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Healthcare Delivery and Political Campaign Planning with Limited Resources: An Optimization Approach

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In this paper, a mathematical model is developed to address two problems. The first problem is on healthcare delivery planning in which the objective is to diagnose and treat as many patients as possible by determining the locations to be visited assuming that patients have the ability to travel a predetermined distance, e.g., to clinics in different locations. For example, a doctor may plan to visit many locations with Ebola patients in a country in Africa. In the case of a natural disaster, where there may be significant damage to the existing infrastructure, a similar scenario may happen. The second problem considers a politician who would like to visit as many locations as possible while attracting voters who would consider travelling to the campaign centers from other locations. In both applications, it is assumed that there is a limited budget and duration to achieve these objectives. These problems are modeled as a mixed integer mathematical model-a variation of travelling salesman problem with covering, budget and time constraints which is known to be an NP-Hard problem. In order to solve this problem efficiently in a reasonable amount of time, a hybrid genetic algorithm is developed. Extensive computational results are presented. It is observed that where there is very limited budget and time, or very extensive resources, solving the resulting problem takes significantly less computational resources compared with other problems. The computational experimentation also provides insights about the effect of budget and distribution of potential visit locations on service rate and profit.