Intelligent Systems (Fall 2012)

Assignment 4: Evolutionary Computation

DUE: Dec. 14

Question 1. (50 points)

A. Implement a binary Genetic Algorithm that uses fitness proportional selection, 1-point crossover, and bit-flip mutation to solve the problem in which the fitness is the number of 1s in the chromosome, i.e. the optimal solution is the chromosome where all genes are set to 1.

B. Run the algorithm 10 times for each of the four following versions of the problem: $l = 5, 10, 20, 50$, where l is the length of the chromosomes. Vary the population size and mutation rate to obtain good results (fast solution).

C. Plot the best fitness in each generation (averaged over the 10 runs), for each of the four problems. There should be one graph with four curves, the x-axis being the generations, and the y-axis the average (best) fitness.

Question 2. (50 points)

A. Implement (1+λ)-ES to optimize the following function:

$$f(\mathbf{x}) = \sum_{i=1}^{N-1} [(1 - x_i)^2 + 100(x_{i+1} - x_i^2)^2]$$

known as the Rosenbrock function (`http://en.wikipedia.org/wiki/Rosenbrock_function`), where N is the number of dimensions, and $-5 \leq x_i \leq 10$, $i = 1, 2, \ldots, N$.

B. Run the algorithm 10 times for each of the following four settings, $N = 5, 10, 20, 50$. Choose your own λ.

C. Plot the average fitness (over the 10 runs) of the parent in each generation for each N. As with question 1B, there should be four curves here.