Syllabus
IE 607 Heuristic Optimization (啟發式最佳化)
Spring 2004

Instructor: 梁韵嘉 (Yun-Chia Liang)
Office Hours: Wednesdays 1:00 to 3:00 PM, or just stop by R2511
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Class Meets: Thursdays 1:10 PM to 4:00 PM in R2105

Course website:
http://logistics.iem.yzu.edu.tw/Teachers/Ycliang/Heuristic%20Optimization%20922/HOindex.htm or you may find it under the global logistics lab web.

Textbook: No specific book is required for this course.

Supplemental Materials: Some journals to look at are *IEEE Transactions on Evolutionary Computation, Journal of Heuristics, Computers & Operations Research, IIE Transactions, INFORMS Journal on Computing, Evolutionary Computation, Annals of Operations Research, Proceedings of the International Conference on Genetic Algorithms, Proceedings of the IEEE International Conferences on Evolutionary Computation*. Some books to look at are *Genetic Algorithms in Search, Optimization and Machine Learning* by Goldberg, *Genetic Algorithms & Engineering Design* by Gen and Cheng, *Adaptation in Natural and Artificial Systems* by Holland, *Evolutionary Computation* by Fogel, *Evolutionary Algorithms in Theory and Practice* by Back, *Swarm Intelligence from Natural to Artificial Systems* by Bonabeau, Dorigo, and Theraulaz, *Swarm Intelligence* by Kennedy and Eberhart, *Modern Heuristic Search Methods* by Rayward-Smith, *Modern Heuristic Techniques for Combinatorial Problems* by Reeves, etc.

Objective: This course is a survey of the newer, most common heuristic search methods. The areas of focus will be simulated annealing (SA), genetic algorithms (GA), evolutionary strategies (ES), tabu search (TS), and ant colony optimization (ACO), and particle swarm optimization (PSO). Other

methods such as random methods will be briefly covered. Both combinatorial and continuous optimization problems will be considered, with emphasis on combinatorics. The main techniques will be introduced, discussed critically and variations presented. Key papers from the literature, including applications, will be used. Students should gain knowledge of how and why these techniques work, when they should be applied and their relative merits to each other and to more traditional approaches, such as mathematical programming.

Course Structure: This class will be lectured in English, and it is a graduate course with emphasis on self exploration and research. There will be homework assignments and a term project.

The homework assignments and project can be a small group (3 people or less) or individual effort. The project can synthesize multiple techniques or be an in depth exploration of on technique using problems and applications are of the student's choice. Each project consists of a written report describing the problem area, the technique(s) selected, and how and why they were applied. A literature review relevant to the project should be undertaken and written up in the report. The report should give results, summarize findings, and make recommendations. A brief oral presentation (15-20 minutes) is also required to provide the same information to your classmates. A project proposal consists of a one page description of the intended project is due on May 13. Projects are due June 17.

Required Skills: Programming of some sort (C, Visual Basic, Pascal, Fortran, Matlab, etc.) is required to implement the optimization methods. The can be done on PC's or workstations without extensive or sophisticated programming knowledge. Emphasis is on effectiveness, not computational efficiency in terms of CPU effort. There are some web sites with code already done that you could modify if you prefer that.

Grading: Homework assignments (5 @ 30 points) 150
Project – oral and written 100
Class participation 10
Total Available 260 (then convert to 0-100 scale)
No late assignment and project will be accepted!!

Schedule of Classes

Date	Subject	Assignments Due
2/19	Introduction to Heuristic Search	
2/26	Introduction to Heuristic Search	
3/4	Simulated Annealing	
3/11	Particle Swarm Optimization	
3/18	Genetic Algorithm	HW#1 Due (SA)
3/25	Genetic Algorithm	HW#2 Due (PSO)
4/1	Evolutionary Strategies	
4/8	Ant Colony Optimization	HW#3 Due (GA)
4/15	no class (Midterm Week)	
4/22	Tabu Search	HW#4 Due (ACO)
4/29	Tabu Search	
5/6	Constrained Handling	
5/13	Miscellaneous Methods and Hybrid Methods	HW#5 Due (TS) Project Proposal Due
5/20	Miscellaneous Methods and Hybrid Methods	
5/27	no class	
6/3	Project Presentation	
6/10	Project Presentation	
6/17	no class (Final Exam Week)	Project Report Due