Genetic Algorithm Example

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Example

Maximize $y = \sqrt{x}$
Subject to $1.0 \leq x \leq 16.0$
Population size: 6
Selection: Roulette-Wheel
Crossover: Single point (pc = 1.0)
Mutation: Bit-wise (pm = 0.03)

String No.	Initial population	Decoded value	x value	$f(x) = \sqrt{x}$	$p_{selection} \frac{f_i}{\sum f}$	Expected count $\frac{f_i}{\overline{f}}$
1	100101	37	9.81	3.13	0.18	1.07
2	011010	26	7.19	2.68	0.15	0.91
3	010110	22	6.24	2.50	0.14	0.85
4	111010	58	14.81	3.85	0.22	1.31
5	101100	44	11.48	3.39	0.19	1.16
6	001101	13	4.09	2.02	0.12	0.69
				sum $\sum f = 17.57$ average $\overline{f} = 2.93$ maximum $f = 3.85$		

$$x_1 = x_1^{min} + \frac{x_1^{max} - x_1^{min}}{2^l - 1} \times D$$

$$x_1^{min} \leq x_1 \leq x_1^{max}$$

l - Length of the sub-string/chromosome

D – Decoded value of the binary-string

Actual count Roulette wheel	Mating pool	Mating pair	Parents	Crossover site	Children strings	Mutation
1	100101	3	100101	10|0101	101010	101010
1	011010	6	111010	11|1010	110101	110101
0	111010	1	011010	011|010	011100	011100
2	111010	5	101100	101|100	101010	1**1**1010
2	101100	4	111010	11|1010	111100	111100
0	101100	2	101100	10|1100	101010	101010

Decoded value	x value	$f(x) = \sqrt{x}$
42	11.00	3.32
53	13.62	3.69
28	7.67	2.77
58	14.81	3.85
60	15.28	3.91
42	11.00	3.32
		sum $\sum f = 20.86$ average $\overline{f} = 3.48$ maximum $f = 3.91$