

## CIS 5644 Distributed Systems

- **Catalog Description:**

- Prerequisite: A high-level programming language, basic knowledge of architecture and operating systems, elementary discrete mathematics, or permission of the instructor.
- We consider a distributed computer system that consists of multiple autonomous processors that do not share primary memory but cooperate by sending messages over a communication network. Discussion of special problems related to distributed control such as election and mutual exclusion, routing, data management Byzantine agreement, and deadlock handling. Some basics of parallel and distributed algorithms. Applications in distributed shared memory, database, file systems, web applications, cloud/edge, P2P, crowdsourcing, and blockchain.

- **Textbook:**

Distributed System Design

Jie Wu, CRC Press, 1999.

- **References:**

1. Distributed Systems: Principle and Paradigms

Andrew S. Tanenbaum and Maarten Van Steen, Prentice Hall, 2002

2. Distributed Algorithms for Message-Passing Systems

Michel Raynal, Springer, 2013.

3. Distributed Algorithms

Nancy A. Lynch, Morgan Kaufmann Publishers, Inc., 1996

4. An Introduction to Parallel Algorithms

Joseph JaJa, Addison-Wesley Publishing Company, 1992..

5. Distributed Computing: Principles, Algorithms, and Systems

Ajay D. Kshemkalyani and Mukesh Singhal, Cambridge, 2008

6. Networks, Crowds, and Markets: Reasoning About a Highly Connected World

David Easley and Jon Kleinberg, Cambridge University Press, 2010.

- **Instructor:**

Dr. Jie Wu, Laura H. Carnell Professor

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- **Goals:**

The student will get exposed to fundamental issues in distributed system design, recent development, and research trends in this area.

- **Class time:** Monday 5:30 pm - 8:00 pm, Tuttleman Learning Center 0401A

- **Office hours:** Monday 3:00 pm - 5:00 pm, SERC 362

- **Grading Policy:**

- Homework: 30%

- Midterm: 25%

- Final: 25%

- Project: 20% (2% project proposal, 8% presentation, and 10% report)

- **Prerequisite by topic:**

1. Basic concepts of computer architecture and operating systems

2. Knowledge of a high-level programming language

3. Elementary discrete mathematics

- **Topics:**

1. Introduction and motivation

2. From map reduce to parallel algorithms

3. Program languages

4. Event ordering and clock synchronization

5. Election and mutual exclusion

6. Byzantine agreement

7. Distributed faults and termination detection

8. Distributed data management

9. Distributed operating systems: deadlock handling

10. Distributed web crawling and page rank

11. Distributed communication protocols: routing and broadcasting

12. Topics in distributed database, distributed file, cloud/edge, P2P, crowdsourcing, and blockchain.