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**National University  
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conference of young scientist  
and students**

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achievements to the 21st  
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problem solution"**

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наукова конференція  
молодих учених,  
аспірантів і студентів**

**“Наукові здобутки молоді –  
вирішенню проблем  
харчування людства у ХХІ  
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## 1. Genetic algorithm in optimization tasks

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**Introduction.** Many, if not most, optimization problems have multiple objectives. Historically, multiple objectives have been combined ad hoc to form a scalar objective function, usually through a linear combination (weighted sum) of the multiple attributes, or by turning objectives into constraints.

**Resources and methods.** The genetic algorithm is a method for solving both constrained and unconstrained optimization problems that is based on natural selection, the process that drives biological evolution. The genetic algorithm repeatedly modifies a population of individual solutions.

**Results.** At each step, the genetic algorithm selects individuals at random from the current population to be parents and uses them to produce the children for the next generation. Over successive generations, the population "evolves" toward an optimal solution. You can apply the genetic algorithm to solve a variety of optimization problems that are not well suited for standard optimization algorithms, including problems in which the objective function is discontinuous, nondifferentiable, stochastic, or highly nonlinear. The genetic algorithm can address problems of mixed integer programming, where some components are restricted to be integer-valued.

The genetic algorithm uses three main types of rules at each step to create the next generation from the current population:

- Selection rules select the individuals, called parents, that contribute to the population at the next generation.
- Crossover rules combine two parents to form children for the next generation.
- Mutation rules apply random changes to individual parents to form children.

The genetic algorithm differs from a classical, derivative-based, optimization algorithm in two main ways, as summarized in the following table.

Table 1

Classical Algorithm	Genetic Algorithm
Generates a single point at each iteration. The sequence of points approaches an optimal solution.	Generates a population of points at each iteration. The best point in the population approaches an optimal solution.
Selects the next point in the sequence by a deterministic computation.	Selects the next population by computation which uses random number generators

**Conclusions.** Genetic algorithms exist in an environment in which there is a very large set of candidate solutions and in which the search space is uneven. Genetic algorithms will do well in any environment, but they will be greatly outclassed by more situation specific algorithms in the simpler search spaces. Therefore genetic algorithms are not always the best choice. Sometimes they can take quite a while to run and are therefore not always feasible for real time use.

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