GENETIC ALGORITHM

EXAMPLES

- Maximize the value of the function $f(x) = -x^2 + 2x$

Over the range of real numbers from **0 to 2** with initial population **11010, 00111, 10110, 00101** with random numbers **0.4, 0.15, 0.7, 0.9**

Select the crossover between the **first** and **fifth** digits.

Decode the individual into a real number

- Individual 1: 11010 $\rightarrow = 0 + \frac{(2-0)}{(2^5-1)} \text{x}(26) = \frac{52}{31} = 1.677$
- Individual 2: 00111 $\rightarrow = 0 + \frac{(2-0)}{(2^5-1)} \text{x}(7) = \frac{14}{31} = 0.451$
- Individual 3: 10110 $\rightarrow = 0 + \frac{(2-0)}{(2^5-1)} \text{x}(22) = \frac{44}{31} = 1.419$
- Individual 4: 00101 $\rightarrow = 0 + \frac{(2-0)}{(2^5-1)} \text{x}(5) = \frac{10}{31} = 0.322$

11010: there are 5 digits in this binary number

The equation is : min + $\frac{maz - min}{2^5 - 1 = (assume\ 5\ digits\ as\ 1\ and\ the\ value\ is\ 32)} * (Binary\ to\ decimal)$

String No.	Initial Population	X Value	Fitness $f(x) = -x^2 + 2x$	Prob	Cumulative	Intervals of R N
1	11010	1.677	0.541	0.21	0.21	0 to 0.21
2	00111	0.451	0.699	0.27	0.48	0.22 to 0.48
3	10110	1.419	0.824	0.32	0.8	0.49 to 0.8
4	00101	0.322	0.541	0.2	1	0.81 to 1
Sum			2.6056			
Average			0.6514			
Maximum			0.824			

Random Number	Region	Chosen string
0.4	0.22 to 0.48	00111
0.15	0 to 0.21	11010
0.7	0.49 to 0.8	10110
0.9	0.81 to 1	00101

Crossover point 1st and 5th digit:

First pair:

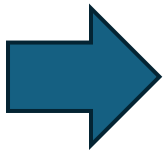
0**0111** → 01011

1**1010** → 10110

Second pair:

1**0110** → 10100

0**0101** → 00111



String No.	New Population	X Value	Fitness $f(x) = -x^2 + 2x$
1	01011	0.709	0.915
2	10110	1.419	0.824
3	10100	1.29	0.915
4	00111	0.451	0.699
(sum)			3.3548
Average			0.8387
Max			0.915

Now we can see, Previously Max value was **0.824** after first generation the value is **0.915**

Thank you

- Reference:
- Vtupulse.com
- https://www.youtube.com/watch?v=Dj1AZ0T-m-I&list=PL4gu8xQu0_5J3xTQDTZM_A17hTid4ahJ1&index=9