Master’s thesis Nova IMS

Genetic algorithm

Arc routing problem

Waste management

Smart cities

Complexity NP-Hard

Sustainability

Future:

1. Size of the streets that don’t allow big trucks to pass

**Title**

Genetic algorithm for a Multiple Capacity Arc Routing Problem, case of Campolide waste management routing.

**Abstract**

The Arc Routing Problem is a routing problem that is within the NP-hard problems set.

**Keywords**

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# Introduction

## Cities urbanization and waste management problem

Human activity has been pushing environmental changes. Global warming, air pollution and biodiversity decrease are some of the examples of these changes that can be observed (Bătăgan, 2011). Urban areas are the principal responsible that drive these changes at multiple scale. Being centers of production, consumption and waste disposal, the impacts on the environment can be repeatedly observed among the cities, especially those located in the developed world (Grimm et al., 2008).

The issues generated by the urbanization are even more worrying given that from 1950s to 2014 the urban population went from 30 per cent to more than half of the world’s population with 54 per cent. Furthermore, in the coming decades, the change on the size and distribution of the urban area will be more expressive, projected to have 66 per cent of the entire world’s population living in the cities by 2050 (United Nations, 2014). Megacities, the ones that by convention have more than 10 million inhabitants are emerging mostly in the developing world, and economic growth will follow the urban growth, demanding more services and resources (Grimm et al., 2008). Although the urbanization process brings opportunities for development, at the same time challenges arise, namely on social equity, environmental sustainability and government (United Nations, 2014).

One of the major environmental and socio-economic problems that come with urbanization is waste management (Karadimas, Papatzelou, & Loumos, 2007). Data from the 2012 World Bank’s report shows that the cities were generating about 1.3 billion tons of solid waste per year, costing $205.4 billion. By 2025 it is expected to increase this generation by 2.2 billion tons with the management cost of $375.5 billion, mainly in lower income countries (Hoornweg & Bhada-Tata, 2012).

It is particularly impactful in the short-term to the citizens and the environment. Uncollected waste, for example, can be harmful to the environment and consequently bring a variety of health issues to the population. Also, poorly waste management have economic impact to the city, because the costs can be higher than it would be to properly address the problem. Manage the waste collection of the households is a hard problem that are faced by cities’ government across the globe (Hoornweg & Bhada-Tata, 2012).

[falar sobre waste collection, os desafios e a dificuldades nos centros urbanos]

## Smart cities role in waste management

[falar sobre o nascimento das smarts cities]

[falar em como as smarts cities se preocupam com o crescimento sustentavel]

[falar em como a questão do lixo é tratada pelas smarts cities]

## Smart cities role in waste management

1. **Project Goals**
   1. **S**
      1. **A**
2. **Methodology**
3. **Concepts**
4. **Project Construction**
5. **Results**
6. **Future works**
7. **Conclusion**
8. **References**