METHODIST UNIVERSITY GHANA

FACULTY OF SCIENCE

DEPARTMENT OF INFORMATION TECHNOLOGY

AND

MATHEMATICAL SCIENCE

FIRST SEMESTER EXAMINATIONS, 2024/2025

MUIT 421: PRINCIPLE OF DISTRIBUTED SYSTEMS (3 Credits)

THURSDAY – 28 NOVEMBER, 2024

TWO HOURS

Answer ALL questions in Section A

And any THREE questions in Section B

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SECTION A (30 MARKS)

ANSWER ALL QUESTIONS IN THIS SECTION

Question 1

A distributed system usually is a collection of computers that do not share a common memory or a common physical clock that communicate by messages passing over a communication network and where each computer has its own memory and runs its own operating system. Typically, the computers are semi-autonomous and are loosely coupled while they co-operate to address a problem collectively. Suppose a bank with 97 branches in Ghana decides to deploy a distributed system nationwide;

i. What in your view could be some of the major motivating factors for the bank's decision? **4 marks**

ii. What advantages could the bank realize as a result of their decision? **4 marks**

iii. Could there be any disadvantages? Explain **4 marks**

iv. What kind of hardware and software may be required for a successful implementation? **4 marks**

v. In designing a network for the intended distributed system, what should be some of the communication related issues that must be considered? **4 marks**

Question 2

i. A user arrives at a railways station that she has never visited before, carrying a PDA that is capable of wireless networking. Suggest how the user could be provided with information about the local services and amenities at that station without entering the station's name and attributes. What technical challenges must be overcome? **10 marks**

SECTION B (30 Marks)

Answer any THREE questions from this section

Question 3

With the aid of a diagram and or examples, explain the following terms;

i. Bus-based multiprocessors
ii. Switched multiprocessors
iii. Bus-based multicomputers
iv. Switched multicomputers **10 marks**

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Question 4

Certain common characteristics that can be used to assess distributed systems are: Resource sharing, Openness, Concurrence, Scalability, Fault tolerance, Transparency. Explain how the above characteristics relate to the construction of a distributed system. **10 marks**

Question 5

What are the challenges of ensuring security in distributed systems, and what are some common security mechanisms used in distributed environments? **10 marks**

Question 6

Explain the difference between the following terms;

i. Distributed operating system and network operating system
ii. Message switching and packet switching
iii. Buffering and caching
iv. Loosely-coupled and tightly-coupled
v. Synchronous execution and asynchronous execution **10 marks**

Question 7

List the 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. To what extent are these failures independent of one another? Suggest how the components can be made to tolerate one another's failures. **10 marks**

Question 8

i. Describe possible occurrences of each of the main types of security threat (threats to processes, threats to communication channels, denial of service) that might occur in the Internet **6 marks**

ii Explain how it is possible for a sequence of packets transmitted through a wide area network to arrive at their destination in an order that differs from that in which they were sent. **4 marks**

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