DABTool - A Test Environment for DAB Ensemble Planning

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1 Introduction

This paper reports on the results of our project concerning digital broadcast network planning (FMS II-II.3.2), which is being carried out in cooperation with the FVP department of the Südwestrundfunk public broadcasting company. One of the main goals of our project is the implementation of an interactive software environment for testing different algorithmic solutions for ensemble and block assignment planning for DAB (Digital Audio Broadcasting) and similar networks which are capable of providing single frequency subnets (SFNs). This software, called *DABTool*, enables us to run systematic test series on both real-world planning problems and randomly generated test instances. The current version of the software now provides all necessary facilities to handle large test series, including a database interface. The basic algorithmic techniques for computing ensemble collections, block assignments, and lower bounds for estimating the quality of computed solutions are implemented as well. More advanced algorithms will be added in the future. In this paper we first discuss the theoretical background of the system, after which the current version of the DABTool program is described in some detail. Finally, we also point out some directions for future work. Further details can be found in the full version of this paper [6].

2 Mathematical Preliminaries

We assume familiarity with the basic notions of graph theory (see, e.g., [5] or [9]) and NP-completeness [4]. All graphs in this paper are simple undirected and loopless. The subgraph of a graph $G = (V, E)$ *induced* by a subset of vertices $W \subseteq V$ is denoted G_W; it consists of the vertex set W and all edges of G between vertices in W. A *coloring* of a graph $G = (V, E)$ is a function f mapping vertices to "colors" in such a manner that $f(v) \neq f(w)\ \forall\ vw \in E$. If $|f(V)| \leq k$ then f is also called a *k-coloring*. The *chromatic number* $\chi(G)$ of G is defined to be the minimum k for which such a k-coloring exists. The *graph coloring problem* is, given $G = (V, E)$ and integer $k \geq 0$, to decide whether G has a k-coloring. A *clique* of a graph $G = (V, E)$ is a subset W of V s.t. G_W is *complete*, i.e., $vw \in E\ \forall\ v, w \in W : v \neq w$. The *clique number* $\omega(G)$ is the maximum number of vertices in a clique of G, and the *clique problem* is, given G and integer $k \geq 0$, to decide whether G has a clique of size at least k. The clique number is an obvious lower bound on the chromatic number of a graph, since all vertices in a clique must be colored differently (this bound is not tight as there are graphs G for which the gap between $\omega(G)$ and $\chi(G)$ becomes arbitrarily large [5]). It is well-known that both the