1 Genetic Algorithm (GA)

Genetic algorithms are probabilistic search algorithms inspired by natural selection and survival of the fittest. They operate on complex problems that would be very difficult, maybe even impossible, to solve by classical methods. Genetic algorithms are very robust and can find near-optimal solutions to problems without knowing anything about how an optimal solution look like, they only require a method of measuring the "goodness" or fitness of a solution.

Genetic algorithms work as follows: An initial population of individual solutions is generated and the fitness of each individual is calculated based on a fitness function, which from now on will be called an objective function. Based on their objective function values the fittest individuals are selected for reproduction. By combining genes of the parent solutions and perform genetic operations such as mutation, a new pool of solutions is generated. Since the solutions of the newly generated population is produced by recombining the fittest solutions from the initial population the average fitness of the newly generated population is expected to be higher than the one of the initial population. This process continues until some stopping condition is reach, and by then the average and best fitness of the population should be pretty high. Figure **??** shows the main operations of the genetic algorithm.

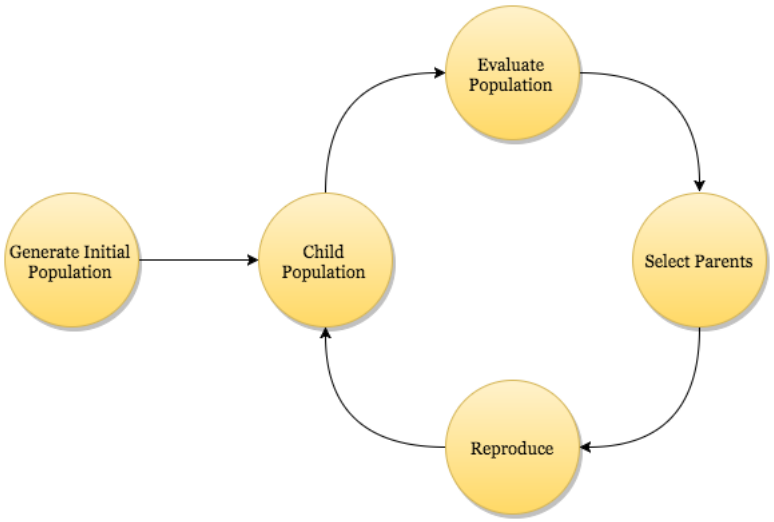
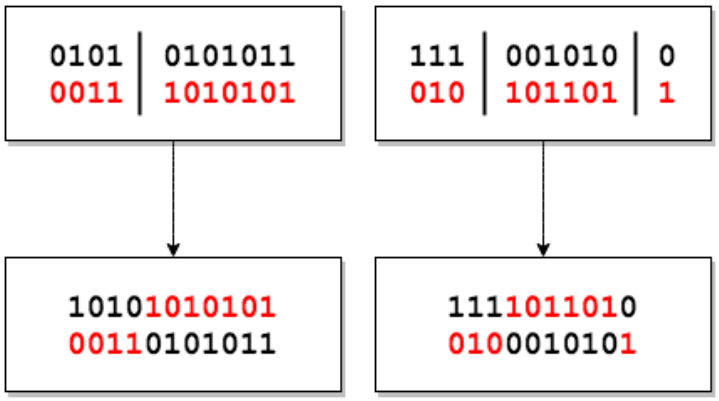


Figure 1: The main operations of and genetic algorithm

1.0.1 Representation of individuals and Reproduction

The individuals (solutions) that the GA perform operations on are represented as bit-strings. Initially each bit-string is generated by randomly assigning either zero or one to each of the "genes" of the individual. An example of an individual is given below:



(a) Single-point crossover. (b) Double-point crossover.

Figure 2: Crossover operations. (a) Singe point crossover at position four. (b) Double-point crossover at positions three and nine.

1.1 The Island Model

1.2 The Cellular Model

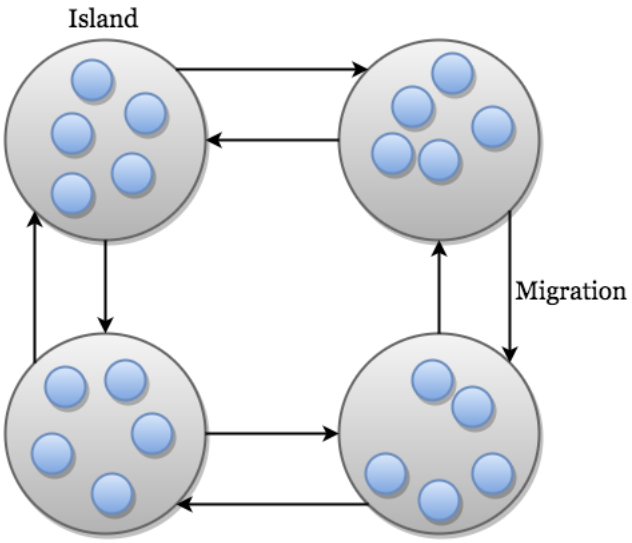


Figure 3: Island Model

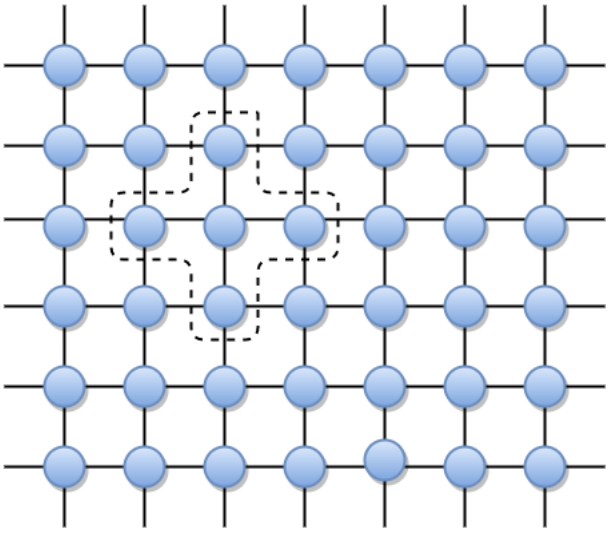


Figure 4: Cellular Model