

CS4320/5314 - Artificial Intelligence

Spring 2009

Lab 2 - Evolutionary Algorithms

Due Monday, February 23, 2009

1. The Traveling salesman problem is described as follows: given a list of cities and their pairwise distances, find the shortest possible tour that visits each city exactly once. Design and implement a genetic algorithm to solve this problem.
2. Evolution strategies can be used to solve difficult constrained optimization problems for which conventional solutions fail. Design and implement evolution strategies to solve each of the following constrained optimization problems:

Maximize: $f(x) = -2x_1^2 + 2x_1x_2 - 2x_2^2 + 4x_1 + 6x_2$
subject to: $x_1 + x_2 \leq 2$
and: $x_1 + 5x_2 \leq 5$
where: $0 \leq x_1$ and $0 \leq x_2$

Minimize: $f(x) = (x_1 - 10)^3 + (x_2 - 20)^3$
subject to: $-(x_1 - 5)^2 - (x_2 - 5)^2 + 100 \leq 0$
and: $(x_1 - 6)^2 + (x_2 - 5)^2 - 82.81 \leq 0$
where: $13 \leq x_1 \leq 100$ and $0 \leq x_2 \leq 100$

Maximize: $f(x) = x_1^2 + (x_2 - 1)^2$
subject to: $x_2 - x_1^2 = 0$
where: $-1 \leq x_1 \leq 1$ and $-1 \leq x_2 \leq 1$

Prepare a report containing the following:

- Introduction. Description of the problem you are trying to solve.
- Proposed solution. How did you solve (or attempt to solve) the problem? Provide an informal, high-level description.
- Implementation. Description of your code (not the actual code). Explain the design choices you made, data structures and programming techniques you used, your user interface, input and output, etc.
- Experimental results. Describe the experiments you performed to test your algorithms. The experiments must be described in a way that allows anybody to replicate them using your code.
- Conclusions. Explain what you learned from the project.

Work in teams of size 1 to 3. No more than one CS graduate student per team is allowed.