Lab 2 - Compare one-point, multi-point, and uniform crossover operators

CSE, SUSTech

Outline of This Lab

- How Does A Crossover Operator Work
- Does The Crossover Type Matter?
- Test Function
- Illustrate The Results!

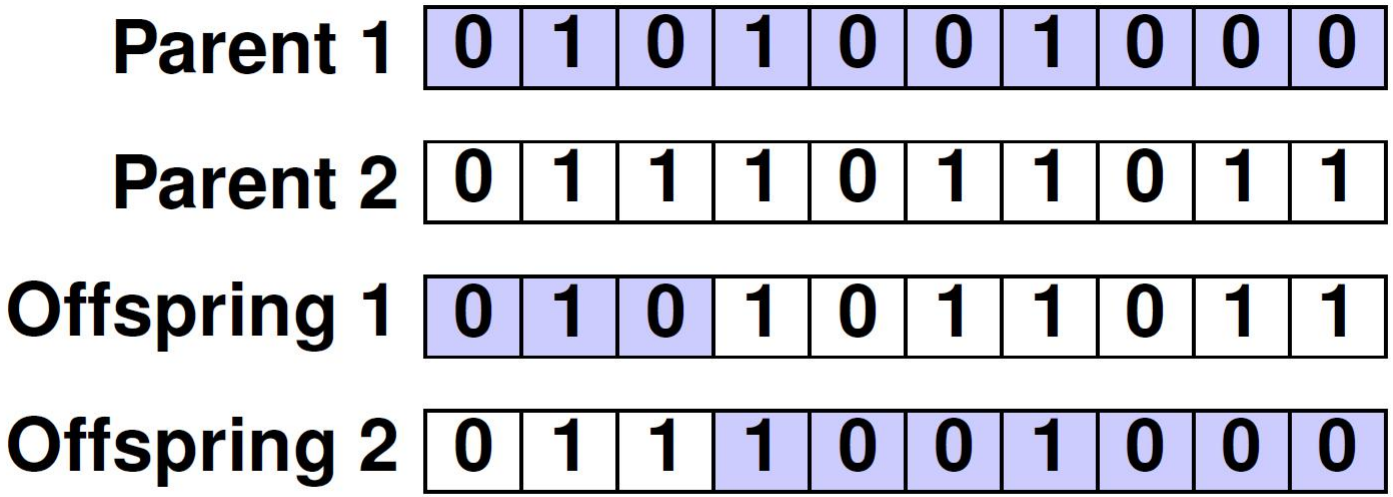
How Does A Crossover Operator Work

Recombination for discrete representation

- ✓One-point crossover
- ✓k-point crossover (k > 1)
- ✓Uniform crossover

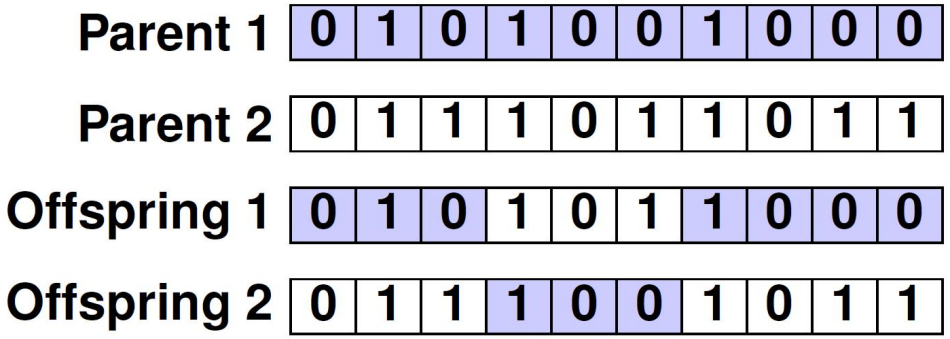
One-point Crossover

Example: choose a random crossover point at 3

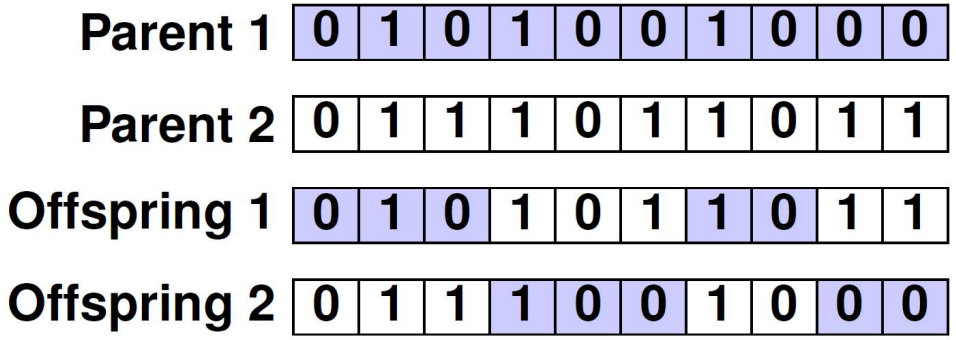


k-point Crossover (k > 1)

- Example: k = 2, choose two random crossover points at 3 and 6



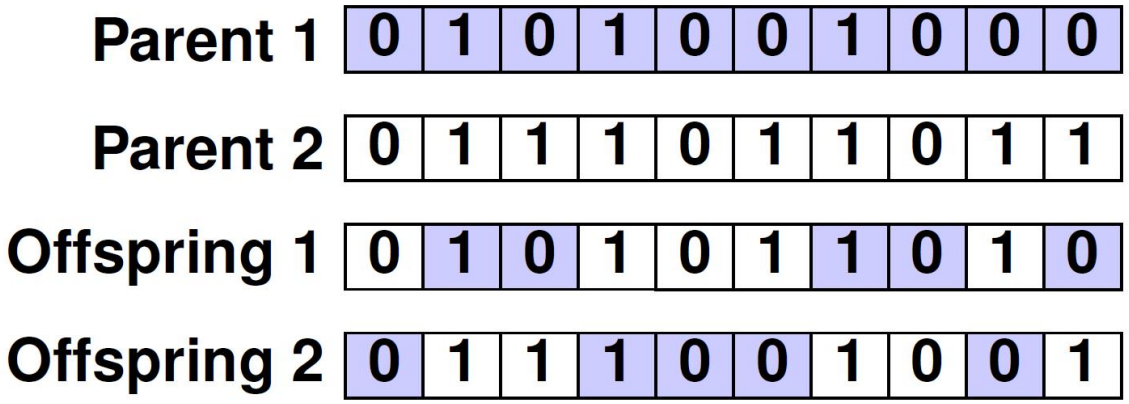
- Example: k = 3, choose three random crossover points at 3, 6, 8



Uniform Crossover

Example: at every point, generate a random number $\in [0, 1]$ with crossover rate 0.5

Gene Index	1	2	3	4	5	6	7	8	9	10
Random	0.31	0.63	0.58	0.07	0.29	0.42	0.59	0.63	0.13	0.73



Does The Crossover Type Matter?

Modify the simple evolutionary algorithm (EA) in Lab 1 with the following three Crossover Operators

- ✓One-point crossover
- ✓Two-point crossover
- ✓Uniform crossover

and run the EA to solve the Test Function given in the next slide.

Test Function

Sphere Function

$$f(x) = \sum_{i=1}^{n} x_i^2$$

with different dimension n = 1, 10, 20, and 30, and x_i, (i = 1, ..., n), in the integer interval [0, 127].

Assume each variable x_i is encoded by 8 bits, and all encoded variables are concatenated to form an individual, therefore, each individual is a string of 8n bits. Assume the population size is 30.

Illustrate The Results!

Plot 12 figures for each combination of crossover type and dimension

- ✓x-axis: current evaluation number.
- ✓y-axis: fitness value of the best individual of current population.