Stochastic Algorithms Project
Optimal solution for Chain Store Distribution

João Teixeira Figueira, Muharrem Tolga Acar, João Mendes Pires

1. Environment:

1.1 The Map: The problem consists of placing chain stores on a map. The map is a two-dimensional rectangle of defined height and width. A set of coordinates will be given, each representing a customer on the map. Each customer wants to buy a set of products which is a subset of a defined set of all possible products.

1.2 The stores: A set of stores is given. The stores have predefined parameters and will all be placed on the map. Each store has an infinite supply of a subset of the possible products and a defined price for each type of product it supplies.

1.3 Customer Behavior: A customer will behave in the following way: they will visit a subset of stores such that each of the products desired by the customer are present in at least one store in this subset. The set of stores will be such that the total travel distance for that customer is minimized (to avoid travelling salesman problems, the customer will travel back home after each visit to a store).

2. Problem:

2.1 Definition: The Problem is specifying the positions for each of the possible stores, such to minimize total unhappiness of the customers.

2.2 Unhappiness: The total customer unhappiness will defined by the following function: $T = \sum_{p=0}^{P} u(p)$ where P is the number of customers and u(p) is the unhappiness function for each customer defined by: $u(p) = Dp * Sp$, where Dp is the sum of the distances between the customer and each of the stores they will visit; and Sp is the total money spent by the customer on the products bought.

2.3 Acceptable Solutions: To each store will be attributed a position represented by a set of two floating point values in range [0, Map Width] and [0, Map Height] respectively. An acceptable solution to the problem is a set of these pairs of values, with each pair representing each store. The pairs should be in the same order the one the stores were given in.

3. Solution:

3.1 Tools: We have elected to use GAGS (Genetic Algorithms from Granada, Spain) for our computations.