MAE 552 – Heuristic Optimization | Homework #1
Due Date: Friday Feb 8, 2002 | Instructor: Dr. Kurt Hacker

Problem One

In a heuristic search algorithm, one of the primary goals is to balance the global and local search components. Discuss how this balance is problem dependent in terms of the size of the search space, the presence or absence of constraints, the shape of the response surface (i.e. the topography of the design space), the difficulty or ease of calculating the objective function and constraints, and the user requirements for near optimality in the solution. Please address each of these issues in a concise paragraph.

Problem Two

You are presented with the following unconstrained optimization problem.

$$\text{Minimize } \mathbf{F}(\mathbf{x}) = [4 - 2.1\mathbf{x}_1^{\,2} + \mathbf{x}_1^{\,4}/3]\mathbf{x}_1^{\,2} + \mathbf{x}_1\mathbf{x}_2 + [-4 + 4\mathbf{x}_2^{\,2}]\mathbf{x}_2^{\,2}$$

$$-3 \le \mathbf{x}_1 \le 3$$

$$-2 \le \mathbf{x}_2 \le 2$$

You must use three methods to solve this problem.

1. Enumerative search with grid resolutions of 0.1, 0.01, and 0.001.
2. Random Search with five different numbers of points, the specific number to be chosen by the student.
   - Describe the effect the number of sample points had on the quality of the solution.
3. Hill climbing method. Use three different neighborhood sizes to be selected by the student.
   - Sample 20 points randomly from the neighborhood during neighborhood search.
   - Select a reasonable number for MAX_ITERATIONS.

For each of the above methods each student is required to create an original computer program in a language of their choosing (C++/C, Fortran, Matlab, Visual Basic, etc.). The code should be commented so that it can be easily understood. Results should include tables and graphs where appropriate and include a discussion of the quality of solutions found by each method as well as their efficiency. Keep the discussion concise and short! The entire assignment excluding the code should not be more than 3-4 pages long. It should be completed in Word or some other word processing program.