Tutorial 09 — Answers
(Version 1.1)

1. The five basic steps of an evolutionary algorithm are:

   (a) Initialise a population, usually randomly

   (b) Perform a task

   (c) Select the fittest performers in the population for the next generation

   (d) Reproduce more members of the population to fill out the next generation

   (e) Repeat the process going back to step 2

2. The "rate" means that in the reproduction step, 20 percent of the members of the population will have their genetic representation "mutated".

   With a genetic algorithm, where the representation is a bit string, "mutation" means that one or more bits will be "flipped".

   With a genetic program, where the representation is an s-expression, "mutation" means that one or more nodes or subtrees will be randomly changed to some other value.

3. The mask contains three crossover points: bits 3, 6 and 10. The 0's in the mask indicate that p2's bits go to child1 and p1's bits go to child2. The 1's in the mask indicate that p1's bits go to child1 and p2's bits go to child2.

   So, given the two parents

   $p1 =$

0	1	1	1	0	0	1	1	1	0	0	1	1	1	0

   $p2 =$

1	1	1	1	0	0	0	0	1	0	0	1	1	1	1

   We have:

$mask =$	0	0	0	1	1	1	0	0	0	0	1	1	1	1	1
$child1 =$	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0
$child2 =$	0	1	1	1	0	0	1	1	1	0	0	1	1	1	1

4. (a) One possible answer is to number each location from 0 to 29. Convert each location number to a binary, e.g., 29 is 11101. Then you can encode a path, visiting each city only once, as a 150 bit string. Each group of 5 bits (enough to represent numbers up to 32) represents a single location in the bit string.

   (b) Yes, a path with a missing location. In other words, the bit string has a 150 bits but the path visits a location more than once.

   (c) The travel time for the path encoded in the genotype.

Version list

- Version 1.0, March 5th 2019.

- Version 1.1, March 9th 2021.