

Grounding and Search

The operation of an answer set solver consists of two steps, *grounding* and *search*. Grounding generates a logic program without variables that has the same stable models as the given program. The grounder of CLINGO is called GRINGO, and the search engine of CLINGO is called CLASP.

Consider, for instance, the result of grounding the program

```
% File color
vertex(a;b;c).
edge(a,b).
edge(b,c).
1 { <C> : color(X,C) : C=1..2 } 1 :- vertex(X).
:- edge(X,Y), color(X,C), color(Y,C).
```

Option `-t` instructs GRINGO to display the output in a humanly readable form:

```
> gringo -t color
vertex(a).
vertex(b).
vertex(c).
edge(a,b).
edge(b,c).
1[color(c,1),color(c,2)]1.
1[color(b,1),color(b,2)]1.
1[color(a,1),color(a,2)]1.
:-color(b,2),color(c,2).
:-color(b,1),color(c,1).
:-color(a,2),color(b,2).
:-color(a,1),color(b,1).
```

The output of GRINGO can be processed by several search engines other than CLASP, including SMOBELS and CMOBELS. The former is the oldest existing search engine for generating stable models. It was created more than 10 years ago by a team led by Ilkka Niemelä in Finland. CMOBELS was designed and implemented by Yuliya Lierler. The design of their successor CLASP uses many ideas of that earlier work.

In the examples below,

```
gringo  is aliased to /projects/tag/gringo-3.0.90/gringo,  
smodels is aliased to /projects/tag/smodels/linux/smodels,  
cmodels is aliased to /projects/tag/cmodels3/linux/cmodels.
```

```
> gringo color | smodels  
smodels version 2.34. Reading...done  
Answer: 1  
Stable Model: vertex(a) vertex(b) vertex(c) edge(a,b) edge(b,c)  
color(b,2) color(c,1) color(a,1)  
True  
Duration: 0.000  
Number of choice points: 1  
Number of wrong choices: 0  
Number of atoms: 33  
Number of rules: 42  
Number of picked atoms: 3  
Number of forced atoms: 0  
Number of truth assignments: 56  
Size of searchspace (removed): 6 (0)
```

```
gringo color | cmodels  
cmodels version 3.81 Reading...done  
Program is tight.  
Calling SAT solver Minisat 2.0 beta ...  
Answer: 1  
Answer set: vertex(a) vertex(b) vertex(c) edge(a,b) edge(b,c)  
color(c,2) color(b,1) color(a,2)  
Total Time 0.00
```

Problem 35^e. Use the tools SMODELS, CMODELS, and CLASP to generate large cliques in graphs `g_200_8000` and `g_300_20000`, and compare their performance.