Emergency Goods Distribution Model over Finite-Time Interval using Genetic Algorithm

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1. Introduction

- There are victims who didn't receive any donations.

- Manually distribution management is difficult to operate.

- Computer can be help to distribute donations without bias.

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2. Problem Description

There are 3 important things the problem:

- Disaster area

- Demand of victims

- Donations

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2.1 Disaster Area

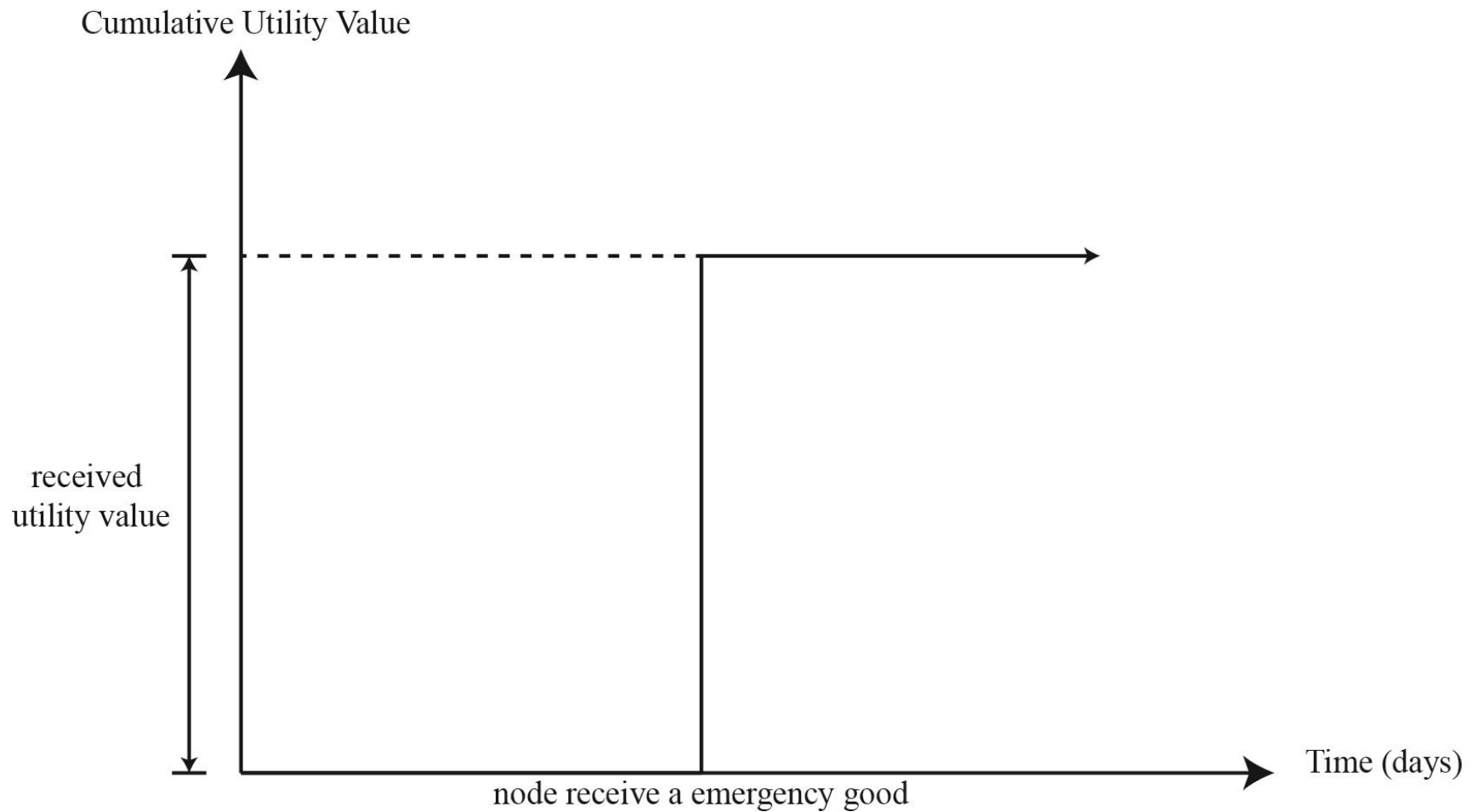- Node   = Distribution center + Cities
- Edge   = Connection between two nodes
- Weight = Time required to travel on edge

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2.2 Demand of victims

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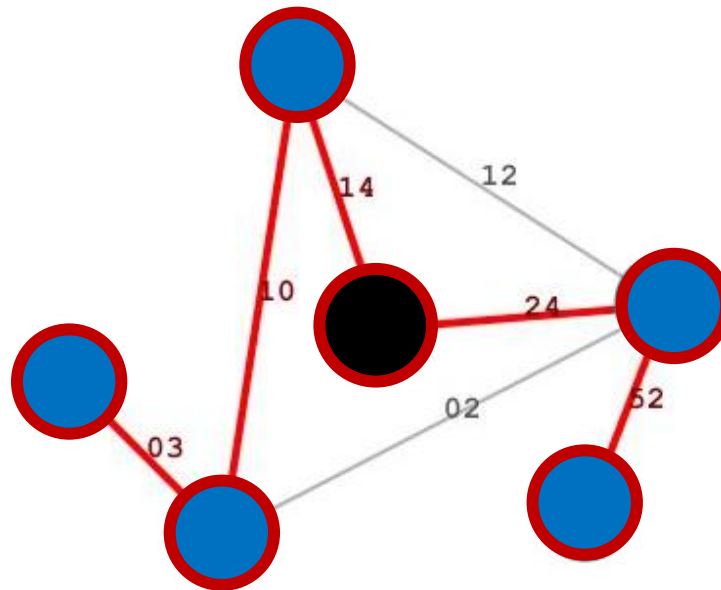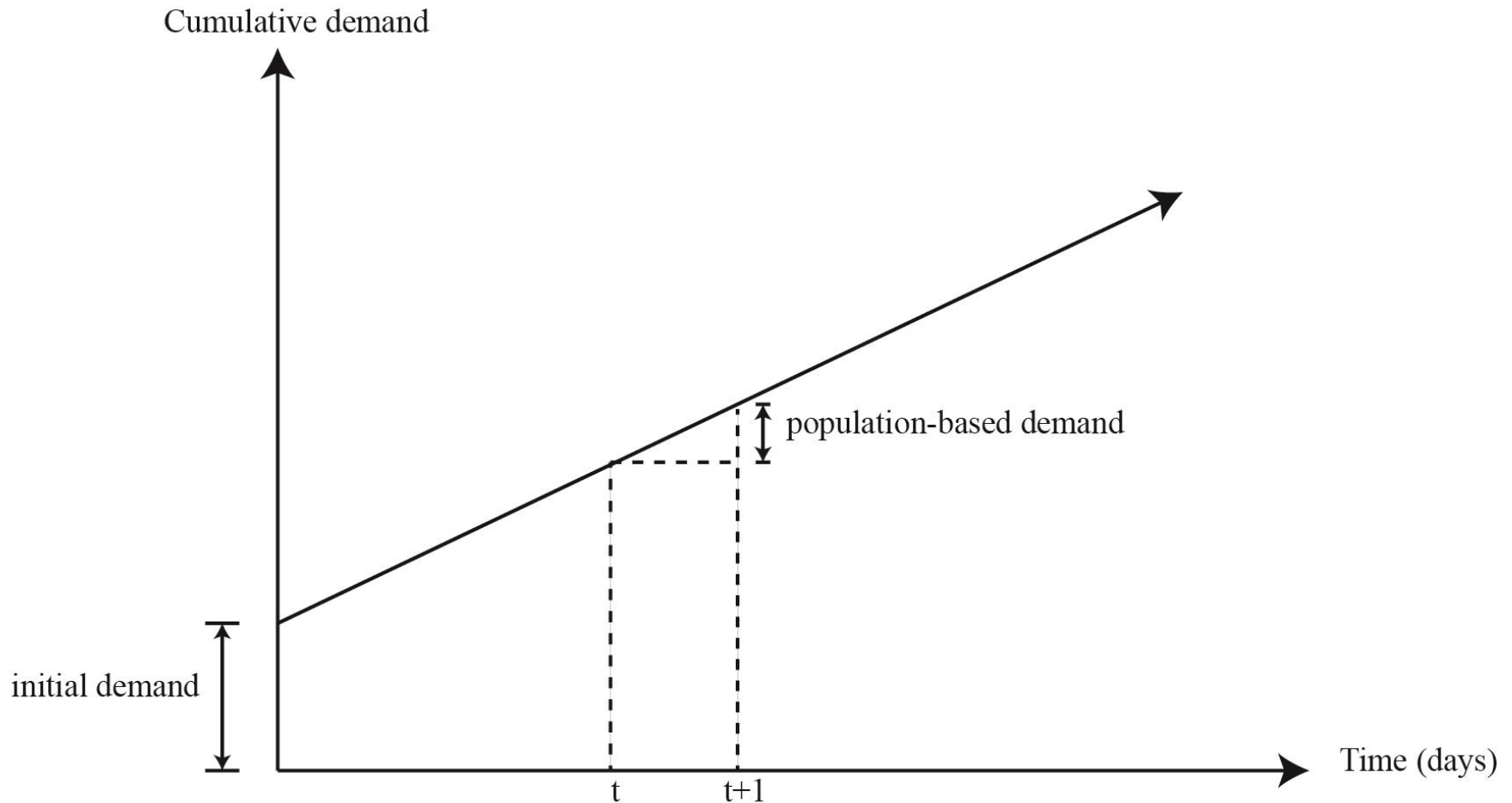
2.3 Donations

2.3 Donations (cont'd)

Utility Value vs Time (days) graph showing initial utility value constant until the expire date.
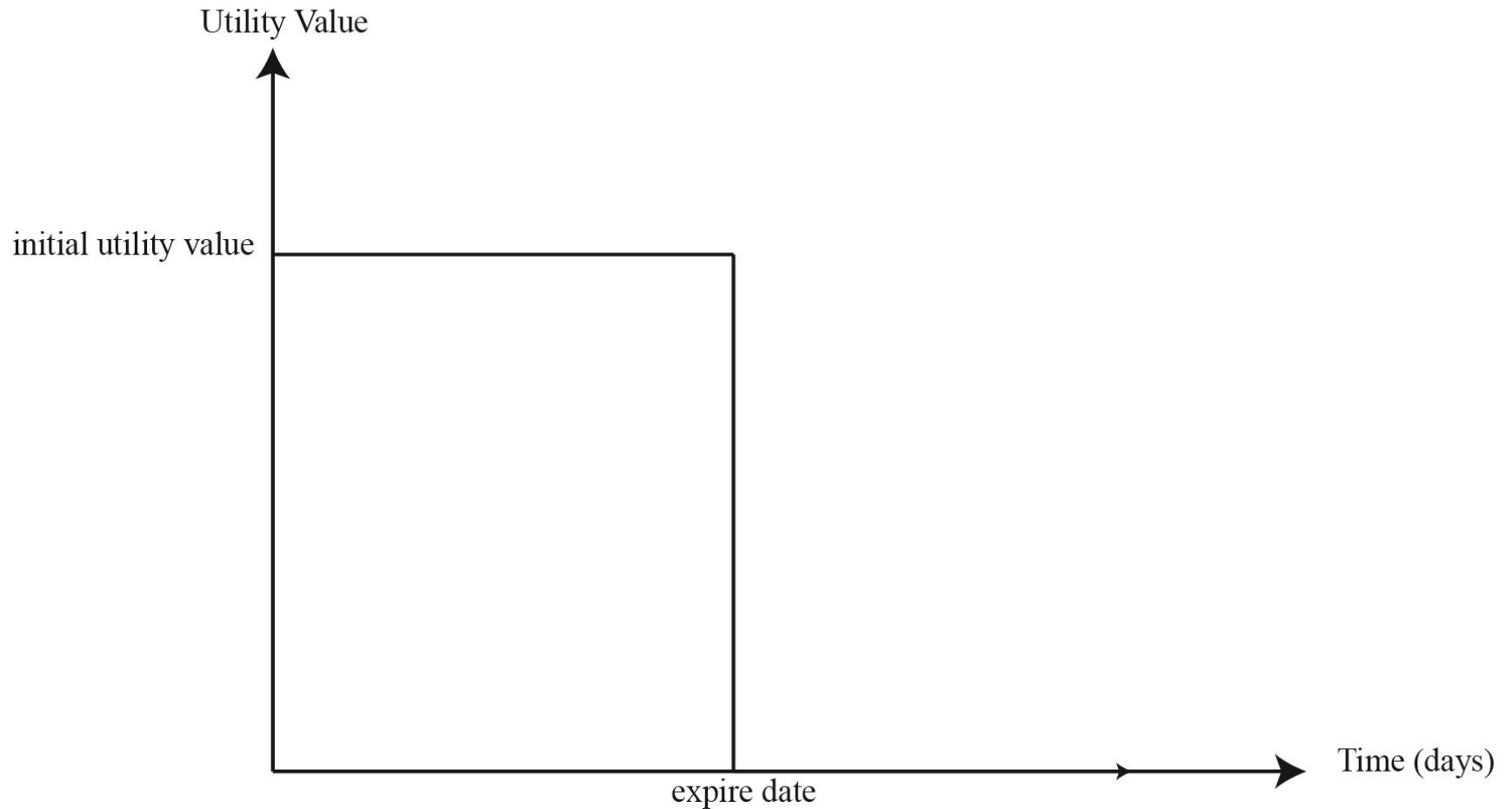
2.4 Assumptions

- Every day distribution center receive donations.
- <u>MUST</u> distribute all received donations in same day.
- <u>NOT</u> know anything about donations received in the future.
- <u>CAN</u> reassign destination to donations during transportation stage.
- <u>NOT</u> consider transportation cost and vehicles.

2.5 Objective Function

- Every nodes has equal ratio between its cumulative utility value and its cumulative demand.

EXAMPLE

Node	Cumulative Utility Value	Cumulative Demand	Ratio
1	70	100	0.7
2	70,000	100,000	0.7
3	7	10	0.7

3. GA in a nutshell

- Evolutionary inspired optimization technique
- Can find near-optimal solutions to difficult problems which take lifetime to solve
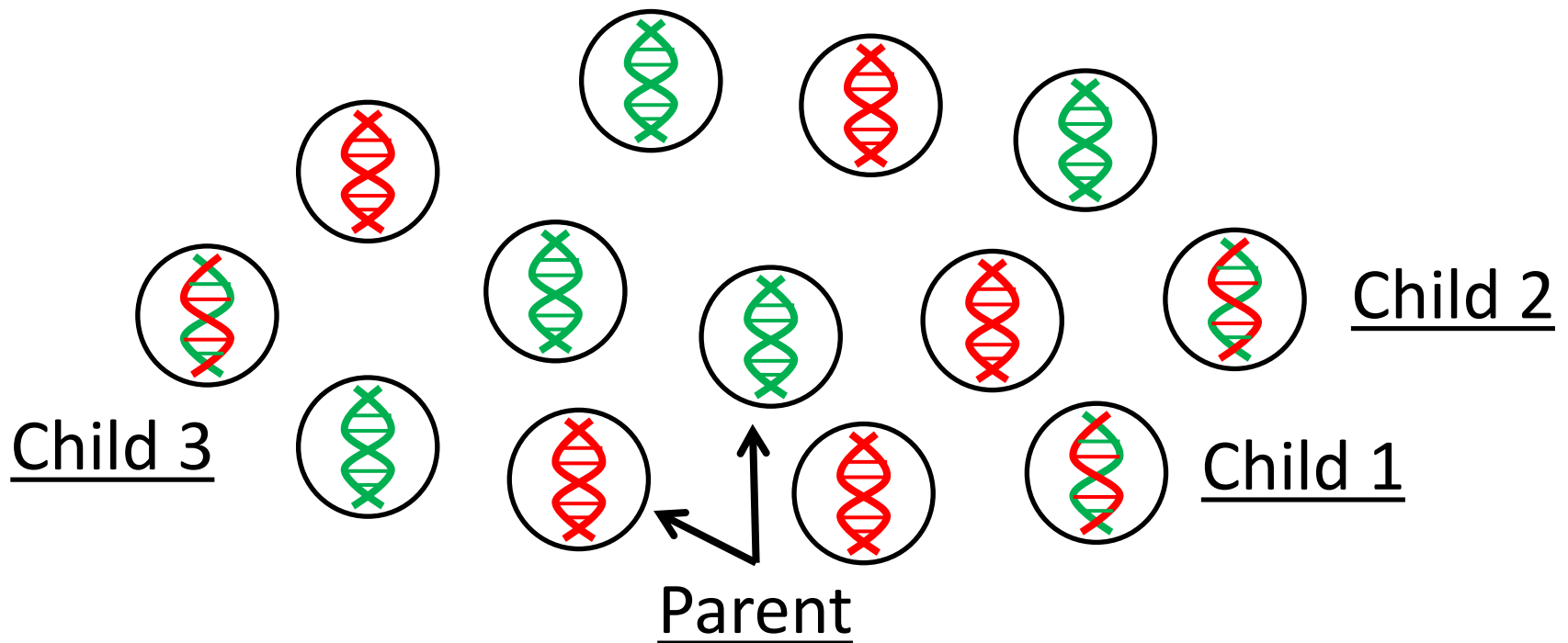- Based on Darwin's Theory of Evolution

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3. GA in a nutshell (cont'd)

- Chromosome = A possible solution of the problem
- Population = Chromosomes that we have now
- Each chromosome has a value called fitness value which determine how much that chromosome suitable to be the answer of the problem.

Population

Chromosome #1	10
Chromosome #2	4
Chromosome #3	2
Chromosome #1	5

Fitness value

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3. GA in a nutshell (cont'd)

- Natural selection (Survival of the fittest)

Child 2

Child 3

Child 1

Parent

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4. Discussion

- Not enough donations
  - Node with demand more than average tend to receive more donations than less ones.

- Few nodes take time to reach
  - Algorithm tends to send donations to them first to deal with transportation duration.

- Few nodes with extremely high demand
  - Distribution center tends to ignore them. (not enough donations)
  - Algorithm can distribute donations well. (otherwise)

5. Future Work

Model can be improved in 3 issues:

- Dynamic Graph

- Dynamic Demand

- Financial Constraint

5.1 Dynamic Graph

- Node insertion
- Node deletion
- Edge insertion
- Edge deletion
- Weight modification
- Change distribution center

5.2 Dynamic Demand

- Node insertion
- Node deletion
- Edge insertion
- Edge deletion
- Weight modification
- Change distribution center

5.3 Financial Constraint

- There exists a way to adjust formula to handle financial constraint called barrier function

Research Contribution

- Node insertion

- Node deletion

- Edge insertion

- Edge deletion

- Weight modification

- Change distribution center

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