Genetic operators

Selection[1]

Selection is the stage of a genetic algorithm in which individual genomes are chosen from a population for later breeding (recombination or crossover).

A generic selection procedure may be implemented as follows:

1. The fitness function is evaluated for each individual, providing fitness values, which are then normalized. Normalization means dividing the fitness value of each individual by the sum of all fitness values, so that the sum of all resulting fitness values equals 1.
2. The population is sorted by descending fitness values.
3. Accumulated normalized fitness values are computed (the accumulated fitness value of an individual is the sum of its own fitness value plus the fitness values of all the previous individuals). The accumulated fitness of the last individual should of course be 1 (otherwise something went wrong in the normalization step!).
4. A random number *R* between 0 and 1 is chosen.
5. The selected individual is the first one whose accumulated normalized value is greater than *R*.

If this procedure is repeated until there are enough selected individuals, this selection method is called fitness proportionate selection or *roulette-wheel selection*. If instead of a single pointer spun multiple times, we have multiple, equally spaced pointers on a wheel that we spin once, it is called stochastic universal sampling. Repeatedly selecting the best individual of a randomly chosen subset is tournament selection. Taking the best half, third or another proportion of the individuals is truncation selection.

There are other selection algorithms that do not consider all individuals for selection, but only those with a fitness value that is higher than a given (arbitrary) constant. Other algorithms select from a restricted pool where only a certain percentage of the individuals are allowed, based on fitness value.

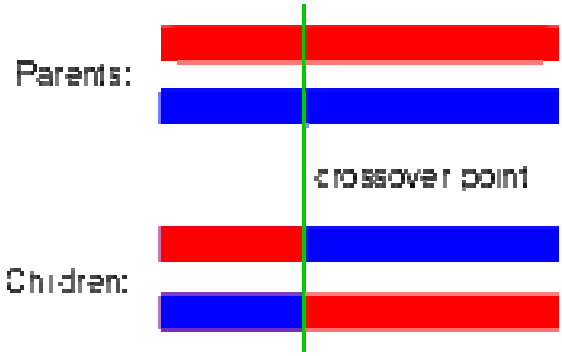
[1] http://en.wikipedia.org/wiki/Genetic_algorithm#Selection

Recombination (or Crossover[2])

Many crossover techniques exist for organisms which use different data structures to store themselves.

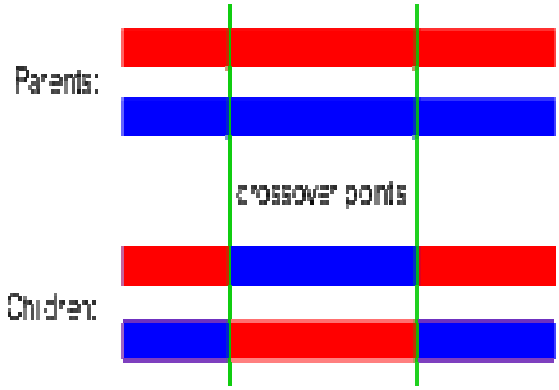
One-point Crossover

A single crossover point on both parents' organism strings is selected. All data beyond that point in either organism string is swapped between the two parent organisms. The resulting organisms are the children :



Two-point Crossover

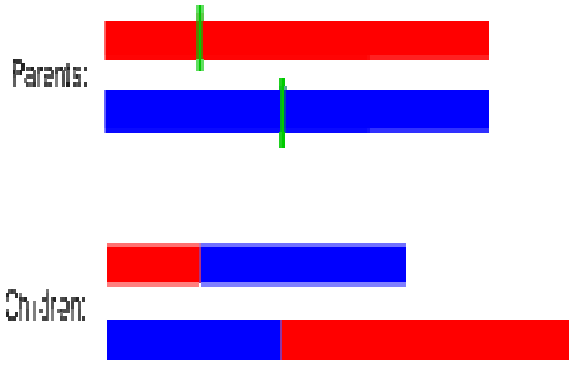
Two-point crossover calls for two points to be selected on the parent organism strings. Everything between the two points is swapped between the parent organisms, rendering two child organisms:



2 http://en.wikipedia.org/wiki/Crossover_%28genetic_algorithm%29

Cut and splice

Another crossover variant, the "cut and splice" approach, results in a change in length of the children strings. The reason for this difference is that each parent string has a separate choice of crossover point.



Inversion[3]

Inversion is a process in which the order of two gene position swapped with respect to each other. In
inversion operator i.e. Inversion(popcurrent) , two points are selected along the length of the
chromosome, the chromosome is cut at those points and the end points of the section cut, gets
reversed(swapped).To make it clear ,we consider a chromosome of length 5 , where two inverse points are
selected randomly(the points are 2 and 4 denoted by _character as shown below)

Offspring	2	3	4	1	5
Offspring	2	1	4	3	5

[3] Er.Rajiv Kumar et. al. / International Journal of Engineering Science and Technology "Genetic Algorithm approach to Operating system process scheduling problem"