CSE 990
Search Based Software Engineering
Fall 2005

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Meta-heuristic search algorithms are a class of algorithms that can be used to solve large optimization problems. In these problems it is usually infeasible to find the globally optimal solution, therefore the searches aim to balance multiple constraints to find a 'good' solution. Software engineering has many problems that fit into this category. Examples include generating test data, clustering of modules for maintenance, cost/effort prediction and software performance tuning. In this course we will learn about several meta-heuristic search algorithms in detail. We will discuss fitness functions, and data structures and algorithms for efficiency and generalization. We will study current literature where meta-heuristic search algorithms have been used to solve problems in software engineering.

The course will have a substantial independent project and will require strong class participation. Many of the lectures will not be structured. You are expected to read the material assigned and participate in discussions.

This course is a project based course. The first part of the course will consist of structured lectures on meta-heuristic search algorithms, and combinatorial techniques. The second part of the course will involve reading current literature on related topics. Students will be responsible for leading presentations. This includes creating supplementary overheads to lead the discussion.

Each student will select a project during the course of the semester. They will be expected to become familiar with a particular body of research beyond the classroom lectures. Students will submit a written report, and give an oral presentation of their findings. A list of suggested projects for this course will be available after the first 4 weeks of classes. Students are encouraged to work on projects related to their current research areas.

To succeed in this course you should have taken an algorithms course and have *some* prior knowledge of software engineering.

This document is available at http://www.cse.unl.edu/~myra/classes/cse990_05/syllabus.html

Course Textbook: There is no official text for this course. I will provide handouts and will try to have one book available on short term loan in the library. Research papers from conferences and journals will be posted on line for you to read.

Topics to be Covered:

(This syllabus will be updated and expanded as the semester progresses. You should use your browser reload button each time to make sure you have the most current version). A detailed schedule of lectures and handouts can be found below.

Part I: Meta-heuristic Search

- Introduction and Overview of Heuristic and Meta-Heuristic Search
  - General optimization problems

    - Fitness functions
    - Local search vs. Meta-heuristic search
    - Combinatorial algorithms for generic data structures
    - Visualization of the Search Landscape
- Specific Search Algorithms (not all may be covered):
    - Hill Climbing
    - Simulated Annealing
    - Great Deluge Algorithm
    - Tabu Search
    - Genetic Algorithms
    - Ant Colony Optimization

Part II: Applications in Software Engineering

In this part of the course we will read research papers that use search to solve software engineering problems. The topics will be specific to the papers read. Some topics that *may* be included are (exact topics may vary):

- Structural testing
- Evolutionary testing
- Program maintenance
- Software Security
- Performance Tuning
- Model Checking

The grading for the class will be as follows:

- Homeworks: problems, programs: **20%**
- In Class participation: **10%**
- Project Proposal: **10%**
- Paper presentation: **10%**
- Final project presentation: **(during dead week) 10%**
- Final project results and paper: **40%**

  There will be no exams given in this course; instead, evaluation will be based primarily on your class participation, assignments, your paper presentation, and your written and oral project presentations. However, there will be considerable reading of research papers involved in the course.

Detailed Class Schedule:

Class	Day/Date	Topic and Lecture Notes	Handouts	Assignments
1	Tues. 8/23	Introduction to Course lecture1.pdf.	Course syllabus . Handed out: Introduction to Heuristic Search	Return Student Questionnaire to me by email, before next class (8/25). Read Introduction to Heuristic Search - handed out.

			(in Library as e-document)	
2	Thurs. 8/25	Introduction to Meta-heuristic Search. Hill Climbing and Simulated Annealing. Slides: lecture2.pdf.		Homework One handed out. Due Thursday 9/1/05 4PM.
3	Tues. 8/30	Genetic Algorithms		
4	Thurs. 9/01			
5	Tues. 9/06			
6	Thurs. 9/08			
7	Tues. 9/13			
8	Thurs. 9/15	Class projects and project timeline.		
9	Tues. 9/20			
10	Thurs. 9/22			
11	Tues. 9/27		Proposal instructions available from Handouts.	Project Proposal due Tuesday, 10/4.
12	Thurs. 9/29			
13	Tues. 10/4			
14	Thurs. 10/6			
15	Tues. 10/11	paper presentations begin		
16	Thurs. 10/13	paper presentation		
-	Tues. 10/18	No Class - Fall Break		
17	Thurs. 10/20	paper presentation		

18	Tues. 10/25	paper presentation		
19	Thurs. 10/27	paper presentation		
20	Tues. 11/1	paper presentation		
21	Thurs. 11/3	paper presentation		
22	Tues. 11/8	paper presentation		
23	Thurs. 11/10	paper presentation		
24	Tues. 11/15	paper presentation		
25	Thurs. 11/17	paper presentation		
26	Tues. 22	paper presentation		
-	Thurs. 4/23	Thanksgiving Holiday		
27	Tues. 4/29			
28	Thurs. 12/01	Final Projects Due		
29	Tue 12/6	Final Presentations		
30	Thur 12/8	Final Presentations		