Designing a Two-Level Hierarchical Communication Network with Redundant Connections

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-- ABSTRACT --

We consider the problem of designing a two-level hierarchical communication network where the embedded backbone network is full-meshed and each user node is connected to two different backbone nodes,one for primary and the other for secondary coverage. In this problem, the following is decided the number and location of backbone nodes, and the assignment of each user to two different backbone nodes. This problem can be widely applicable to designing networks where system reliability and fast response time is crucial and , therefore, alternative routes are required to provide for appropriate service during link or node failures. We formulate the problem as an 0-1 integer quadratic programming model, and then linearize it to an equivalent 0-1 integer programming model. By exploiting the special structure of the linealized model, we develop an efficient solution procedure which is a dual-based method. This procedure is tested on a wide variety of problems and computational results are reported.