



## National Taiwan University of Science and Technology

### 2021 Winter 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*