

OPTIMIZATION OF THE EMERGENCY MATERIALS DISTRIBUTION NETWORK WITH TIME WINDOWS IN ANTI-BIOTERRORISM SYSTEM

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Received July 2008; revised December 2008

ABSTRACT. *To optimize the process of materials distribution in anti-bioterrorism system and improve the emergency relief timeliness, emergency materials distribution problem in system of anti-bioterrorism was constructed to be a multiple traveling salesman problem (MTSP) in paper the authors have done before. In that paper, knowledge of graph theory was used to transform the MTSP to be a TSP, then such TSP route was analyzed and proved to be the optimal Hamilton route theoretically. Besides, a new hybrid genetic algorithm was designed for solving the problem. However, only length of the route was considered as the objective function, while time windows, another much more important factor was neglected. In this paper, the MTSP with time windows is studied, and the best equilibrium solution of emergency materials distribution is obtained via numerical simulation. Moreover, combine with the SIR epidemic model, relationship between the parameters and the results are discussed. The research results show that the best emergency materials distribution scheme can be found by the method proposed in this paper effectively, which have a certain guiding significance for the actual emergency rescue work.*

Keywords: Anti-bioterrorism, MTSP, Hybrid genetic algorithm, Emergency materials distribution, Time windows

1. Introduction. With rapid development of the global economy, a new biological virus can get to anywhere around the world in 24 hours. Virus which lurked in the forest or other biological environment before, have been forced to face human ecology when its nature ecology environment destroyed, and this would cause some new type diseases such as Marburg hemorrhagic fevers in Angola, SARS in China, Anthrax mail in USA, Ebola in Congo, smallpox and so on. Bioterrorism threats are realistic and it has a huge influence on social stability, economic development and human health. Without question, nowadays the world has become a risk world, filling with kinds of threaten from both nature and man made.

Economy would always be the most important factor in normal materials distribution network. However, timeliness is much more important in emergency materials distribution network. To form a timeliness emergency logistics network, a scientific and rational emergency materials distribution system should be constructed to cut down length of the emergency rescue route and reduce economic loss.

In 1990s, America had invested lots of money to build and perfect the emergency warning defense system of public health, aiming to defense the potential terrorism attacks of biology, chemistry and radioactivity material. Metropolitan Medical Response System (MMRS) is one of the important part, which played a crucial role in the "9.11" event