Enhancing Emergency Evacuation Route Planning: A Multi-Party Capacity Constraint Approach

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This extended abstract focuses on the critical aspect of Evacuation Route Planning (ERP) in emergency management. ERP aims to reduce the loss of life and harm to the public during natural disasters or terrorist attacks. Despite efforts to plan for such events, incidents like the Hurricane Katrina and the 2023 earthquake in Turkey and Syria have revealed the need for improved emergency planning.

The primary goal of ERP is to find optimal evacuation plans, considering factors such as transportation networks, the number of evacuees and responders, their initial locations, and safe destinations. This abstract presents an algorithmic approach to tackle the ERP problem and minimize evacuation egress time. It involves modeling the spatial structure as a network with capacity constraints on nodes and edges, incorporating information about the initial and final locations of evacuees and responders.

The proposed approach introduces the concept of a multi-party emergency evacuation process, where evacuees and responders have distinct objectives. It seeks to calculate the fastest possible routes for evacuees from sources of danger to safe locations while enabling responders to migrate from anywhere to destinations in danger. The algorithm addresses the priority of areas or nodes, ensuring high-risk locations are evacuated first. This is achieved by employing a modified Dijkstra's algorithm with edge travel time and node priorities as the weight criteria. The approach introduces a clever mechanism with super-source and super-sink nodes to handle the multi-party nature of the algorithm, providing a structured way for parties to share common evacuation routes. By determining the maximum flow along a path and managing available capacities in real-time, the algorithm ensures efficient evacuation without overloading any path.

In conclusion, this abstract outline a promising approach to emergency evacuation route planning, considering node priorities and providing more efficient total egress time for multiple parties involved, especially in regions prone to natural disasters and densely populated areas, as it addresses a crucial aspect of emergency management, potentially saving lives during critical events.