Regenerator Location Problem

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**Abstract**

In a fiber-optic network the distance a signal can travel without suffering loss of quality is limited. This happens due to certain impactful factors present in the signal transmission process, such as attenuation and dispersion. To extend the distance a signal can travel without losing quality, it is necessary to periodically restore the signal using Regenerators. These devices are very expensive to deploy and maintain and, for this reason, it is important to have the minimum number of regenerators in a network. The regenerator location problem looks to obtain the subset of regenerators to be installed for the minimum cost possible whilst allowing each pair of nodes to communicate with each other. We tackled the regenerator location problem using four distinct algorithms, a genetic algorithm, artificial bee colony, ant colony optimization and a custom algorithm. The extensive computational experiments show and compare the performance of each algorithm we implemented.

*Keywords*: Regenerator Location Problem, Genetic Algorithm, Custom Algorithm, Ant Colony Optimization, Artificial Bee Colony

**1. Introduction**

Detailed problem description and context

**2. Optimization Algorithms**

**2.1. Custom Algorithm**

Brief Intro

**2.1.1. Algorithm Description**

Describe Algorithm

**2.1.2 Experimental Studies**

Describe the tests we ran along with respective graphics

**2.2. Genetic Algorithm**

Genetic Algorithms are inspired by Darwin’s theory of evolution. Some of the techniques often used are inheritance, mutation, selection and crossover.

We begin with the first population, usually randomly generated. Each Individual from that population is evaluated using a specific function, and the resulting value should reflect the quality of the individual as a solution to the problem.

The search for the best solution happens for a certain number of iterations, called generations. For each generation, the first step is always to choose *n* individuals (this is done using the selection method) and the result will be a “new” population. Next, we apply genetic operators to this new population in order to create different individuals, eventually better than the ones that already exist. The last step in each generation is to evaluate the newest population. When the whole process is complete, the algorithm returns the best individual found.

**2.2.1 Algorithm Description**

Describe Algorithm

**2.2.2 Experimental Studies**

Describe the tests we ran along with respective graphics

**2.3. Artificial Bee Colony**

Brief Intro

**2.3.1. Algorithm Description**

Describe Algorithm

**2.3.2 Experimental Studies**

Describe the tests we ran along with respective graphics

**2.4. Ant Colony Optimization**

ACO is a system based on agents that simulate the natural behavior of ants.

**2.4.1. Algorithm Description**

Describe Algorithm

**2.4.2 Experimental Studies**

Describe the tests we ran along with respective graphics