

LAB # 8:**GENETIC ALGORITHM****Objectives:**

- To implement genetic algorithm in python

Hardware/Software Required:

Hardware: Desktop/ Notebook Computer

Software Tool: Python 2.7/ 3.6.2

Introduction:

Genetic algorithm (GA) is a metaheuristic inspired by the process of natural selection that belongs to the larger class of evolutionary algorithms (EA). Genetic algorithms are commonly used to generate high-quality solutions to optimization and search problems by relying on bio-inspired operators such as mutation, crossover and selection. The basic structure of a GA is shown in Figure 1:

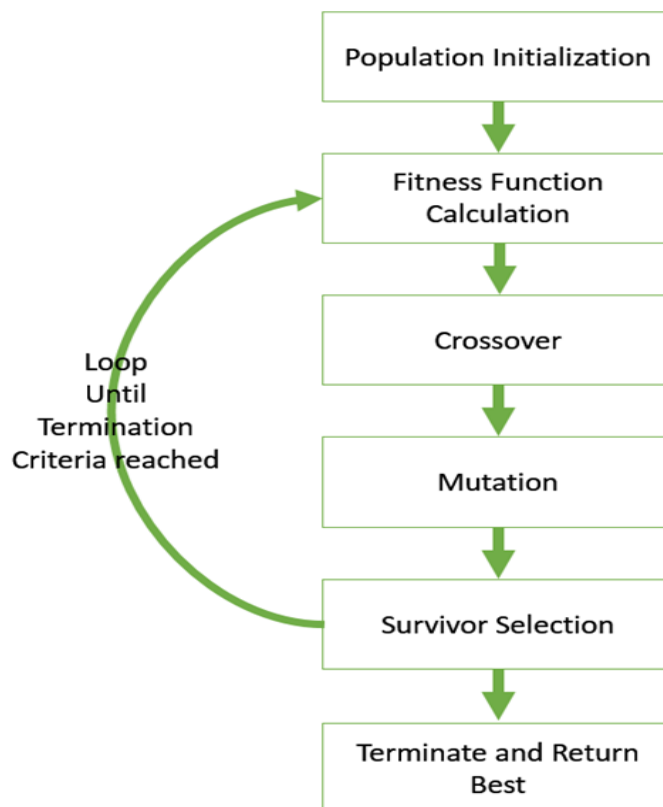


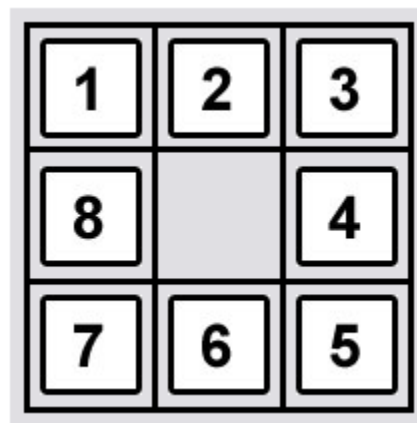
Figure 1: Genetic Algorithm

GA starts with initializing population (which may be generated at random or seeded by other heuristics), select parents from this population for mating. Apply crossover and mutation operators on the parents to generate new off-springs. And finally, these off-springs replace the existing individuals in the population and the process repeats. In this way, genetic algorithms try to mimic the human evolution to some extent.

Lab Task:

8-Slider Puzzle:

An 8-slider puzzle is a combinational puzzle that challenges a player to slide pieces along certain routes to establish a certain end-configuration. The pieces to be moved may consist of simple shapes, or they may be imprinted with colors, patterns, sections of a larger picture, numbers, or letters. One of such example is shown below:



The optimizations through genetic algorithm can be used to solve 8-slider puzzle. The details about fitness, crossover and mutation are:

Chromosomes: 8 moves consisting of 'Up', 'Down', 'Left' and 'Right'.

Fitness: Total number of correct moves for each chromosome.

Crossover: Crossover exchange moves between adjacent chromosomes after determining maximum fitness value.

Mutation: Change the first problematic move in chromosome with least fitness. E.g. if the move is 'left', then change is to 'right' and vice versa. If the move is 'up', then change it to 'down' and vice versa.

The pseudocode for GA is given below. Your job is to use GA to solve 8-slider puzzle.

Initial chromosomes:

| Move 1 | Move 2 | Move 3 | Move 4 | Move 5 | Move 6 | Move 7 | Move 8 |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Up | Right | Up | Down | Down | Right | Left | Down |
| Up | Left | Down | Up | Down | Up | Right | Right |
| Up | Up | Right | Up | Right | Up | Right | Right |
| Right | Up | Left | Up | Left | Down | Right | Down |

GA():

Initialize chromosomes ch1, ch2, ch3 and ch4 as shown above

Initialize coordinates of blank space

Compute fitness for all chromosomes and store them in f1, f2, f3 and f4

while fitness of all chromosomes is less than 8

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    if f1 != 8
        crossover ch1 with ch2
    end
    if f2 != 8
        crossover ch2 with ch1
    end
    if f3 != 8
        crossover ch3 with ch4
    end
    if f4 != 8
        crossover ch4 with ch3
    end

```

Compute fitness for all chromosomes and store them in f1, f2, f3 and f4

Mutate chromosome with least fitness value

Re-compute fitness for all chromosomes and store them in f1, f2, f3 and f4

return all chromosome pairs

Conclusion:

Write the conclusion about this lab

NOTE: A lab journal is expected to be submitted for this lab.