Problem Chosen	2023 MCM/ICM Summary Sheet	Team Control Number
B		2300050

An Aerial Disaster Relief Response System Based On Goal Programming Model

Summary

Keywords: Goal programming model, Three-dimensional container loading methods;

Contents

1 Basic Introduction

1.1 Background

In 2017, the worst hurricane to ever hit the United States territory of Puerto Rico left the island with severe damage and caused over 2900 fatalities. The combined destructive power of the hurricane's storm surge and wave action produced extensive damage to buildings, homes, and roads, particularly along the east and southeast coast of Puerto Rico. The storm, with its fierce winds and heavy rain, knocked down 80 percent of Puerto Rico's utility poles and all transmission lines, resulting in loss of power to essentially all of the island's 3.4 million residents. In addition, the storm damaged or destroyed the majority of the island's cellular communication networks. The electrical power and cell service outages lasted for months across much of the island, and longer in some locations. Widespread flooding blocked and damaged many highways and roads across the island, making it nearly impossible for emergency services ground vehicles to plan and navigate their routes. The full extent of the damage in Puerto Rico remained unclear for some time; dozens of areas were isolated and without communication. Demands for medical supplies, lifesaving equipment, and treatment strained health-care clinics, hospital emergency rooms, and non-governmental organizations' (NGOs) relief operations. Demand for medical care continued to surge for some time as the chronically ill turned to hospitals and temporary shelters for care.

1.2 Literature Review

1.3 Problem Restatement

- Design and minimize the cost of a drone fleet, and also the associated packing configuration.
- When designing a drone fleet, take consideration of both video and medical package capability.
- Route designing and drone payload packing configurations.
- Write a 1-2 page memo to the CEO of HELP, Inc.

1.4 Our works

1.5 Assumptions and Justifications

- Assume that

Justifications:

- Assume that

Justifications:

1.6 Notations

The mostly used symbols and their definitions are defined (Table 1), and more symbols will be defined later in the text.

Table 1: Notations of symbols

Symbol	Data Type	Description
D_{ik}	Boolean	The i-th drone will heading for the k-th place.
Y_{im}	Boolean	The i-th drone uses the m-th type of drone.
V_i	Boolean	The i-th drone has video capability.
C_{imk}	Boolean	The i-th drone carries the m-th type of package to the k-th place.
T_i	Two-dimensional Array	The possible combination of the i-th drone to carry the packages.
$T_i[j][m]$	Interger	The number of the m-th type of package in the j-th combination of the i-th drone.
X_m	Two-dimensional Array	The combination of different medical packages in the m-th type of package.
N_k	Vector	The number of the medical packages needed in the k-th place.

2 The ARIMA Model:

2.1 Data Collection

Collecting adequate data is the foundation of an evidence-based model. Our data come from several professional websites such as London Bullion Market Association[1], NASDAQ[2], etc. To be as accurate as possible, we should choose the countries without too many missing values.

2.2 Indicators of Model

The ARIMA Model depends on several indicators:

- The
- The
- The
- The

After consideration,

6.2 Sensitivity Analysis of the TOPSISS Model

6.3 Sensitivity Analysis of the Markov Model

7 Strengths and Weaknesses

7.1 Strengths

Our work aims at investigating trends of global language users and their distrubution situation. With this model, we put forward targeted proposal for a multinational service company, and optimize its planned number of offices. At last, we evaluate the effectiveness of our model. To sum up the above, the model and the policies proposed have the following strengths:

- Inclusive

The model involves 5 indicators, well presenting most of the major factors determining the trends of golbal languages and their distribution. This makes the data analysis and policy-making reliable and rigorous.

- Quantified

- Comparitive

7.2 Weaknessess

Despite the advantages, there are still some shortcomings in our models and the proposal:

- Ignoring External Shocks

As a major premise, we exclude catastrophic disasters and wars. Too big these changes are that we cannot precisely predict the trend of world population distribution and language development trends afterward. But in real world, all circumstances are possible, so our model is still limited.

- Ignoring the Second Generation of the Immigrants

We generally consider that native languages will not change after immigration to another cultural circle. But after 50 years, the next generation of the immigrants are born. Our model does not take their native languages into account.

8 Conclusion

9 Memorandum

References

[1] London Bullion Market Association [EB/OL]. https://www.lbma.org.uk/prices-and-data/lbma-gold-price.

[2] NASDAQ [EB/OL]. https://www.nasdaq.com.