

Revision for Genetic Algorithms

The Principles of Natural Selection and Evolution

Evolution is a mechanism based in natural selection that creates solutions to problems by selectively breeding possible answers.

For evolution to occur the following elements are necessary:

- **Variety** (in the form of various possible and feasible answers to the problem, a population)
- **Selection** (a way to encourage the possible answers that are better to multiply and others to wither out)
- **Measurement of fitness** (to be able to determine how to do selection)
- **Reproduction** (to be able to replenish the population of possible answers when selected out)
- **Mutation** (to create or replenish variety in the population)

Creating Evolution:

To configure a problem for evolution the following steps need to be followed:

- Represent the possible answers in a formal structure called the **chromosome**.
- Create a random population of **varied** chromosomes.

- Tests each chromosome in the population to see how **fit** it is to solve the problem.
- **Select** individuals randomly, but the fitter, the more probable they are to be selected.
- Apply the **genetic operators** to the selected individuals to replenish the population and **repeat** the cycle.
- In each repetition, test if the answer has been found (**termination criteria**), and terminate if it has.

The Genetic Operators:

To replenish the population once selection has been applied, individuals have to be reproduced in different ways.

- By **copy**: this creates identical copies, it increases the population but has **NO effect in evolution**.
- By **mutation**: this randomly changes an individual in the population. Is the **ONLY** renewable source of variety, thus is **absolutely necessary** for evolution to occur.
- By **crossover**: this explores variety in the **most efficient** way thus speeds up evolution. Is very efficient but eventually exhausts variety.

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