# CSCI 604 Distributed Computer Systems Architecture

# Unit 7

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| Teacher: | George Rudolph |  |
| Subject: | Replication and Mobile Computing |  |
| Objective 1: | * Models |  |
| Objective 2: | * Fault-tolerance |  |
| Objective 3: | * High-availability and performance |  |
| Objective 4: | * Transactions with replicated data |  |
| Objective 5: | Association |  |
| Objective 6: | Interoperation |  |
| Objective 7: | Sensing and Context-awareness |  |
| Objective 8: | Security, Privacy and Adaptation |  |

## C Level Maximum 50 points

Your written answers may include pictures, drawings, short phrases instead of sentences, as long as the answer is clear and says what you mean.

1. List the requirements that Coda meets that AFS does not. (5 pts)
2. List factors that are relevant to high availability of replicated data. (5pts)
3. Briefly explain the role of group communication in replication. (5 pts)
4. List requirements for view delivery, and for each one, one sentence about their impact. (5 pts)
5. List and define the guarantees provided by view-synchronous group communication. (5 pts)
6. Give a model for fault-tolerant services as it relates to data replication. (5 pts)
7. Every linearizable service is also sequentially consistent. However, the converse does not hold. Explain why. (10 pts)
8. Create a drawing that contrasts passive replication and active replication. (10 pts)
9. List the architectures for replicated transactions. For each, highlight its major feature(s). (5 pts)
10. How is mobile computing different from other forms of distributed computing? (5 pts)
11. List the characteristics that we assume for devices that are useful for mobile and ubiquitous computing. For each, describe its impact. (10 pts)
12. What is the impact of mobile devices on trust and privacy? (5pts)
13. List the issues that must be dealt with in the design of a discovery service. (5 pts)
14. Create a flyer that contrasts the features of a discovery service that uses a directory server or is serverless. (5 pts)
15. Convert Figure 19.4 in your text to a UML sequence diagram. What information do you gain by using the sequence diagram? What information might you lose in the sequence diagram version as compared to the original? (10 pts)
16. Create a flyer that contrasts the strengths and weaknesses of network association with the strengths and weaknesses of physical association. (10 pts)
17. Explain the ‘lost opportunity’ problem and give an example. (5 pts)
18. Explain the difference between indirect and direct device interoperation. (5 pts)
19. List some ways programmers manage state in a volatile system. (5 pts)
20. List four functional challenges to be overcome in designing context-aware systems. (5 pts)

21. Explain the concept of “nomadic computing” (10 pts).

## B Level 30 points—Choose Two

1. Write pseudocode for dependency checks and merge procedures as used in Bayou that are suitable for a simple room-booking application.
2. Devise a scheme for integrating two replicas of a file system directory that underwent separate updates during disconnected operation. Either use Bayou’s transformational approach, or give a solution for Coda.
3. Many sensor nodes are to be scattered throughout a region. The nodes are to communicate securely. Explain the problem of key distribution, and give pseudocode that outlines a probabilistic strategy for distributing leys.
4. Assume that a device can execute 3 million instructions for the same amount of energy used to transmit or receive 1 kbit of data a distance of 100m by radio, namely 3 Joules. The device has the option of sending a 100-kbyte binary to a compute server 100m away. The server will execute 60 billion instructions and exchange 10,000\*1 kbit messages with the device. If energy is the only consideration, should the device offload the computation, or execute it itself? Assume computation on the device uses negligible energy in the offloaded case.

## A Level 20 points—Choose One

1. Do you think ubiquity means that computing will become “invisible” to us? Is ubiquitous computing necessarily good for society?
2. What would be the impact on society if we had as a goal that everyone should live and work in smart spaces or smart home?
3. Because we can be reachable almost any time anywhere, should people expect to be able to reach us any time anywhere?
4. What information do we typically give up when computing on the internet that might compromise our privacy and security? Do we give up more when engaging in mobile computing? Is this inevitable, or are there steps we can take to minimize the leakage?

F: < 60 D: < 70 C: < 80 B: < 90 A: >= 90