CS 420

Project 5

**Ksenia Burova**

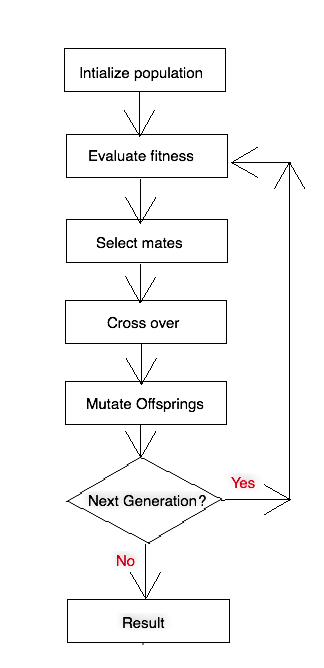
April 23rd, 2017

**Genetic Algorithms**

Project Report

***Abstract*:** In this project, the goal was to investigate details of the simplified genetic algorithm with emphasis on important biological processes like variation, heredity and selection. The following set of parameters was observed in different variations: population size, number of genes in individual, mutation and crossover probabilities, and number of generations. For every set variation, the program was run several times to better illustrate results and statistics. The discussion of the effects of the various parameters and overall ability to find the best solution concludes this report.

1. **Introduction.**

The methods of adaptation like variation, heredity and selection, are motivated by biological evolution. The essential parts of adaptation procedure are survival of the fittest and genetic diversity. In computer science, the purpose of genetic algorithms is to simulate real biological evolution by mapping program and data on DNA-like structures. “The DNA-like structures exist in populations those members can mate, cross over, and mutate, thus sharing fitness-increasing traits similar to those of real populations of species found in nature” (Flake, 342). Genetic algorithms are widely used for solving optimization problems, where optimization problem is a problem of finding the best solution out of all. Fitness function used in algorithm quantifies merit of potential solutions.

The algorithm itself includes following steps:

1. Each individual is represented as genetic string of ‘0’s and ‘1’s, the length of the string represents number of genes. Population gets initialized randomly with the number of such individuals.
2. Fitness of each individual gets calculated and evaluated.
3. A pair of parents chosen several times to mate and cross over.
4. Mutate resulted offspring.
5. Replace parents’ population with offspring’s’ population.
6. Repeat process or not depending on number of generations.

Img. . Genetic algorithm outline

Pg.343 (330)

1. **Experiment Set Up.**

The following parameters are used in this experiment:

1. Number of genes in the genetic string (*l*)
2. Population size (*N*)
3. Mutation probability ()
4. Crossover probability ()
5. Number of generations (*G*)
6. Seed for random number generator

Fitness of individual is calculated using following formula:

where is an integer representing genetic binary string.

Experiments consist of trying multiple combinations of parameters specified above. We also run experiment with each combination multiple times to achieve better results and statistics.

1. **Experiment Flow.**

**Combination 1 (base case):**

l = 20 , N= 30 , = 0.033, = 0.6, G = 10, seed = 1234

**Combination 2**

l = 5 , N= 10 , = 0.033, = 0.6, G = 10, seed = 1234

**Combination 3**

l = 5 , N= 20 , = 0.033, = 0.6, G = 10, seed = 1234

**Combination 4:**

l = 5 , N= 40 , = 0.033, = 0.6, G = 10, seed = 1234

**Literature Cited**

Flake, Gary William. *The Computational Beauty of Nature*. Cambridge, MA: The MIT Press, 1998. Print.