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Hankuk University of Foreign Studies

2025 Winter Session

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

Email: sumsaha@gmail.com

Credit: 4

Class Hours:

This course will have 60 class hours, including 32 lecture hours, professor 8 office hours, 8-hour TA discussion sessions, 4-hour review sessions, 8-hour extra classes.

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:

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

Grading System (1 ~ 100)

A+ : 96 - 100	A : 91 - 95
B+ : 86 - 90	B : 81 - 85
C+ : 76 - 80	C : 71 - 75
D+ : 66 - 70	D : 60 - 65
F : 0 - 59	
Pa : Pass	Fa : Fail

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

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- *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*