CS361 ALGORITHMS and Computation Theory
Course Syllabus, Spring, 2017

Time/Place	: MW 14:00 – 15:50 @ITC301
Instructor/Office/Phone	: Jie Liu / ITC302B / 8-8989
Office Hours	: Refer my page at www.wou.edu/~liuj
Email Address	: liuj@wou.edu (start your subject with CS361 to draw my attention)

Required Text:

Introduction to Algorithms, Second EditionJul 16, 2001 by Thomas H The MIT Press. Different editions such as the third and first would mostly work.

Introduction to the Theory of Computation by Michael Sipser. ISBN 978-0534950972 (This is the 2nd edition, get used for $10, for info to come)

Course Description:

Course covers fundamental algorithms and data structures used to solve a variety of problems. These include searching, advanced sorting, graphs, strings and algorithms for solving other hard problems. Develops and explores algorithm design strategies such as divide and conquer, dynamic programming, greedy approaches and backtracking. Algorithm analysis is developed at a more advanced level and includes analysis of recursive algorithms and covers the classification of algorithms by computational complexity. The course also includes an introduction to the theory of computation including automata, Turing machines and formal languages.

Course Outcomes/Objectives

After completing this course, students will be able to

1. select and use an appropriate algorithm that uses a greedy approach, divide and conquer, dynamic programming or backtracking algorithm to solve a difficult problem.
2. select and apply a graph algorithm to solve an appropriate problem using a graph data structure.
3. understand basic automata computability and complexity and use that understanding in a productive way, for example, to design a deterministic finite state machine to accept a specified language as well as a regular expression to represent it.

COURSE OUTLINE

WEEK	TOPICS	READING	HOMEWORK
1~2	Introduction; Algorithm; Algorithmic Paradigms; Divide and Conquer; Merge sort, Quicksort; Recurrence relations, Lower bound for sorting , radix sort	2.3 and Chpater 7, 8	Lab 1
2 ~3	Dynamic Programming; matrix-chain multiplication	Chpater 15	HW1, Q1
3 ~4	Greedy algorithms	Chpater 16	HW2, Lab 2
4~5	Graph algorithms: Breadth and depth first search, connected components, minimum spanning trees; Greedy algorithms, and Backtracking; Shortest path problem	Chpater 22, 23, 24	Q2 (take home)
5	Graph algorithms, Review, midterm		5/3/2017

6	String data structures and algorithms; substring search	Chapter 32	HW3
7	Computational Complexity and Intractability; NP and P vs. NP; Hard problems; Traveling Salesperson; SAT; Knapsack	Chapter 34	Lab3, Q3
8	Finite automata, regular expressions and regular languages	selected readings	
9	Pushdown automata, context free languages; Turing Machine; Universal Turing Machine	Selected readings	HW4, Q5
10	Church-Turing thesis; approximate algorithms, heuristics	Selected readings	
11	Final Exam		

TOPICS (BY ACM KNOWLEDGE AREA)

AL/Basic Analysis

- Complexity classes, such as constant, logarithmic, linear, quadratic and exponential
- Recurrence relations
- Analysis of iterative and recursive algorithms
- Master Theorem

AL/Algorithmic Strategies

- Brute-force algorithms
- Greedy algorithms
- Divide-and-conquer algorithms
- Recursive backtracking
- Dynamic programming
- Heuristics

AL/Fundamental Data Structures and Algorithms (most of these topics are in CS 260; if not covered in CS 260 then this class will need to pick up)

- Efficient sorts (merge sort, quicksort, heapsort)
- Graph algorithms, including depth and breadth-first traversals

AL/Basic Automata Computability and Complexity

- Finite-state machines
- Regular expressions
- The Halting problem
- Context-free grammars
- Introduction to P and NP classes and the P vs. NP problem
- Introduction to the NP-complete class and common NP-complete problems (i.e. SAT, Knapsack)

AL/Advanced Automata Theory and Computability [Elective topics]

- Regular and Context-Free languages
- Pushdown automata and Turing machines
- Nondeterministic finite automata (NFA)
- The Church Turing thesis

AL/Advanced Data Structures Algorithms and Analysis

- Graph algorithms: connected components, topological sort, shortest paths, minimum spanning trees, …
- String-based data structures and algorithms: tries, ternary search trees, substring search

DS/Basics of Counting

- Solving recurrence relations for typical algorithms (i.e. Towers of Hanoi, Mergesort, Quicksort, Binary Search, …)

IS/Basic Search Strategies

- Problem spaces, problem solving by search (state space search)
- Uninformed search

Grading:

Labs and Exercises	20%	Midterm	25%
Quizzes	20%	Final	35%

The cut off for letter grades are: A 90%, **B** 80%, **C** 70%, **D** 60%.
I sometime use +/- when you almost, but not yet, make to the next letter grade. I also reserve the right, in the some rare situations, to move a student's letter grade above the calculated one. Students who score more than 80% of the possible on the final and have the highest score will receive an A. If you fail the final, you are not allowed to pass the course, per division rule.

Project:

TBA

Labs and Exercises:

Labs and exercises have to be done individually although discussions on general subjects among students are strongly encouraged.

Quizzes and Exam:

There will be four quizzes. Midterm will be given 5/3/2017 You may bring ¼ sheet, double sided, of notes to the midterm. Final will be give during school scheduled final time. You may bring ½ sheet, double sided, of notes to the final. Notes, students have to score 60% or higher on the final to pass the course. We may have to take a coding midterm on week 10. We will see.

Class Philosophy

I would like very much for students to contribute to the overall learning process. If a student has a question, an idea, an answer to a question, an interesting story, or a suggestion, please let us all hear it so, hopefully, others may learn something from it.

Note:

1. All exercises and labs are due at the beginning of the class on the due day unless otherwise instructed. All exercises and labs must be handed in on time ready or not. Exercise or labs that are ONE week late will not be accepted. Exercises or labs turned in late will receive a 30% reduction in credit for each working day. Exceptions to this rule are rare and they must be cleared with the professor first.
2. Actual class schedule may vary considerably from the estimated – please pay attention.
3. Most of the labs and exercises will take many hours to complete. Start early on each lab and allow about twice as much time as you think you will need.

4. The expected attendance rate is 99%. Students who miss a class need to read the materials by him/her self first.
5. The detailed schedule is given so you can preview the materials.
6. If you want me to reconsider a grade you've been given for an assignment, you must submit your rationale in writing within one week of receiving the assignment back with the grade. Your request should identify the specific change requested and provide a reasoned argument and evidence in support of the change. You must deliver your request for grade change to me in my office, during my office hours.
7. If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Services, APSC 405, or at 503-838-8250, as early as possible in the term. Students needing medical or mental health care can access the Student Health and Counseling Center by calling 503-838-8313, emailing at health@wou.edu, or by walking in to schedule an appointment.
8. Electronic items such as cell phones, laptops, iPads, iPods and e-book readers should not distract you or your classmates during class. If you are distracting yourself or others, in any way, with an electronic item in class, you will be asked to step into the hall until you are done with the item. Unauthorized electronic items used on exams or quizzes will result in a score of 0 on that entire exam or quiz.
9. An incomplete grade will be given only in unusual circumstances. You must be passing the class at the time of the request for an incomplete, and there must be a serious event that is out of your control and prevents you from completing the class

Academic Dishonesty:

CODE OF STUDENT RESPONSIBILITY 574-031-0030 SPECIFIC STANDARDS AND POLICIES

THE FOLLOWING LIST OF PROHIBITED FORMS OF CONDUCT IS NOT ALL INCLUSIVE SINCE IT IS NOT POSSIBLE TO LIST ALL POTENTIAL VIOLATIONS. THE UNIVERSITY REQUIRES THAT ALL STUDENTS BEHAVE IN A MANNER CONGRUENT WITH ESTABLISHED COMMUNITY STANDARDS AND IN A MANNER CONDUCTIVE TO THE DEVELOPMENT OF THE INDIVIDUAL. ACTIONS DETRIMENTAL TO THE MISSION OF THE UNIVERSITY AND THE LEGITIMATE ACTIVITIES OF THE ACADEMIC COMMUNITY WHICH CONSTITUTE THE UNIVERSITY ARE IN VIOLATION OF THIS CODE AND MAY BE SUBJECT TO JUDICIAL PROCEDURES.

*ACADEMIC DISHONESTY, WHICH INCLUDES BUT IS NOT LIMITED TO:

CHEATING: INTENTIONAL USE OR ATTEMPTED USE OF ARTIFICE, DECEPTION, FRAUD, AND/OR MISREPRESENTATIONS OF ONE'S ACADEMIC WORK;

FABRICATION: UNAUTHORIZED FALSIFICATION AND/OR INVENTION OF ANY INFORMATION OF CITATION IN ANY ACADEMIC EXERCISE;

FACILITATING DISHONESTY: HELPING OR ATTEMPTING TO HELP ANOTHER PERSON COMMIT AN ACT OF ACADEMIC DISHONESTY. THIS INCLUDES STUDENTS WHO SUBSTITUTE FOR OTHER PERSONS IN EXAMINATIONS OR REPRESENT AS THEIR OWN PAPERS, REPORTS, OR ANY OTHER ACADEMIC WORK OF OTHERS;

PLAGIARISM: REPRESENTING WITHOUT GIVING CREDIT THE WORDS, DATA, OR IDEAS OF ANOTHER PERSON AS ONE'S OWN WORK IN ANY ACADEMIC EXERCISE. THIS INCLUDES SUBMITTING, IN WHOLE OR IN PART, PREWRITTEN TERM PAPERS OF ANOTHER OF RESEARCH OF ANOTHER, INCLUDING BUT NOT LIMITED PRODUCT OF COMMERCIAL VENDOR WHO SELL OR DISTRIBUTE SUCH MATERIALS. AND THE APPROPRIATION OF AND/OR USE OF ELECTRONIC DATA OF ANOTHER PERSON OR PERSONS AS ONE'S OWN, OR USING SUCH DATA WITHOUT GIVING PROPER CREDIT FOR IT; OR ANY USE OR ATTEMPTED USE OF ELECTRONIC DEVICES IN GAINING AN ILLEGAL ADVANTAGE IN ACADEMIC WORK IN WHICH USE OF THESE DEVICES IS PROHIBITED, AND SUCH DEVICES INCLUDE BUT ARE NOT LIMITED TO CELL PHONES, PDAS, LAPTOPS, PROGRAMMABLE CALCULATORS, ETC.

PROGRAMMING LANGUAGE SOURCE CODE IS NO DIFFERENT WHERE ACADEMIC HONESTY IS CONSIDERED. THE CODE YOU WRITE IN A COMPUTER SCIENCE COURSE IS NOT ESSENTIALLY DIFFERENT FROM THE PAPER YOU WRITE FOR A LITERATURE OR HISTORY CLASS. THEY ARE BOTH YOUR OWN WORK AND IDEAS.