

parameter	value
bit string length	100
population size	100
selection	Truncation Selection
elitism	1% (i.e. best chromosome cloned)
mutation rate	1% (i.e. $1.0/N$)
crossover	true
generations	500 (terminate at max fitness)

1. Try evolving a solution using just mutation (no crossover) 10 (or more) times. How many generations does it appear to take to evolve a solution? How much variation is there in the number of generations taken from run to run? Is this more or less than you expected (both how many generations and the variation in required generations between runs)?

Run #	Final Generation
Run 1	Generation 232
Run 2	Generation 224
Run 3	Generation 166
Run 4	Generation 247
Run 5	Generation 206
Run 6	Generation 227
Run 7	Generation 205
Run 8	Generation 146
Run 9	Generation 182
Run 10	Generation 210

Max Variation: 101

The variation is about what I would have expected with no crossover.

The number of generations overall seems good, but I know it would be higher with no elitism.

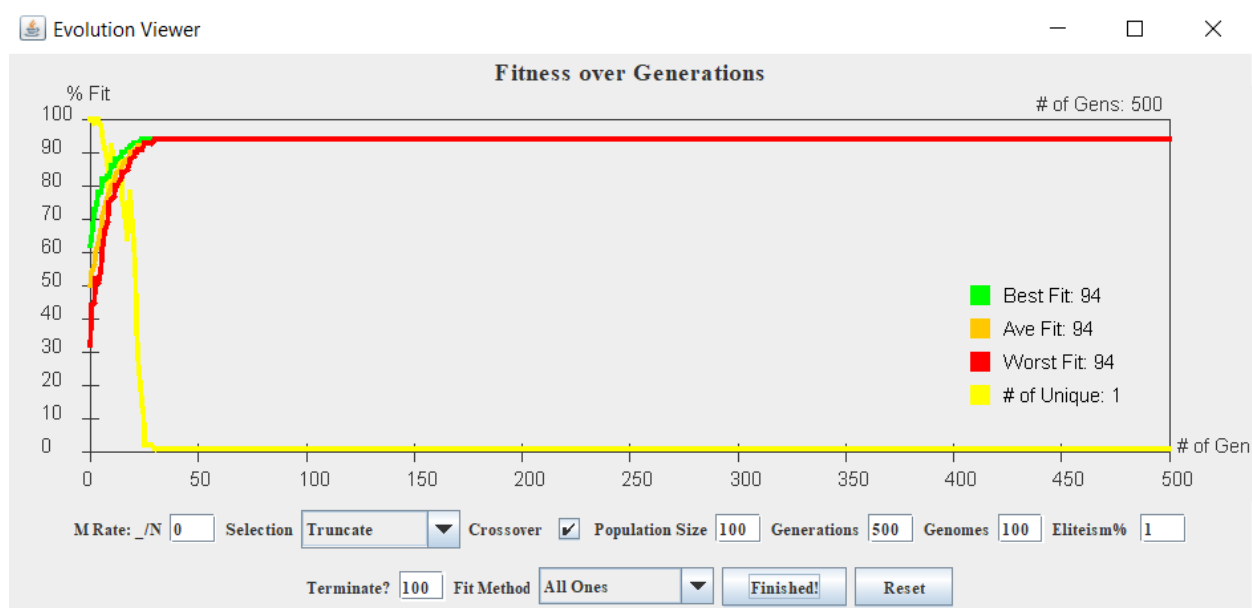
2. Repeat experiment #1, but use crossover (single crossover point) and mutation. What do you think will happen? How many generations does it appear to take to evolve a solution? What can you conclude from this?

Run #	Final Generation
Run 1	Generation 43
Run 2	Generation 34
Run 3	Generation 39
Run 4	Generation 36

Run 5	Generation 36
Run 6	Generation 30
Run 7	Generation 39
Run 8	Generation 39
Run 9	Generation 31
Run 10	Generation 40

It gets to the desired fitness level much faster than without crossover. It takes roughly 40 generations, which means crossover greatly improves the speed by roughly 5 times.

3. Repeat experiment #1, but with ONLY crossover (single crossover point) meaning you should set the mutation rate to 0. What do you think will happen? Run the experiment and report on your findings. Write down your best explanation of the results.



The fitness seems to improve but reaches a maximum fitness when all the chromosomes in the population are identical. I believe this is due to the elitism rate, which means that crossover from that chromosome will ultimately pass down through the entire generation.

4. Try different variations of parameters and turn mutation and crossover on and off in conjunction with different selection methods. (In particular, you might try experiments 1/2/3 with rank selection and Roulette Wheel) Do you find anything surprising? (You do not have to provide plots of all the experiment you run here, but select the most interesting ones to report on)

parameter	value
bit string length	100
population size	*

selection	Truncation Selection
elitism	1% (i.e. best chromosome cloned)
mutation rate	0% (i.e. $1.0/N$)
crossover	true
generations	500 (terminate at max fitness)

Population Size	Best Fitness
50	82
100	89
150	96
200	98
250	100

