|  |  |
| --- | --- |
| 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.

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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 |

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