CSCI 5105: Introduction to Distributed Systems

Spring 2019

Instructor: Abhishek Chandra

Homework 1 (100 points)

(*Due: in class Feb 19th)*

Please

- **Do not try to find the answers from the internet.**
- **Do homework <u>individually</u>.**
- **Don't forget put your name on the submission.**

1. (10 points) Assume an unstructured overlay network. Each node will randomly choose N nodes for its neighbors. If P and Q are both neighbors of R, what is the probability they are also neighbors of each other?

2. (10 points) What does (distribution) transparency mean? Provide different types of transparency.

3. (15 points) What is scalability in distributed systems? How can transient synchronous communication affect scalability, and how could these be solved?

4. (10 points) What are pros and cons of **centralized** and **decentralized** architectures?

5. (15 points) Consider a simple server that carries out client requests without accessing other servers. Explain why it is generally not possible to set a limit on the time taken by such a server to respond to a client request. What would need to be done to make the server able to execute requests within a bounded time? Is this a practical option?

6. (15 points) Explain why a remote procedure call (RPC) cannot have a reference parameter? What is the model for parameter passing in a remote procedure call?

7. (15 points) Suppose that you could make use of only transient asynchronous communication primitives, including only an asynchronous receive primitive, how would you implement primitives for transient synchronous communication?

8. (10 points) What are pros and cons of Application-level tree-based and Flooding-based multicasting?