MULTI-PERIOD NETWORK INTERDICTION PROBLEMS WITH APPLICATIONS TO CITY-LEVEL DRUG ENFORCEMENT

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ABSTRACT

The analysis of networked critical infrastructure flow systems subject to disruption via accident or human intervention, is an important mathematical problem with a variety of applications in many areas. Our research has targeted a critical societal problem – namely, the challenge posed by city-level illegal drug trafficking, to law enforcement officials working within limited resources. Illegal drug trafficking constitutes a dynamically changing supply chain involving a hierarchical network structure, in which criminals seek to maximize the flow of goods and services through the network. We have developed novel approaches and models incorporating multi-period network interdiction strategies with many new applications in several classes of flow problems such as efficiently scheduling the activities of law enforcement in order to successfully interdict the drug supply. Our contacts with the City of Troy Narcotics unit provided detailed informational and database material on the logistics, modus operandi and quantitative elements characterizing a typical city-level illegal drug trafficking operation. Realistic test instances based on this data base were used in conjunction with newly developed software to test and validate our new mathematical model. The model has also been employed in computational analysis of several policy questions relating to management of illegal drug activity. The results provide significantly novel and useful tools to aid law enforcement in managing illegal drug trafficking utilizing limited resources efficiently. Additionally, more sophisticated mathematical models have also been considered for more complex supply chains involving interacting parallel channels to treat multi-commodity trafficking which has applications in combating inter-city illegal drug trafficking.