

# SCSat: A Soft Constraint Guided SAT Solver

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# What is SCSat?

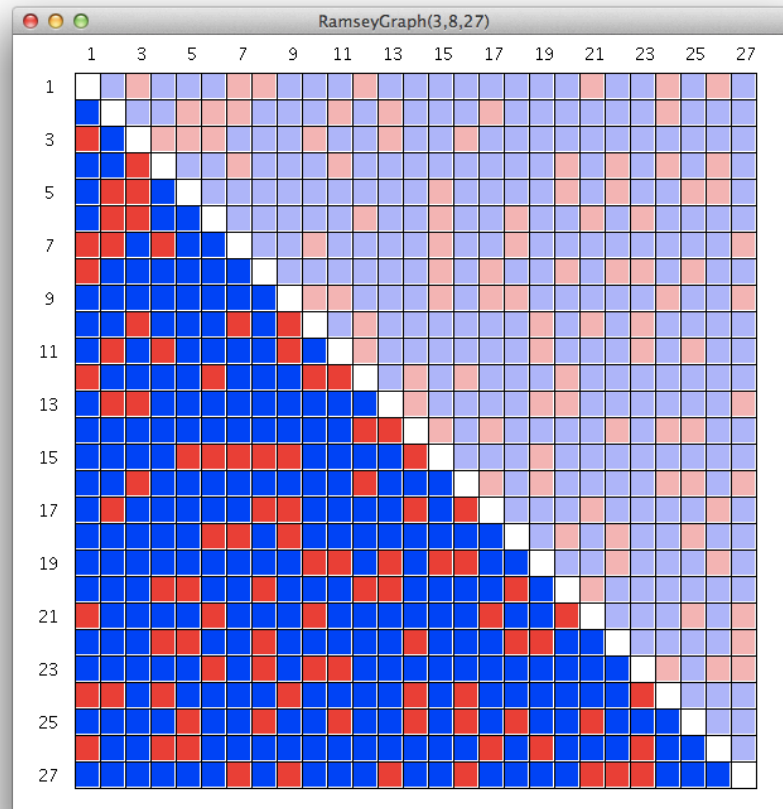
- SCSat is a SAT solver which can be used for solving any problem  $P$  which is supposed to be satisfiable.
- If there is a good *soft constraint* ( $SC$ ) s.t.
  - The search space is reduced so that  $P \wedge SC$  becomes much easier than  $P$ ;
  - The solver's attention is turned to seeking solutions only of good features such as symmetries; and
  - In case the  $SC$  is too strong, it can be relaxed to  $SC^r$  so that  $P \wedge SC^r$  becomes satisfiable.

# How to solve it?

Given a CNF for  $P$  and a Weighted-CNF for  $SC$ , SCSat will perform simple iterations:

```
i := 0; SCi := SC;  
do {  
    solve(P ∧ SCi);  
    if (a model is found) then exit(SAT);  
    else if (SCi is empty) then exit(UNSAT);  
    else { SCi+1 := relax(SCi); i := i+1; }  
}
```

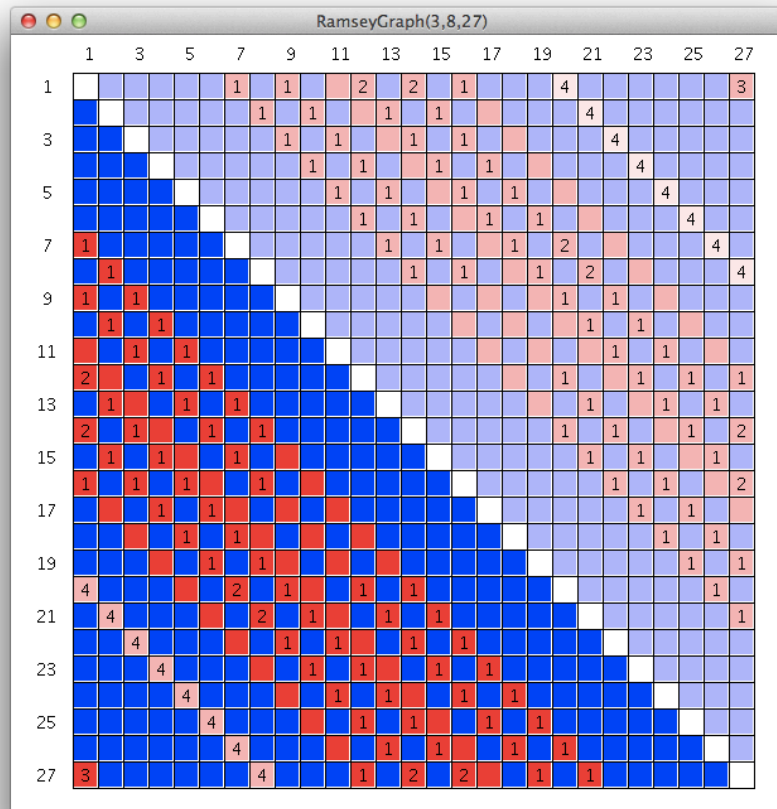
Ex. A normal SAT solver would take quite some time to find a RamseyGraph(3,8,27)



#vars=  
 $27 * 26 / 2 =$   
**351**

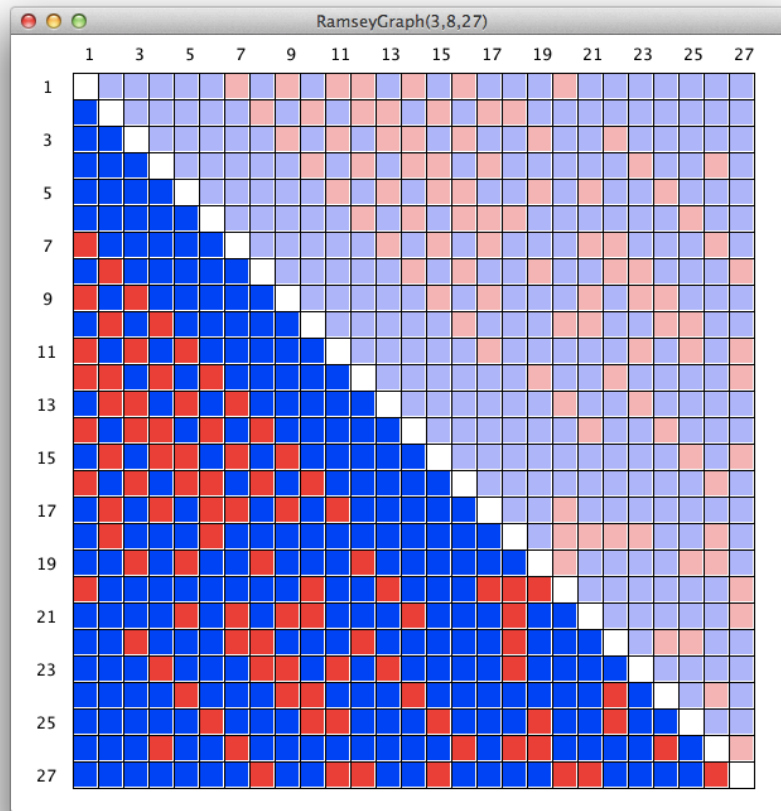
# Are there any prettier solutions?

## No.



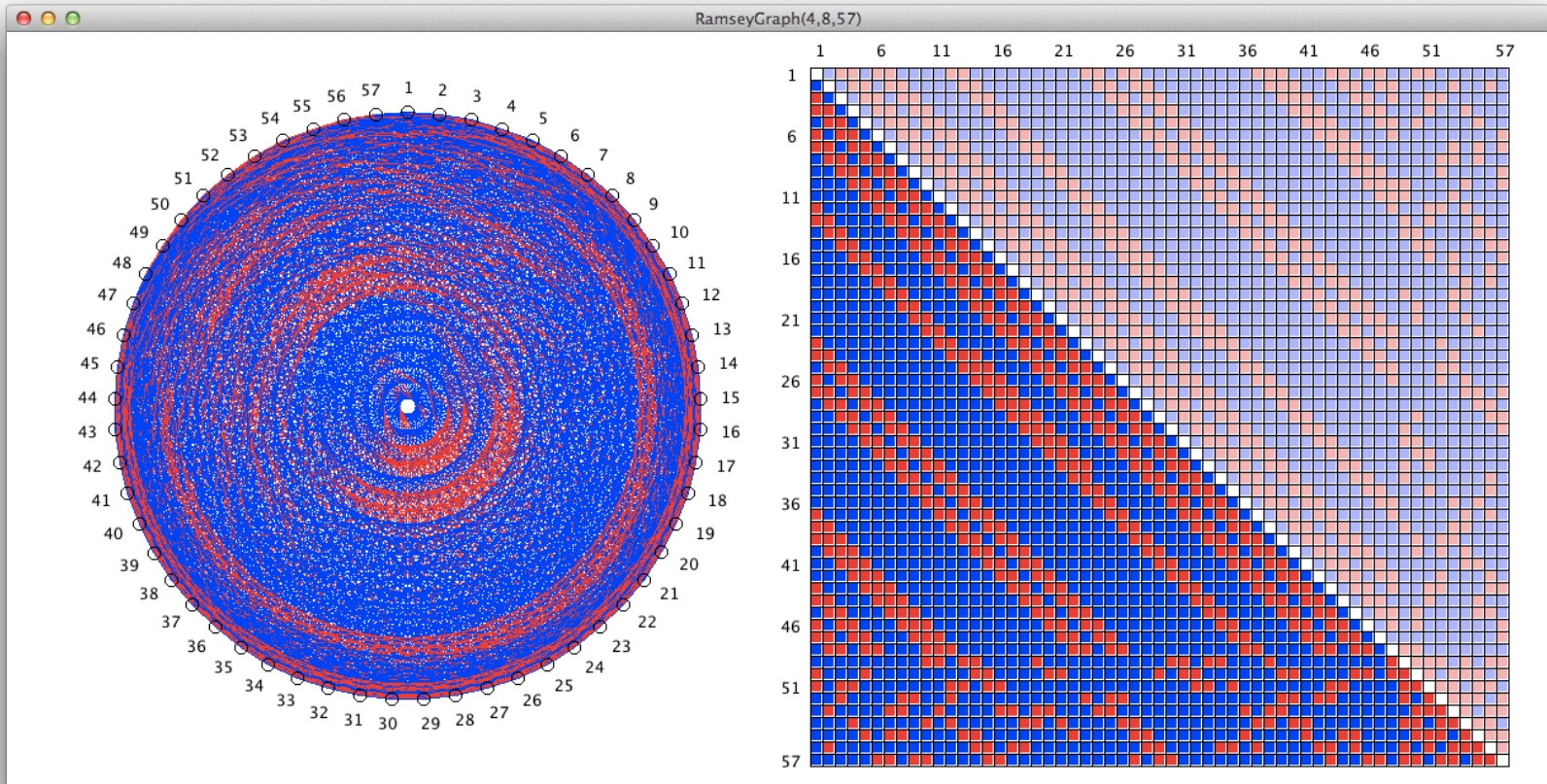
net #vars=  
#stripes=  
**26**

SCSat will obtain a true solution  
by inducing more adequate SC



partially  
striped

# Results: RamseyGraph(4,8,57) that improves the LB of $R(4,8)$ to 58



See arXiv:1212.1328, 2012

# Summary

If your problem

- has not yet been solved after months of search, but
- it is supposed to be satisfiable, and
- it seems to have a solution of a good feature which can be well expressed in SC,

then, try SCSat!



Thank you!