Various versions of our first-order logic theorem prover Scott have been developed over the past decade to employ the concept of semantic guidance for improving the underlying system Otis by McCune (Stanley, MacKenzie 1994; Hodkinson & Stanley 2001; 2002). We introduce our latest attempt to speed up Otis’s proof search, Sofii. While the various Scotts consisted of ordinary constraint solver to gain information about the problem to be solved, Sofii is implemented from scratch and uses a solver capable of handling soft constraints.

**Scott**
- built on top of Otis (first-order logic theorem prover) and Prover9 (finite domain constraint solver)
- finite preference strategy for nist given clause selection
- conceptually orthogonal method
- models of set of support clauses provided by constraint solver Sofii (Stanley 1994)
- preferences given clauses that are likely to be in several models
- solution often found with fewer given clauses, but generation of multiple models quite costly

**Sofii**
- similar strategy as Scott, but single model by soft constraint solver SFindler
- most of current usable list modifiable
- set of support partition into buckets (by length of clauses and truth value in current model) for faster given clause selection
- new given clause
- selected from set of support by finite preference strategy and incorporated into Sofii's model
- selected against model
- step incorporated with no model change
- if this new model
- used by Otis to generate new clauses

**Finfer**
- finite domain constraint solver
- generate sets with finite domain for all variables and functions in the theory to be modified
- only short clauses compiled into constraints
- for more information on Otis’s Finfer (Stanley 1984)

**SFindler**
- MAS-CSP solver employing depth-first branch and bound
- supports soft constraints

**Results**
- solved on all difficult problems from the CASC-18 System Competition (Stucki & Stucki 2002)
- compared to runs of Otis on some problems
- time limit: 90 minutes per problem
- Otis solves some problems that Sofii does not solve and vice versa
- on harder problems that both systems solve, Sofii generally takes longer for given clauses but often longer time
- successful, positive example: L2C32 (problem in logic calculation)
- Sofii takes 12.9 seconds, Otis gives up after 16 minutes
- figure shows number of clauses in set of support (dots) over given clauses, vertical 300 clauses in set of support
- Otis’s set of support is much more sparsely, indicating that Sofii is being the easier
- Sofii gives clue after much longer given clauses than Otis, which looks beyond what is shown in the figure
- generally, the harder a problem, the more semantic guidance will help
- early models did not guide the search very well
- deep limit search, less for minimal graphs and model becomes more accurate

**Conclusion and Future Work**
- Sofii from formal feedback, but already much faster than its predecessor Scott
- good start in exploring semantic guidance using a soft model
- possibilities for future work
- semantic resolution could be implemented ( usable constraint list with both types in real and at least most part of new new search start Sofii in guiding model) (Stucki 1997)
- fine tuning of the various parameter settings and details of clause selection algorithm
- some features of Sofii to model adapting to different classes of problems automatically

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**References**