Minimum labelling spanning tree problem

In the MLST problem we are given an undirected, labelled (or coloured) graph as input, with a label assigned to one or more edges, but with each edge having only one label allocated, and the aim is to find a spanning tree of the graph having the mini-mum overall number of labels [8]. The MLST problem has many real-world applications in different fields, such as in data compression, telecommunications network design and multimodal transportation systems [11]. For example, in multimodal transportation systems there are often circumstances where it is needed to guarantee a complete service between the terminal nodes of the network by using the minimum number of provider companies. This situation can be modelled as a MLST problem, where each edge of the input graph is assigned a label, denoting a different company managing that link, and one wants to obtain a spanning tree of the network using the minimum number of labels. This spanning tree will reduce the construction cost and the overall complexity of the network. A practical example in this context is given by multimodal transportation networks of large territories, from regions to states, or even continents, during humanitarian crisis events like, for example, volcanic eruptions, terrorist threats, floods, tsunamis, etc. In these very delicate crisis management situations, amongst different types of human intervention, it is also necessary to reorganize dynamically the entire transportation network of the damaged area, taking into account the upcoming inaccessible or forbidden zones, and guaranteeing a minimal working transport service among main cities, hospitals, airports, principal way outs, and others, with the minimum number of different transportation carriers and companies.

Definition:-Minimum labelling spanning tree problem

GIVEN: A labelled connected undirected graph G = (V, E, L), where V is the set of nodes, E is the set of edges, and L is the set of labels

GOAL: Find a spanning tree T of G such that min|LT|, where L is the set of labels used in T.



*Fig. The two graphs show a sample graph and its optimal MLST solution.*