MAASAI MARA UNIVERSITY

UNIVERSITY EXAMINATIONS 2021/2022 (REGULAR)

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES
DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

FOURTH YEAR FIRST SEMESTER EXAMINATION

COURSE CODE: COM 4116

COURSE TITLE: DISTRIBUTED OPERATING SYSTEM

DATE: 7th April 2022   TIME: 8:30 am - 10:30am

INSTRUCTIONS TO CANDIDATES

- **Question ONE in Section "A " is Compulsory**
- **Answer any Two (2) Questions from Section "B"**
- **Illustrate your answers where necessary**

SECTION A

QUESTION ONE (COMPULSORY 30 MARKS)

1. Briefly explain four different characteristics of a distributed operating system **(4 Marks).**
2. List and describe any two main functions used in communication using shared memory in distributed operating systems **(2 Marks).**
3. Briefly explain what a Nonce is, and provide two examples of some items that can be used as a nonce **(3 Marks).**
4. You have to design a process migration facility for a distributed system. Briefly explain the factors that will influence your decision to design a preemptive or a non-preemptive process migration facility **(5 Marks).**
5. Briefly mention one difference and one similarity between threads and processes **(4 Marks).**
6. Using an example, explain the following properties of a distributed file system:
   (a) High degree of availability **(2 marks)**
   (b) High degree of recoverability **(2 marks)**
   (c) High degree of robustness **(2 marks)**

7. Briefly explain any four differences between a replica and a cache (4 Marks).
8. Briefly explain one similarity and one difference between the RPC model and the ordinary procedure call model? (**2 Marks**)

SECTION B

QUESTION TWO (20 marks)

1. In many client-server systems, the timeout mechanism is used to guard against the hanging of a client forever if the server crashes. That is, in these systems, if after sending a request message to a server a client does not receive a reply from the server within a fixed timeout interval, the client assumes that the server has crashed and can take necessary corrective actions.
   With three good reasons, provide the ideal length of the timeout in any preferred units for such systems **(4 Marks)**
   If the server computer is fully reliable, is it still useful to use the timeout mechanism? Give reasons for your answer **(6 Marks)**

2. Failure Handling is an essential part of message passing in processes within a distributed operating system environment to handle partial failures
   A. Briefly explain three error types during massage passing in DOS **(6 Marks)**
   B. Using a diagram, illustrate how errors can be handled with incorporation of synchronization (**4 Marks**).

QUESTION THREE (20 marks)

An application consists of three transactions T1, T2, and T3 that are defined below:
T1 : begin_transaction
read(x); readtz); write(x-5); write(z+5);
end_transaction
T2 : begin_transaction
readiz); write(z-8); read(y); write(y+8);
end_transaction
T3 : begin_transaction
read(x); write(x+4); read(y); write(y-4);
end_transaction
Describe how the concurrency of these three transactions can be controlled by using the Following:
(a) Same type of locks for both read and write operations **(2 Marks)**.
(b) Type-specific locks **(2 Marks)**
(c) Intention-to-write locks **(2 Marks)**
(d) Optimistic concurrency control scheme **(2 Marks)**
(e) Timestamp-based concurrency control scheme **(2 Marks)**

QUESTION FOUR (20 marks)

a. Distributed operating system 4.1 students were required to modify the password system of the school portal with the aim of improving the authentication process. While providing a security mechanism for each,

suggest four essential authentication properties to be considered to enhance the modified system **(8 Marks)**

b. Assuming that the school plans to introduce a new web-based application for booking rooms in addition to the system in (a) above, without changing/altering the existing authentication mechanism. with a reason, suggest an authentication solution to integrate the two systems **(2 Marks).**

c. List and briefly explain any 5 mechanisms/methods of optimizing RPC'S for better performance **(10 Marks)**