QMaxSAT1702 and QMaxSATuc

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QMaxSAT is a SAT-based MaxSAT solver which uses CNF encoding of Pseudo-Boolean (PB) constraints [1]. The current version is obtained by adapting a CDCL based SAT solver Glucose 3.0 [2], [3]. There are two main types among SAT-based MaxSAT algorithms: core-guided and model-guided. QMaxSAT follows the model-guided approach.

Let $\phi = \{(C_1, w_1), \ldots, (C_m, w_m), C_{m+1}, \ldots, C_{m+m'}\}$ be a MaxSAT instance where C_i is a soft clause having a weight w_i $(i = 1, \ldots, m)$ and C_{m+j} is a hard clause $(j = 1, \ldots, m')$. A new blocking variable b_i is added to each soft clause $C_i(i = 1, \ldots, m)$. Solving the MaxSAT problem for ϕ is reduced to find a SAT model of $\phi' = \{C_1 \vee b_1, \ldots, C_m \vee b_m, C_{m+1}, \ldots, C_{m+m'}\}$ which minimizes $\sum_{i=1}^{m} w_i \cdot b_i$.

QMaxSAT leaves the manipulation of PB constraints $\sum_{i=1}^{m} w_i \cdot b_i < k$ to Glucose by encoding them into SAT. Several encodings have been proposed so far. We adopt Totalizer [4], Binary Adder [5], Modulo Totalizer [6], and Weighted Totalizer [7] for encodings PB constraints. The last one is essentially the same as Generalized Totalizer [8]. Which encoding is used depends on the total $\sum_{i=1}^{m} w_i$ of weights of all soft clauses and k.

We introduce a new SAT encoding for PB constrains, called Mixed Radix Weighted Totalizer [9] into QMaxSAT1702. This encoding is an extension of Weighted Totalizer, incorporating the idea of mixed radix base [10].

QMaxSATuc is a hybrid solver between core-guided and model-guided while it mainly follows model-guided approach. QMaxSATuc runs in two modes: core-guided and model-guided. QMaxSATuc alternates these modes. QMaxSATuc performs core-guided mode with a set B of blocking variables. B is initialized to $\{b_1, \ldots, b_m\}$, i.e. the set of all blocking variables.

In core-guided mode, all blocking variables in B are negated. These negated variables are passed to Glucose as assumptions. Glucose treats each literal in assumptions as an unit clause. Glucose returns a subset of assumptions used in the UNSAT proof. Each soft clause corresponding to a blocking variable in the subset can be regarded as an element in the unsat-core of ϕ'. We make a clause having all blocking variables in the subet as literals, and add it to the clause database in order to eliminate the core. Thus, we minic the core-guided approach. We also subtract all the blocking variables in the subet from B. In model-guided mode, nothing is passed to Glucose as assumptions. This is the normal mode of QMaxSAT .

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