

Homework 3 (Midterm 2)

FourMax Problem

The TwoMax problem is a multimodal optimization problem that has 2 optimal solutions. The fitness function of the TwoMax problem is:

$$f(\mathbf{x}) = \max\{u(\mathbf{x}), \bar{u}(\mathbf{x})\}, \quad u(\mathbf{x}) = \sum_{i=1}^n x_i, \quad \bar{u}(\mathbf{x}) = \sum_{i=1}^n (1 - x_i),$$

where $\mathbf{x} = \langle x_1, x_2, \dots, x_n \rangle, \quad x_i \in \{0, 1\}.$

In this homework assignment, we introduce the FourMax problem. FourMax problem has 4 optimal solutions, and one FourMax problem is made by concatenating two TwoMax problems. The fitness function of the FourMax problem is:

$$f(\mathbf{x}) = \max\{u(\mathbf{x}_{1:n}), \bar{u}(\mathbf{x}_{1:n})\} + \max\{u(\mathbf{x}_{n+1:2n}), \bar{u}(\mathbf{x}_{n+1:2n})\},$$

where $\mathbf{x} = \langle x_1, x_2, \dots, x_{2n} \rangle, \quad \mathbf{x}_{i:j} = \langle x_i, x_{i+1}, \dots, x_j \rangle, \quad x_i \in \{0, 1\}.$

Solve the FourMax problem using GA. The objective is to find all solutions and maximize the fitness values of the population. Use the parameters below.

- **Individual length = 50** (i.e., $n = 25$)
- **Population size = 100**
- **Maximum generation = 300**

Try using general overlap selection and sharing method.

Submit a zip file to the TA's email containing the following:

- Final population.
 - **fourmax.txt**
- Source code (Python, C, or C++)
 - In your source code, set a seed to make your GA reproducible. (e.g. `np.random.seed(12)`, `random.seed(34)`, `srand(56)`, etc.)

The name of the zip file must include **your name** and **your student id**.

Due: 11/14 23:59

Email: cheetos@gm.gist.ac.kr