**EE 496**

**INTRODUCTION TO COMPUTATIONAL INTELLIGENCE**

**HOMEWORK**

**#1**

**Assigning Students to Courses Using Genetic Algorithm**

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1. **INTRODUCTION**

In this homework, we are going to assign students to courses that has limited capacity (8) concerning their preferences of priority for the courses. The student group may be crowded or not and the popularity of the courses may be balanced or unbalanced. Genetic algorithm is used to assign the students to the courses in the optimal way in terms of the preference of students. Also, effect of different metaparameters for genetic algorithms are observed

1. **METHODS**

For using genetic algorithm to student assignment, 4 functions must be defined.

* How an initial population is created, which data structure is used for individuals.
* How the fitness values of individuals are calculated.
* How a mutations occurs.
* How a child is produced by two parents (Crossover)

1. **Creation of Initial Population and Type of Individuals**

For defining individuals, 20x4 (or 30x4) matrices are used where rows correspond to students and columns correspond to courses; for defining populations, MATLAB cell arrays of these matrices are used. Initial population is created randomly by creating a 20x4 (or 30x4) zero matrix and assigning “1” to a random index of each row. If an individual corresponds to a distribution that exceeds course capacity, it is removed from population. This routine occurs until the initial population fills up to its capacity, which is determined by the user.

1. **Fitness (and Cost) Function**

In contrast to the convention, MATLAB’s Genetic Algorithm toolbox is a **minimization** tool of the fitness function. So, the lower fitness function means better individuals using this toolbox. Hence, fitness function is selected to be sum of all elements of elementwise product of an individual and preference matrix. ***ÖRNEK***

Moreover, cost function is selected to be sum of every student’s distance from its first selection. For example if every student is assigned to its favorite course except 2 students; one is assigned to its second favorite course and the other is assigned to its third favorite course. Then the cost function is (2-1) + (3-1) = 3.

1. **Mutation Function**

Mutation is simply small alterations of chromosomes of individuals. In our case, mutation function is determined to be a swap between two students from different courses. By this way, mutation of a proper (not exceeding any course capacity) individual will also be proper.

1. **Crossover Function**

Crossover is an operation that takes two (or more) individuals as parents and results in a new individual that resembles its parents. In our case, crossover function is single point crossover. First n row of first parent and last 20-n (or 30-n) row of second parent is merged to make a child where n is a randomly selected number. If the child is faulty (exceeds course capacity), the child is omitted and crossover is repeated for different n.

1. **EXPERIMENTAL RESULTS**

1. **CONCLUSIONS**