School of Engineering
ENG 335 Computational Intelligence
Professor Michael Negnevitsky
2025

ASSIGNMENT 3
Genetic Algorithms

Issued:	Thursday, 18 September 2025
Submission:	Thursday, 9 October 2025
Penalty for Later Submission:	5% per day

This is a compulsory assessment item. It counts 15% towards the final assessment and contributes to learning outcome ILO7. ILO7 is assessed in this assignment and a mark of 50% is required to achieve this ILO.

Goals:

Develop a genetic algorithm for optimising the location of an emergency response unit in order to minimise the response time to a medical emergency in a city.

Submission Requirements:

This assignment is for a group of two students. Each group submits a single report (should include the User's Guide) as well as software developed.

Plagiarism:

Each assignment must be entirely your own work. Plagiarism is not tolerated (you will automatically fail the course).

Problem description:

Part 1
The city is mapped into a 7 km × 7 km grid, shown in Figure 1. A number in each sector of the grid represents an average number of emergencies per year in a given sector.

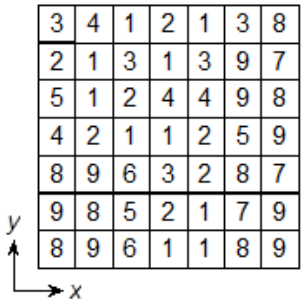

Figure 1. A grid-map of a 7 km × 7 km city.

A fitness function can be defined as a reciprocal of the sum of distances weighted by emergency rates:

$$f(x,y) = \sum_{n=1}^{49} \lambda_n \sqrt{(x_n - x_{eru})^2 + (y_n - y_{eru})^2} \,,$$

where λ_n is the emergency rate in sector n; (x_n, y_n) are the coordinates of the centre of sector n; and (x_{eru}, y_{eru}) are the location coordinates of the emergency response unit. It can be assumed that the emergency response unit can be located only in the centre of a sector.

Part 2

Develop a genetic algorithm for the problem described in Part 1 assuming that there is a river that divides the city into two parts, West and East, at x = 5 km. West and East are connected by a bridge located at x = 5 km and y = 5.5 km, as shown in Figure 2.

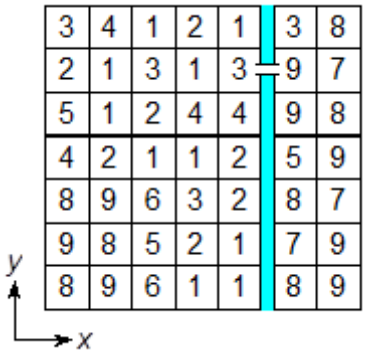

Figure 2. A grid-map of a 7 km × 7 km city divided by a river.

Find the optimal location of the emergency response unit and compare it with the one obtained in Part 1.

Guidelines:

This assignment should take about 8 hours of work. Remembering that a report is required, you should aim to allocate your efforts in roughly the following proportions:

1.	Familiarisation with the travelling salesman problem	10%.
2.	Implementation of the genetic algorithm	50%.
3.	Testing the genetic algorithm	10%.
4.	Developing a user-friendly interface (GUI) with simulation of the algorithm	20%.
5.	Assignment Report	10%.

Assignment report should include the following:

1. Introduction.
2. Short description of the domain problem.
4. Description of the genetic algorithm developed (examples are required!).
5. User's Guide.
6. Conclusions.