

# Tutorial 09

(Version 1.1)

1. What are the five basic steps of an evolutionary algorithm? List the steps and briefly describe each step.
2. Explain what it means to have a *mutation rate* of 20%. Clearly describe both the “rate” and the “mutation” aspects of the term.
3. Given the following two parents:

$$\begin{array}{l} p1 = \\ p2 = \end{array} \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ \hline 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1 & 1 \\ \hline \end{array}$$

and the following *crossover mask*:

$$mask = \begin{array}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|c|} \hline 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 1 & 1 \\ \hline \end{array}$$

Show the resulting offspring. Explain how you arrived at your result.

4. You are given an assignment to solve the traveling salesman problem (TSP) using a genetic algorithm. In the assignment, there is a map with thirty locations that the salesman must visit. The goal of the GA is to minimise travel time. In addition, the salesman has to visit each location once and only once. Assuming the salesman can begin his journey at any one of the thirty locations:
  - (a) Describe a *bit string* representation for encoding a solution (i.e., the genotype) for your GA.
  - (b) Given your answer to the previous question, is it possible to have an invalid genotype? Explain your answer.
  - (c) Describe a fitness function for your GA.

## Version list

- Version 1.0, March 3rd 2019.
- Version 1.1, March 9th 2021.