



National Taiwan University of Science and Technology

2022 Summer Program

CSC 400 Algorithm Design and Analysis

Course Outline

Course Code: CSC 400

Instructor: Dr. Suman Saha

Home Institution: Pennsylvania State University

Office Hours: By appointment

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Credit: 4

Course Description:

The purpose of the course is to study how to design and analyze computer program algorithms to solve real-world problems. The course will begin with a review of the concept of algorithm complexity and basic graph algorithms; and then cover algorithm design approaches such as greedy, divide and conquer, and dynamic programming; then, a network flow problem will be introduced and algorithm design by reduction to a network flow problem will be discussed; then, the notion of problem reduction will be used to discuss and prove the computational intractability (i.e., hardness) of a problem; time permitting, approaches to handling intractable problems, such as approximation algorithms and local search algorithms, will be discussed as well.

Course Objectives:

After completing this course the student will be able to abstract a real-world problem to a computational problem and design an algorithm to solve the problem computationally and analyze its running time and storage space complexities.

Required Textbooks:

Jon Kleinberg and Eva Tardos, Algorithm Design, Addison Wesley.



Grading & Evaluation:

A+:4.3——95-100

A :4.0——87-94

A-:3.7——82-86

B+:3.3——78-81

B :3.0——75-77

B -:2.7——71-74

C+:2.3——68-70

C :2.0——65-67

C -:1.7——61-64

D :1.0——55-60

E :0.0——49-54

X :0.0——0

Course Schedule:

Week1

- Understand Algorithm Complexity
- Graph Algorithm
 - BFS
 - DFS
 - Dijkstra
 - Floyd Warshall
 - Prims
 - Kruskal
- Divide and Conquer
 - Binary Search
 - Merge Sort
 - Quick Sort
 - Karatsuba Algorithm for fast multiplication
- *Homework -1*

Week2

- Divide and Conquer
 - Finding convex hull
 - Strassen's matrix multiplication
 - Find the closest pair of points



- Algorithm for fast Fourier transform
- Greedy Algorithm
 - Activity Selection Problem
 - Graph Coloring Problem
 - Job Sequencing Problem
 - Huffman Coding
- *Midterm Exam*

Week3

- Dynamic Programming
 - Longest Common Subsequence
 - Longest Increasing Subsequence
 - Edit Distance
 - Minimum Partition
 - Longest Path in Matrix
 - Subset Sum Problem
 - 0-1 Knapsack Problem
 - Boolean Parenthesization Problem
- *Homework - 2*

Week4

- Network Flow Applications
- Computation and Intractability
- NP-Hard Problem
- *Final Exam*