IE 552 Heuristic Methods for Optimization (3 0 3) (ECTS: 7.5)

Fall 2020 Tentative Course Syllabus

Catalog Description
Introduction, simulated annealing, tabu search, genetic algorithm, ant colony optimization, ant colony, variable neighborhood search and particle swarm optimization.

Course Objective
To cover various (meta)heuristic search approaches for solving difficult combinatorial optimization problems.

Lecturer
Ayyuce Aydemir Karadağ, Ph.D in Industrial Engineering
Office: L-310, aykaradag@cankaya.edu.tr
Office hour: To be announced.

Lecture Hours
Tuesday 18:00-21:00 (Online)

Course Outline: A tentative outline is given below and the instructor reserves the right to make changes as she sees necessary.

Week	Topics
1.	Introduction
2.	Categorization of heuristics
3.	Construction heuristics
4.	Classical improving search
5.	Simulated annealing
6.	Tabu search
7.	Genetic algorithms
8.	Swarm intelligence and ant colonies
9.	Scatter search
10.	Constraint handling
11.	Genetic Algorithms for multiobjective optimization
12.	Variable neighborhood search
13.	Evaluation of heuristic performance
14.	Computational complexity of heuristics

Textbook
- El-Ghazali Talbi: Metaheuristics - From Design to Implementation, Wiley, 2009 .
- J. Dr´eo, A. P´etrowski, P. Siarry, E. Taillard, Metaheuristics for Hard Optimization, simulated Annealing, Tabu Search, Evolutionary and Genetic Algorithms, Ant Colonies, Springer, 2003.

Reference Books
- Sean Luke, 2013, Essentials of Metaheuristics, Lulu, second edition.
- Gendreau, Michel and Jean-Yves Potvin (eds) (2012) Handbook of Metaheuristics. Springer.
- Talbi, El-Ghazali (2009) Metaheuristics; From Design to Implementation. Wiley.

- Stefan Edelkamp, Peter Norvig: Heuristic Search: Theory and Applications, Elsevier, 2011.
- Fred Glover, Gary A. Kochenberger: Handbook of Metaheuristics, Springer, 2010.
- Zbigniew Michalewicz, David B. Fogel: How to Solve It: Modern Heuristics, Springer, 2004.
- Holger H. Hoos ,Thomas Stützle: Stochastic Local Search, Morgan Kaufmann, 2005.
- Sadiq M. Sait, Habib Youssef: Iterative Computer Algorithms with Applications in Engineering: Solving Combinatorial Optimization Problems, Wiley, 2000.
- Christos H. Papadimitiou, Kenneth Steiglitz: Combinatorial Optimization., Dover Publications, 2nd edition, 1998.
- K. Deb: Multiobjective optimization using Evolutionary Algorithms, Wiley, 2001

Computer Usage
It is imperative that students use any computer programming language effectively.

Grading : Evaluation of the students will be based on
- paper presentation (10%),
- homeworks (3*15= 45%) to account for the midterm grade, and
- a final exam (45%).

Homeworks
Group work is not allowed on any assignment. Each student will choose an industrial engineering problem and develop different meta-heuristic algorithms to solve this problem. In each homework, simulated annealing, genetic algorithm and tabu search algorithms will be used, respectively. Students can use any programming language they want. Each student will prepare a report and give an oral presentation of their work. Details of the report will be announced later. Students who submit their report on time but do not make a presentation cannot get any points from the assignment. The sum of three homework grades makes up the student's midterm grade.

Attendance: Attendance may be taken during class sessions. It is best if you fully attend every hour. If you miss even a single hour, you will find it hard to understand the following course material since the topics are interrelated.