

## CIS 5644 Distributed Computing

- **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, and blockchain.

- **Textbook:**

- Distributed System Design  
Jie Wu, CRC Press, 1999.

- **References:**

1. Distributed Algorithms for Message-Passing Systems  
Michel Raynal, Springer, 2013.
2. Distributed Algorithms  
Nancy A. Lynch, Morgan Kaufmann Publishers, Inc., 1996
3. An Introduction to Parallel Algorithms  
Joseph JaJa, Addison-Wesley Publishing Company, 1992.
4. Distributed Systems: Principle and Paradigms  
Andrew S. Tanenbaum and Maarten Van Steen, Prentice Hall, 2002.
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.

- **Instructors:**

- Dr. Jie Wu, Laura H. Carnell Professor of Computer and Information Sciences  
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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:** Tuesday 5:30 pm - 8:00 pm, Tuttleman Learning Center 0401B
- **Office hours:** Tuesday: 3:00 pm - 5:00 pm, SERC 362
- **Grading Policy:**
  - Homework:  $4 * 10\% = 40\%$
  - Group project: 30% (10% presentation + 20% report)
  - One exam: 30%
- **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 and clock synchronization
  4. Event ordering and clock synchronization
  5. Election and mutual exclusion
  6. Byzantine agreement
  7. Distributed faults and termination detection
  8. Distributed communication protocols: routing and broadcasting
  9. Distributed data management
  10. Distributed operating systems: deadlock handling
  11. Distributed web crawling and pagerank
  12. Virtual currency: bitcoin and blockchain
  13. Topics in distributed shared memory, database, file systems, crowdsourcing, Hadoop, and cloud.