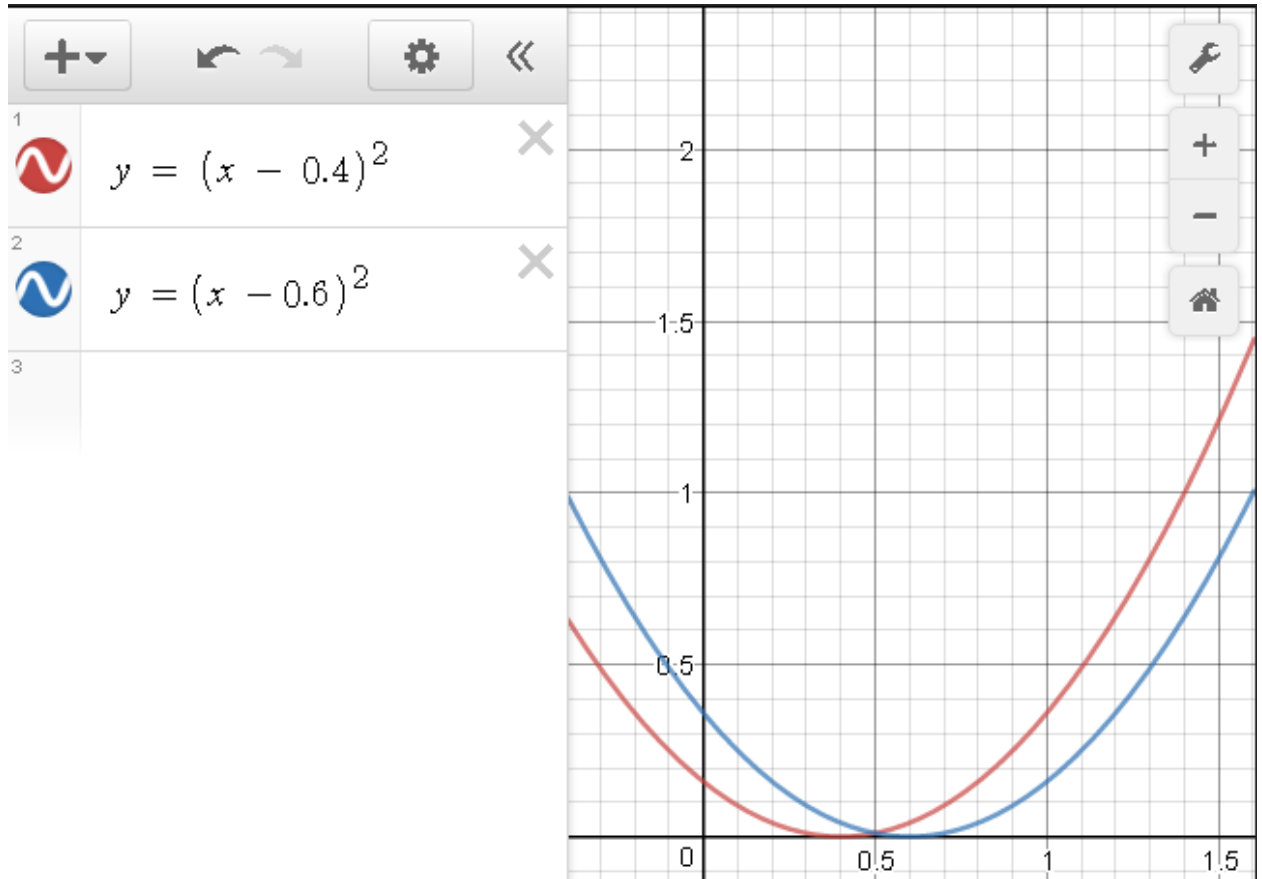


# Nikita Kharuk

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Graphic of functions:

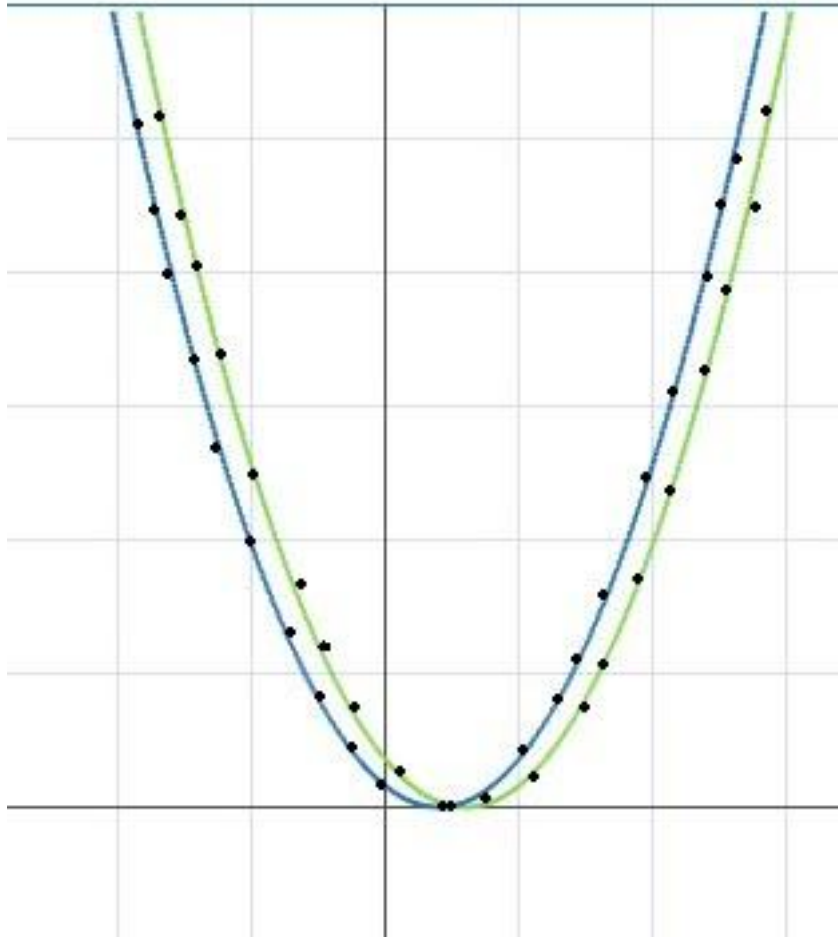


Start table:

|     | chromosome | x      | f1(x - 0.4)^2 | f2(x - 0.6)^2 | dominate | be dominated |
|-----|------------|--------|---------------|---------------|----------|--------------|
| x1  | 0011110010 | 0,308  | 0,005640825   | 0,010641      | 16       | 4            |
| x2  | 0001010100 | 0,422  | 0,054916391   | 0,094916      | 7        | 12           |
| x3  | 0010011001 | 0,963  | 0,009736263   | 0,014736      | 13       | 6            |
| x4  | 0110110000 | 0,391  | 0,199096509   | 0,239097      | 1        | 18           |
| x5  | 0010111010 | 0,522  | 0,001404284   | 0,006404      | 18       | 1            |
| x6  | 0111111100 | 0,762  | 0,009599233   | 0,013599      | 13       | 6            |
| x7  | 0000010101 | 0,911  | 0,144070658   | 0,194071      | 3        | 15           |
| x8  | 0110101001 | 0,358  | 0,179960156   | 0,19996       | 2        | 17           |
| x9  | 0000110110 | 0,294  | 0,085767391   | 0,145767      | 5        | 11           |
| x10 | 0100100010 | 0,25   | 0,028114813   | 0,068115      | 9        | 9            |
| x11 | 0011000111 | 0,0083 | 0,0089000     | 0,006470      | 12       | 7            |
| x12 | 0010001001 | 0,919  | 0,01701621    | 0,067016      | 14       | 5            |
| x13 | 0101000000 | 0,844  | 0,051459901   | 0,08146       | 8        | 11           |
| x14 | 0010101100 | 0,24   | 0,003760001   | 0,00576       | 17       | 2            |
| x15 | 0001010101 | 0,155  | 0,073756229   | 0,053756      | 8        | 11           |
| x16 | 0011000010 | 0,261  | 0,000360199   | 0,00056       | 19       | 0            |

|     |            |       |             |          |    |    |
|-----|------------|-------|-------------|----------|----|----|
| x17 | 0010001001 | 0,882 | 0,019036691 | 0,017037 | 10 | 9  |
| x18 | 0000100101 | 0,04  | 0,108064544 | 0,106065 | 4  | 16 |
| x19 | 0111110101 | 0,286 | 0,387895165 | 0,337895 | 0  | 19 |
| x20 | 0100011000 | 0,1   | 0,024273859 | 0,022274 | 10 | 9  |

Start graphic with 20 random points:



Intermediate table:

|     | chromosome | x     | $f1(x - 0.4)^2$ | $f2(x - 0.6)^2$ | dominate | be dominated |
|-----|------------|-------|-----------------|-----------------|----------|--------------|
| x1  | 0110111100 | 0,456 | 0,171369495     | 0,045782        | 12       | 7            |
| x2  | 0010000000 | 0,376 | 0,035680119     | 0,000123        | 7        | 12           |
| x3  | 0100010000 | 0,174 | 0,322758183     | 0,135511        | 13       | 6            |
| x4  | 0101010101 | 0,017 | 0,054600074     | 0,188067        | 1        | 18           |
| x5  | 0110101001 | 0,182 | 0,347528941     | 0,151723        | 18       | 1            |
| x6  | 0111011101 | 0,827 | 0,217544517     | 0,070978        | 13       | 6            |
| x7  | 0011010000 | 0,997 | 0,031108537     | 0,000558        | 3        | 15           |
| x8  | 0000000010 | 0,39  | 0,00237867      | 0,061887        | 2        | 17           |
| x9  | 0011111110 | 0,777 | 0,247640923     | 0,088587        | 5        | 11           |
| x10 | 0010110001 | 0,562 | 0,06212022      | 0,201816        | 9        | 9            |
| x11 | 0000111000 | 0,411 | 0,007952773     | 0,012281        | 12       | 7            |
| x12 | 0010111101 | 0,765 | 0,10513259      | 0,015436        | 14       | 5            |
| x13 | 0011010110 | 0,49  | 0,215673965     | 0,069911        | 8        | 11           |
| x14 | 0011010001 | 0,91  | 0,134498327     | 0,321194        | 17       | 2            |
| x15 | 0110110000 | 0,047 | 0,156131736     | 0,038078        | 8        | 11           |

|     |            |       |             |          |    |    |
|-----|------------|-------|-------------|----------|----|----|
| x16 | 0011000010 | 0,261 | 0,000360199 | 0,00056  | 19 | 0  |
| x17 | 0101100010 | 0,295 | 0,20346572  | 0,063037 | 6  | 12 |
| x18 | 0100001110 | 0,996 | 0,144701726 | 0,032543 | 4  | 16 |
| x19 | 0000111011 | 0,747 | 0,116352127 | 0,01991  | 10 | 7  |
| x20 | 0010111011 | 0,452 | 0,13759011  | 0,029218 | 4  | 11 |

Intermediate graphic:

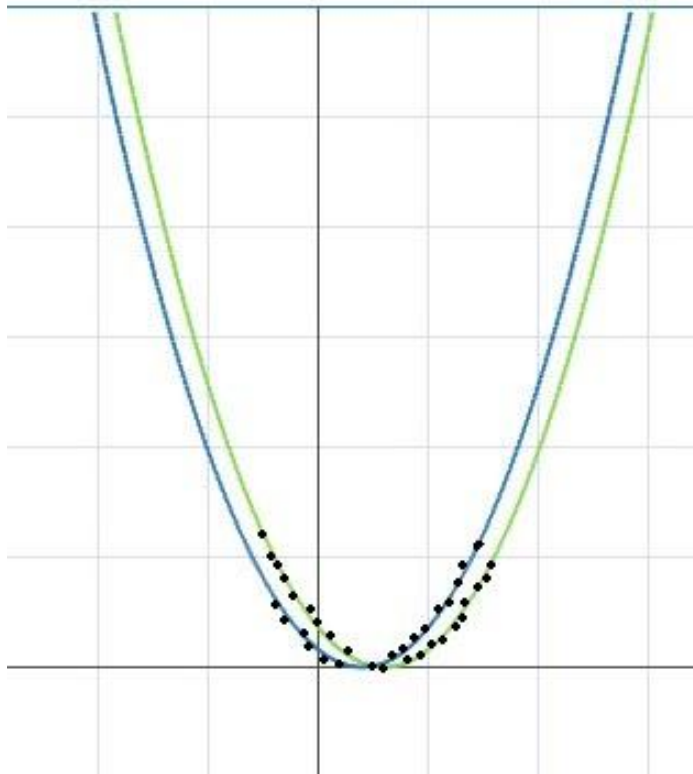
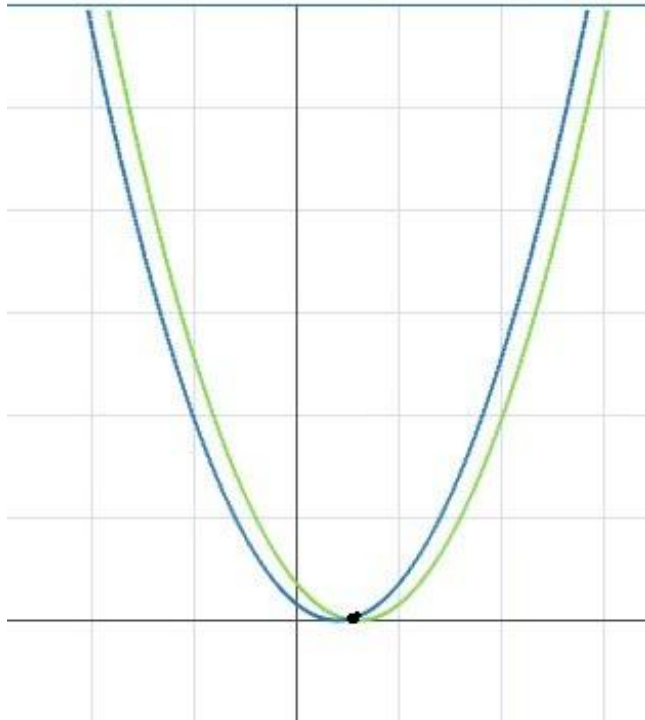


Table after last iteration:

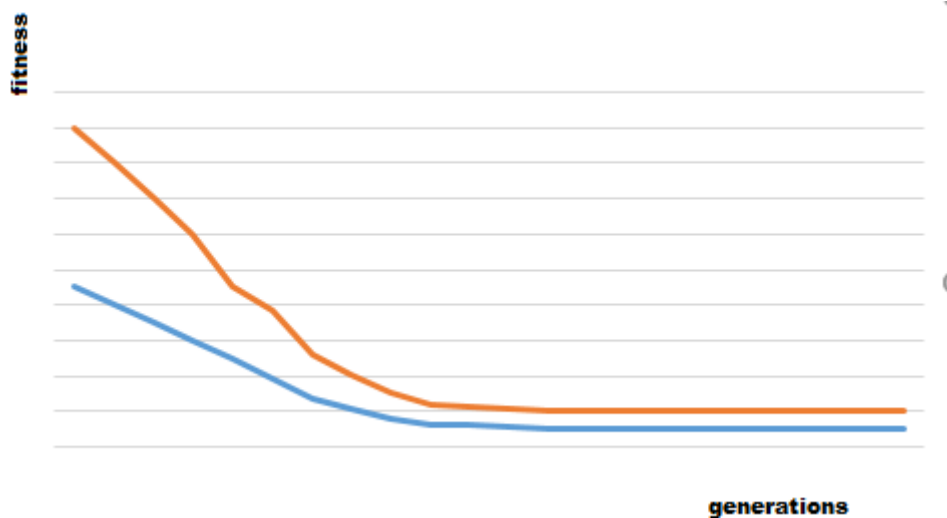
|     | chromosome | x     | $f1(x - 0.4)^2$ | $f2(x - 0.6)^2$ | dominate | be dominated |
|-----|------------|-------|-----------------|-----------------|----------|--------------|
| x1  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x2  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x3  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x4  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x5  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x6  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x7  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x8  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x9  | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x10 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x11 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x12 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x13 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x14 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x15 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |
| x16 | 0011000010 | 0,261 | 0,000360199     | 0,00056         |          |              |

|     |            |       |             |         |  |  |
|-----|------------|-------|-------------|---------|--|--|
| x17 | 0011000010 | 0,261 | 0,000360199 | 0,00056 |  |  |
| x18 | 0011000010 | 0,261 | 0,000360199 | 0,00056 |  |  |
| x19 | 0011000010 | 0,261 | 0,000360199 | 0,00056 |  |  |
| x20 | 0011000010 | 0,261 | 0,000360199 | 0,00056 |  |  |

Graphic after last iteration:



Fitness evolution graphic:



### Conclusion:

Based on the results of the work, we can see that the algorithm works, but I think that using linear recombination will speed up the program, as it will not be necessary to translate the numbers into a binary form.