Société de Calcul Mathématique SA
(Mathematical Modelling Company, Corp.)
Tools for decision help
since 1995

Archimedes Maps

An Archimedes map of a territory, of a set, is a decomposition of this territory, of this set, into disjoint zones of equal importance for some criterion.

For example, an Archimedes map of France for the criterion "population" is a decomposition of the whole country into disjoint zones of same population.

Other criteria may be for instance:

- Electricity consumption.
- Prevalence of a certain risk (natural, such as earthquakes, or medical, connected with a certain disease).
- Disposition of resources, equipment, such as pharmacies, buses, warehouses, stocks of vaccines, etc.

The use of Archimedes maps

There are two possible applications:

1. **Optimal location of resources**

If we have a territory (for instance France), with the criterion "population", then an A-map of France, for this criterion, will be used as follows: since each subset has the same population, each subset should contain the same number of schools, of doctors, and so on.

If the criterion is "consumption of electricity", then each zone should be provided with the same amount of equipment: perhaps plants, in order to produce electricity, or High Tension Lines, in order to bring it from somewhere else.

If the criterion is "garbage production", then each zone should be equipped with proper means for retreatment, plants or trucks to carry it somewhere else.

If the criterion is "number of people with flu", then each zone should receive an equal number of vaccines.

These are very simple examples, but they illustrate very well the use of Archimedes Maps: such a map will help people in charge of the decisions to use at best the resources they have at their disposition. They will use the map in order to know where to put these resources.

Another type of application is linked with the location of monitoring points:

2. Optimal location of monitoring points

Here are some examples:

- Given a river in any country in Europe, where should one put 10 stations for monitoring water quality? This is a one-dimensional problem.

- For France, where to put 300 stations for air quality surveillance? This is a two-dimensional problem.

- For the Paris area, where should the firemen put their basis stations (these are the places where the vehicles stay before they are called for fires or assistance to victims)? This is also a two-dimensional problem.

- Where to put temperature sensors in a nuclear reactor? This is a 3-dimensional problem.

- Assume we have a computational code, depending on 40 parameters. We want to identify say 500 situations which we will call "generic" or "characteristic", in the sense that we feel that with these situations we can have a good idea of what the code produces in general. How to define these situations? This is a 40-dimensional problem.

One can easily find numerous examples of other types. All infrastructures are connected to some social need, which has to be measured in order to appreciate the size of the infrastructure. An Archimedes map provides a sound scientific representation.

Reference

Bernard Beauzamy: Archimedes' Modern Works. SCM SA, ISBN: 978-2-9521458-7-9, ISSN: 1767-1175. August 2012

http://scmsa.eu/archives/SCM_Archimedes_order.htm