A brave new algorithm *

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Abstract. At the beginning of this year one of the authors read 'A brave new world' by Aldous Huxley. The Nobel describes a dystopia, which anticipates the development of breeding technology, and how this technology creates the perfect human race. Taking into account that when talking about genetic algorithms our goal is to achieve the optimum solution of a problem, and this book kind of describes the process for making the "perfect human", we will try to work on this parallelism in this paper. The goal is to develop a Genetic algorithm based on the fecundation process of the book and compare it to other algorithms to see how it behaves. Investigating how the division in castes affects the diversity in the poblation.

Keywords: Evolutionary algorithm · Metaheuristics · Another keyword.

1 First Section

1.1 A Subsection Sample

Please note that the first paragraph of a section or subsection is not indented. The first paragraph that follows a table, figure, equation etc. does not need an indent, either.

Subsequent paragraphs, however, are indented.

Sample Heading (Third Level) Only two levels of headings should be numbered. Lower level headings remain unnumbered; they are formatted as run-in headings.

Sample Heading (Fourth Level) The contribution should contain no more than four levels of headings. Table 1 gives a summary of all heading levels.
Displayed equations are centered and set on a separate line.

$$x + y = z \tag{1}$$

* Supported by organization x.

Table 1. Table captions should be placed above the tables.

Heading level	Example	Font size and style
Title (centered)	**Lecture Notes**	14 point, bold
1st-level heading	**1 Introduction**	12 point, bold
2nd-level heading	**2.1 Printing Area**	10 point, bold
3rd-level heading	**Run-in Heading in Bold.** Text follows	10 point, bold
4th-level heading	*Lowest Level Heading.* Text follows	10 point, italic

Please try to avoid rasterized images for line-art diagrams and schemas. Whenever possible, use vector graphics instead (see Fig. 1).

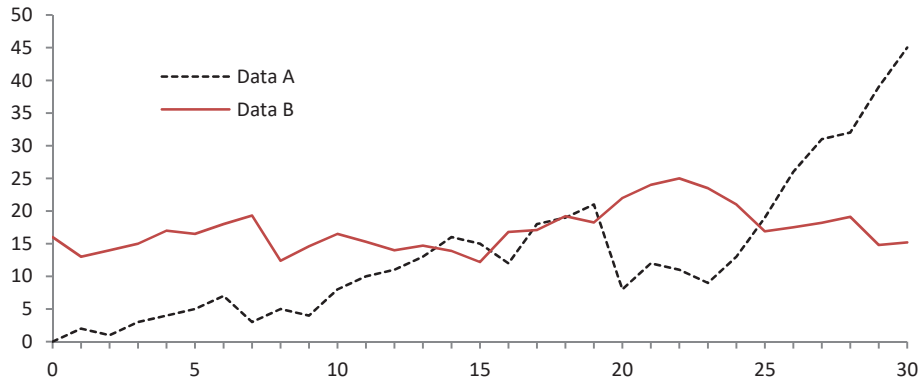

Fig. 1. A figure caption is always placed below the illustration. Please note that short captions are centered, while long ones are justified by the macro package automatically.

Theorem 1. *This is a sample theorem. The run-in heading is set in bold, while the following text appears in italics. Definitions, lemmas, propositions, and corollaries are styled the same way.*

Proof. Proofs, examples, and remarks have the initial word in italics, while the following text appears in normal font.

For citations of references, we prefer the use of square brackets and consecutive numbers. Citations using labels or the author/year convention are also acceptable. The following bibliography provides a sample reference list with entries for journal articles [1], an LNCS chapter [2], a book [3], proceedings without editors [4], and a homepage [5]. Multiple citations are grouped [1–3], [1, 3–5].

2 Introduction

At the beginning of the year one of the authors read the famous book by Aldous Huxley: A brave new world. The novel is a distopy that describes the develop-

ment in reproductive technology, psychological manipulation and classical conditioning. The population is divided in *castes*, assigned since birth, where everyone knows and accepts their place. We are talking about a "optimum world", whose optimization is based on the population and in the balance the division in castes creates, not in an individual.

When we talk about evolutionary algorithms the target is reaching the optimum solution for a problem., and this books perfectly describes the process through which they have reached the perfect human race. Thereforth we want to develop an algorithm based on the book's fecundation proceses and compare its behaviour with other algorithms. Also, investigating how the division in castes affects the poblation's diveristy.

3 Algorithm's Nature

As it was mentioned before, the algorithm is based in the optimization's process of the human race described on the book, thus we are talking about an algorithm based in the evolution of a population, it will follow the structure of evolutionary algorithms specifically a *genetic algorithm*. The book describes how they achieved the perfect human race working with an assembly line with different phases. This will be reflected with a *generational evolutionary algorithm* with selection, crossover, mutation and replacement operators.

The process begins in the ***Fecundation Room***, here the eggs are created and fertilized. Once the fertilization is finished all the eggs got to the ***Hatchery*** where the caste to which each individual will belong is decided. Huxley describes how the higher castes (*Alpha* and *Beta*) are suministred a higher amount of nutrients and hormones during the incubation. While the lower castes (*Gamma*, *Delta*, and *Epsilon*) are deprived of these elements, needed for the development. To imitate this "lack of nutrients", in the algorithm developed we will deprive the lower castes of the operators, they will only mutate. With all that has been mentioned, the castes will be developed in the following way :

- **Alphas**: in the books they are the most intelligents, the elite belongs to this group. They have responsibilities, they are ones that take decisions. In our implementation they will be reproduced with other individuals of the caste and they will evolve with all the operators.
- **Betas**: in the book they are less intelligents that the before mentioned and their main role is working in administrative tasks. In the implementation, the crossover will only be with individuals from the Alpha caste,
- **Gammas**: in the book they are subordinates, whose tasks require hability. In the implementation they will only mutate, but using local search
- **Deltas** and **Epsilons**: in the book both these castes are employees of the other castes and do repetitive works. In the implementation they will only have mutation by fixed segment.

With this structure in min the metaheuristic will be divided in the following phases :

- **Fecundation room**: the individuals are created in a randomized way.
- **Hatchery room**: in this phase we will divide the population in castes. We will do this following the fitness value of the individual as the criteria. Furthermore, each caste will have a different population percentage. Because in the book they mention that lower castes are produced with the *Bokanovsky's process*, where an ambryo its divided into 96 identical twins. In the algorithm this will be reflected in the population size, that will descende when the caste is higher.
- **Caste evolution**: each caste will follow a different process, as it was mentioned before

We are not talking about static castes, they are generated at the beginning of each generation. Let's imagine that we have a poplation size of ten, each individual with a fitness value. In the fist iteration the population will be divided following that value. After that, each individual will follow the evolution process corresponding to the caste. At the end of each generation all the chromosomes will be mixed, regardless of the caste. The next generation will start dividing this chromosomes in castes again.

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