About this course

Algorithms, or a step-by-step process to efficiently reach a desired goal, have been part of human history since the 1200’s. Algorithms are a fundamental component to any computerized system. In this foundational course, you will learn several different algorithms and be able to explain how they work and why they are considered good. This will help you:

1. Evaluate appropriate algorithmic techniques that can lead to more efficient solutions for a problem, instead of just coding the first idea that comes to mind

2. Develop sound background knowledge on algorithms that will allow you to navigate the literature, beyond the context of this class.

In order to achieve this, you will have to work through and understand several algorithmic techniques and the mathematical background necessary for analyzing the properties of these techniques and the algorithms based on them.

Specific topics covered include:

- Greedy Algorithms
- Divide-and-Conquer
- Dynamic Programming
- Amortized Analysis
- Graph Algorithms
- Network Flows
- NP-completeness

Required prior knowledge and skills

- Basic understanding of Asymptotic Notation (Big-Oh), recurrence relations, proofs, Recursion, Worst-Case Analysis, and basic discrete math (e.g., sets, functions, logic, graphs, etc.).
- Understanding of basic data structures and algorithms such as Sorting Algorithms, Hash Tables, Binary Search Trees, Heaps, and Red-Black Trees.
- Basic understanding of Graph Algorithms such as Depth-First Search, Breadth-First Search, Minimum Spanning Trees (Kruskal’s and Prim’s algorithms), and Shortest-paths (Dijkstra’s algorithm).

Learning Outcomes

Learners completing this course will be able to:

- Identify and apply algorithmic techniques to solve a problem
- Apply knowledge of algorithms in multiple contexts using multiple programming languages
- Evaluate correctness and efficiencies of algorithms

Estimated Workload/Time Commitment Per Week

18 - 20 hours per week
Andréa Richa joined Arizona State University (ASU) in 1998. She is currently affiliated with the Biomimicry Center at ASU, and the Biosocial Complexity Initiative in general. Prof. Richa's main areas of expertise are in distributed/network algorithms and computing in general. More recently she has focused on developing the algorithmic foundations on what has been coined as programmable matter, through her work on self-organizing particle systems (SOPS) (see sops.engineering.asu.edu). Her work has been widely cited, and includes, besides SOPS, work on bio-inspired distributed algorithms, distributed load balancing, packet routing, wireless network modeling and topology control, wireless jamming, data mule networks, underwater optical networking, and distributed hash tables (DHTs). Dr. Richa received the 2017 Best Senior Researcher award from the School of Computing, Informatics, and Decision Systems Engineering (CIDSE). She was the recipient of an NSF CAREER Award in 1999, an Associate Editor of IEEE Transactions on Mobile Computing, and the keynote speaker and program\general chair of several prestigious conferences. In particular, Prof. Richa was the Program Committee Chair of the 31st International Symposium on Distributed Computing (DISC), 2017, one of the top two conferences in distributed computing. Prof. Richa has also delivered several invited talks both nationally and internationally. For a selected list of her publications and other accomplishments, CV, and current research projects, please visit www.public.asu.edu/~aricha or sops.engineering.asu.edu.