of view serializability. (2 marks)
- c) Describe two main reasons why synchronization is need in distributed systems (4 marks)
- d) Identify the main benefits of middleware to distributed system programmers(2 marks)
- e) Inter-process communication refers to the exchange of information between separate threads or processes. Differentiate the following two basic models of inter-process communication. (4 marks)
 - i. Shared Memory
 - ii. Message Passing
- f) Replication is a key strategy for improving reliability, fault tolerance and availability in distributed systems. Expound the two types of replications used in distributed file systems (DFS). (4 marks)
- g) Write briefly about a Domain Name System (DNS) (3 marks)
- h) Itemize three reasons why we need fault tolerance in distributed systems (3 marks)

QUESTION TWO: (20 MARKS)

- a) The purpose of the system models is to describe common properties and design choices for distributed system in a single descriptive model. Identify and explain three types of models (6 marks)
- b) The following snippet represent the transactional programming model. Use it to answer questions below.

```
Begin_transaction (initial_consistent_state)
    One or more database operations

if (reach_new_consistent_state) then
    Commit_transaction (new_consistent_state)
else
    Abort_transaction (initial_consistent_state)
```

Describe the following terms as used in the model above.

- i. Begin_transaction (2 marks)
- ii. Commit_transaction (2 marks)
- iii. Abort_transaction (2 marks)
- c) Distinguish between the centralized system and distributed system (8 marks)

QUESTION THREE: (20 MARKS)

- a) Consider a distributed environment with four systems, A,B,C and D. Name the type of transparencies required in each of the following situations: (4 marks)
 - i. Data available at all four systems and user want to modify the data at D.
 - ii. Printer connected to A is disconnected and connected to B. User wants to access that printer.
 - iii. Breakdown of system, D.
 - iv. User want to access the software X without knowing its whereabouts
- b) In a database system, there may be a large number of transactions that are executed concurrently. Each transaction must ensure that it always preserves the consistency of the database system. Describe the four properties of transaction that ensure the database is in a consistent state. (8 marks)
- c) Discuss any four problems that can occur in a database system in which there are many transactions being executed concurrently. (8 marks)

QUESTION FOUR: (20 MARKS)

- a) Describe the following two main approaches for concurrency control protocols (4 marks)
 - i. Pessimistic approaches
 - ii. Optimistic approaches
- b) Identify and discuss five typical problems, caused by the concurrent execution of transactions (10 marks)
- c) Differentiate the following types of middleware communication
 - i. Persistent versus transient (2 marks)
 - ii. Synchronous versus asynchronous (2 marks)
 - iii. Discrete versus streaming (2 marks)

QUESTION FIVE: (20 MARKS)

- a) Transactions in a distributed system can be categorized into the following two classes. Examine them.
 - i. Local transaction (2 marks)
 - ii. Global transaction. (2 marks)
- b) Enumerate **six** desired features of a good message-passing system (6 marks)
- c) Designing a distributed system does not come as easy and straightforward. A number of challenges need to be overcome in order to get the ideal system. Identify and discuss **five** major challenges in distributed systems (10 marks)