



KENYATTA UNIVERSITY

EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION

SCO 333: DISTRIBUTED COMPUTING

2ND SEMESTER 2023/2024

TIME: 2 HOURS

INSTRUCTIONS:

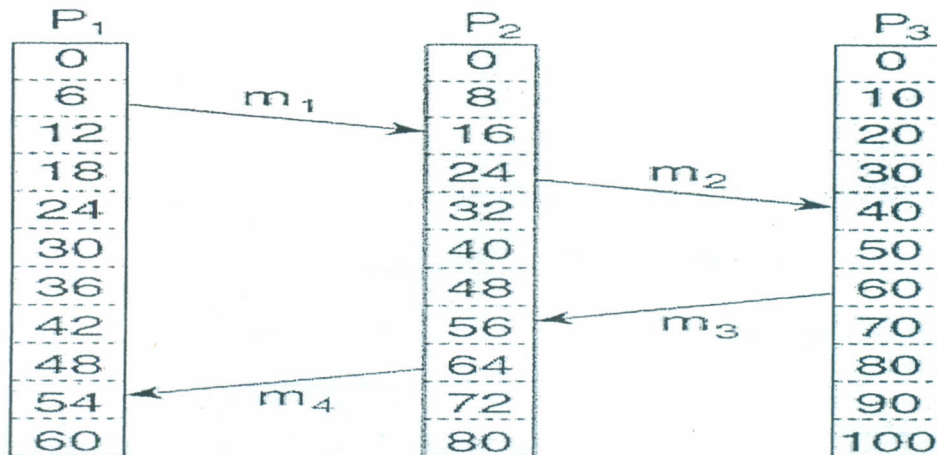
ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (COMPULSORY) [30 MARKS]

- a. Consider someone who receives an executable program as an electronic mail attachment.
 - i. Identify and explain three possible effects of running the program. [6 Marks]
 - ii. Explain how the issues highlighted above can be resolved [3 Marks]
- b. An email address consists of a user's name and a domain name. Sending a mail to a user does not involve knowing their physical or network location. Nor does the procedure to send an email message depend upon the location of the recipient.
 - i. Identify the 2 forms of transparency from this scenario [2 Marks]
 - ii. Draw an C/S architecture for the above email application [4 Marks]
- c. Outline and explain four distributed systems design concerns [4 Marks]
- d. Explain the meaning of the terms latency, jitter and bandwidth as used in distributed computing. [3 Marks]
- e. Explain two reasons why a database may be replicated in several servers in a distributed computing environment [2 Marks]
- f. Suppose that both caller and callee are travelling by train in different parts of a country, moving from one environment (cell) to another. Assume the caller's phone is the client and the callee's phone is a resource. Identify with a reason, a transparency form in this scenario. [2 Marks]
- g. Given that search engines enable users to look up summaries of information available on web pages at sites throughout the Internet and that these summaries are made by web crawlers, which run in the background at a search engine site, use an appropriate illustration to explain why a search engine is both a server and a client [4 Marks]

QUESTION TWO

- a. Study the figure below then answer the question that follow:



Using Lamport's algorithm, show how the above diagram can be adjusted to collect message communication between the three processes [4 Marks]

- b. Consider a hypothetical car hire company and sketch out a three-tier solution to the provision of their underlying distributed car hire service. Use this to illustrate the **three** benefits and **three** drawbacks of a three-tier solution considering issues such as performance, scalability, dealing with failure and also maintaining the software over time. [6 Marks]
- c. Consider two communication services for use in asynchronous distributed systems. In service A, messages may be lost, duplicated or delayed and checksums apply only to headers. In service B, messages may be lost, delayed or delivered too fast for the recipient to handle them, but those that are delivered arrive with the correct contents.
- Describe the classes of failure exhibited by each service. [2 Marks]
 - Classify their failures according to their effects on the properties of validity and integrity [5 Marks]
 - Explain whether service B can be described as a reliable communication service. [3 Marks]

QUESTION THREE

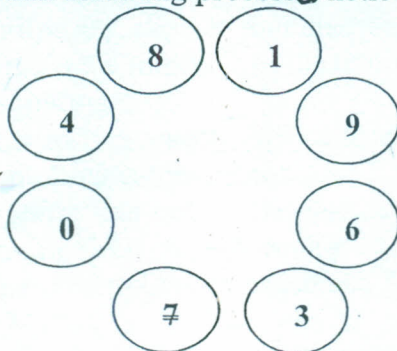
- a. A client attempts to synchronize with a time server. It records the round-trip times and timestamps returned by the server in the table below. Calculate time to which the client computers adjust [6 Marks]

Round trip ms()	Time(hr:min:sec)
22	10:54:23.674
25	10:54:25.450
20	10:54:28.342

- b. Explain three examples of applications where the use of mobile code is beneficial. [6 Marks]
- c. State and explain three specific and contrasting levels of heterogeneity experienced in contemporary distributed systems. [6 Marks]
- d. Resources in the world wide web and other services are named by URLs. Show what this initials denote and give two examples of web resources that can be named by URLs [2 Marks]

QUESTION FOUR

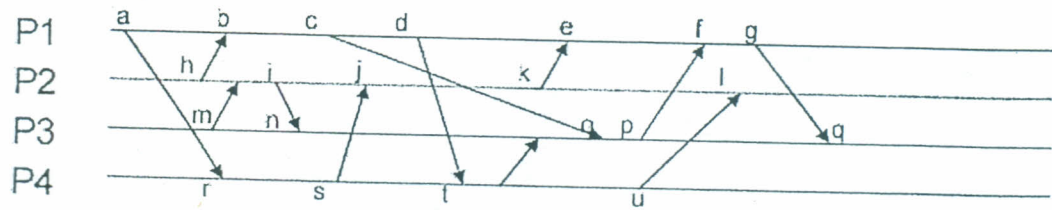
- a. List three main software components that may fail when a client process invokes a method in a server object giving an example of a failure in each case [6 Marks]
- b. Explain how ftp.ku.ac.ke can be resolved recursively [6 Marks]
- c. Briefly explain how the following processes would elect a new leader using bully's algorithm assuming process 3 notices the current leader is not responding.



[8 Marks]

QUESTION FIVE

- Define the terms: distributed systems, heterogeneity, mobile agent [3 Marks]
- Explain three benefits of middleware to distributed systems programmers providing examples of each benefit. [3 Marks]
- Consider the following event diagram for processes P1, P2 and P3 executing in a distributed system.



[8

Marks]

- Describe the RMI process using suitable illustrations clearly identifying the processes in the client and server during the communication process. [6 Marks]