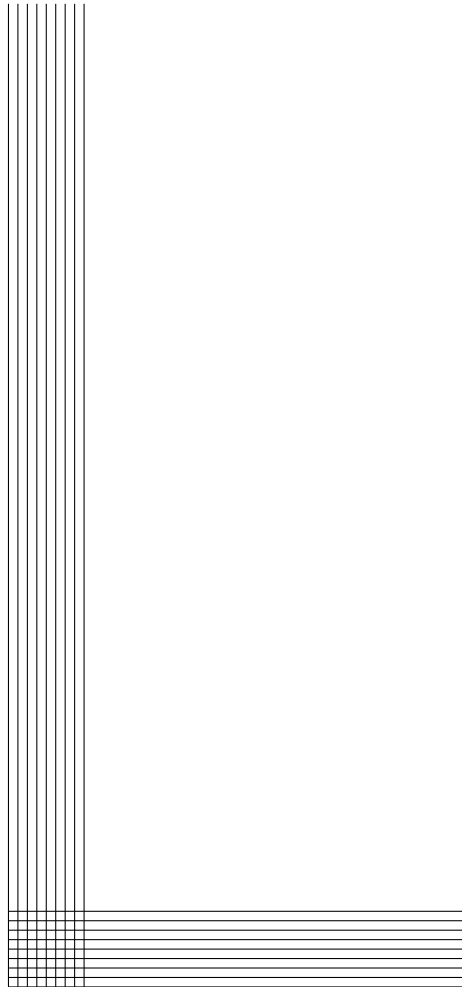


A RESSOURCE ALLOCATION PROBLEM FOR POST-CATACLYSMIC SITUATIONS



By Alexandre Fréchette (260279964)
January 31, 2010

Background

On January 13, 2010, Haiti was hit by a devastating earthquake, measuring 7.0 on the Richter scale and with an epicenter just 22 kilometers from the capital city, Port-au-Prince. Up to three million people were affected and most infrastructures were destroyed. The international community is now in a race to provide food, water, medical services and materials to satisfy the needs of millions of people.

The United Nations (UN) were given the responsibility to lead the resource allocation process. The material resources arrive by boat and airplane and are stored at the UN headquarters in Port-au-Prince. The task is to send these resources and medical and military teams to the key distribution points in Haiti.

Problem

The UN created an extensive record of all the resources that are at hand and need to be distributed. These resources are of many types. Here is a few examples:

- (1) Food;
- (2) Water;
- (3) Medical Supplies;
- (4) Medical Teams;
- (5) Machinery;
- (6) Construction Material;
- (7) Military Teams;

For each resource an approximated total available quantity was fixed. Then, the military with the help of the Haitian community was able to make a list of cities that act as distribution points. Each city has a list of particular needs, which were quantified and separated into sections. Here are some examples:

- (a) Food;
- (b) Water;
- (c) Medical Attention - satisfied at a certain level with medical supplies and greatly by medical teams;
- (d) Support - satisfied at a certain level by military teams or medical teams and greatly by machinery;
- (e) Reconstruction - satisfied at a certain level by construction material and greatly by military teams;

The goal is to send resources to each of those cities in order to satisfy their needs. The resources will travel from UN's headquarters in Port-au-Prince to each city in Haiti. In addition, we are asking for the distribution to be done in

one stage, if possible. Less transportation means more time with the people at destination. With such resource allocation plan in hand, the UN will be able to distribute resources as efficiently as possible.

However, the earthquake destroyed many roads and transportation is now tedious in Haiti. A crude transportation network of the routes we are sure were safe and existent was sketched, and the resource allocation must be planned accordingly:

- (i) Only the routes from the network can be taken.
- (ii) Some cities are reachable by plane, others are not.
- (iii) If the plane is used, then medical teams cannot travel with military teams for lack of space, and food and water cannot be packed with machinery.
- (iv) If the plane is used, then the different resource capacities of the plane must be satisfied.
- (v) There is only a fixed total amount of plane routes that can be used.
- (vi) Some routes require the presence of military protection.
- (vii) Most of the network is fragile, so a limit on the total amount of resources is given to each route.

Finally, there are some rules about the transportation and distribution of the resources that must be followed:

- (i) If food or machinery is to be distributed, then in some cities the presence of military teams is required.
- (ii) After a certain limit of construction material sent, machinery must also be sent.
- (iii) After a certain limit of water sent, machinery must also be sent.
- (iv) After a certain limit of medical supplies, medical teams must also be sent.
- (v) After a certain limit of any resource, military teams must also be sent.
- (vi) After a certain limit of medical or military teams, additional food and water must also be sent.

Objective Desired

The main priority is to satisfy as best as possible the needs of as many distribution points as possible. Since it is a large project done in such a hurry, the Haitian government suggested the distribution plan was first tried with the cities from the Ouest Department, which is Port-au-Prince's department. Then, if the results are satisfying, the distribution process will be extended to the whole island of Haiti.

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A Haiti and its Main Cities

