Raport MiniSat Presentation

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Overview

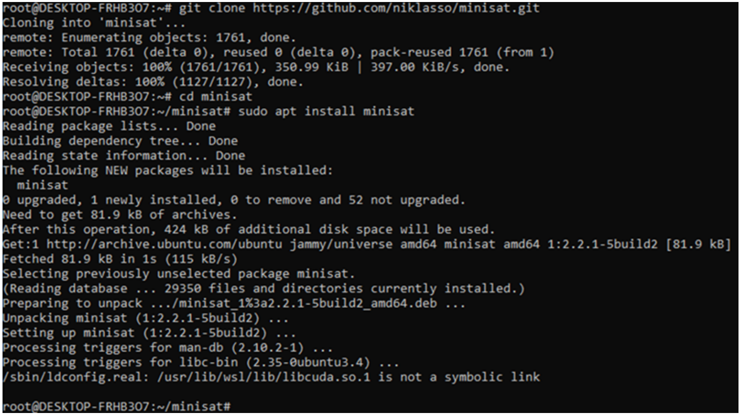
Strengths & Installation

Strengths:

- Efficient
- Minimalist
- Open Source

Installation Commands:

- `git clone https://github.com/niklasso/minisat.git`
- `cd minisat`
- `sudo apt install minisat` sau `make install`



```
root@DESKTOP-FRHB307:~# git clone https://github.com/niklasso/minisat.git
Cloning into 'minisat'...
remote: Enumerating objects: 1761, done.
remote: Total 1761 (delta 0), reused 0 (delta 0), pack-reused 1761 (from 1)
Receiving objects: 100% (1761/1761), 350.99 KiB | 397.00 KiB/s, done.
Resolving deltas: 100% (1127/1127), done.
root@DESKTOP-FRHB307:~# cd minisat
root@DESKTOP-FRHB307:~/minisat# sudo apt install minisat
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  minisat
0 upgraded, 1 newly installed, 0 to remove and 52 not upgraded.
Need to get 81.9 kB of archives.
After this operation, 424 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/universe amd64 minisat amd64 1:2.2.1-5build2 [81.9 kB]
Fetched 81.9 kB in 1s (115 kB/s)
Selecting previously unselected package minisat.
(Reading database ... 29350 files and directories currently installed.)
Preparing to unpack .../minisat_1%3a2.2.1-5build2_amd64.deb ...
Unpacking minisat (1:2.2.1-5build2) ...
Setting up minisat (1:2.2.1-5build2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.4) ...
/sbin/ldconfig.real: /usr/lib/wsl/lib/libcuda.so.1 is not a symbolic link

root@DESKTOP-FRHB307:~/minisat#
```

Usage

Running Command:

- `nano input.cnf`
- `minisat input.cnf output.txt (optional)`

Command-Line Options:

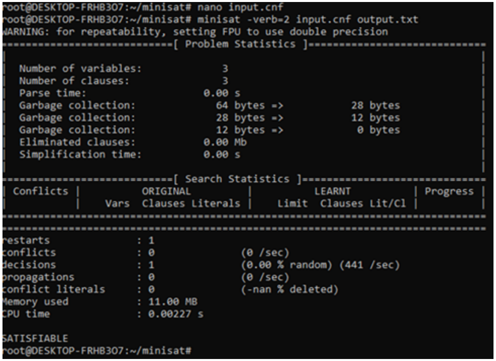
- `verb=<nivel>`
- `cpu-lim=<secunde>`
- `mem-lim=<megabytes>`

CNF File:

```
n cnf 3 3
1 -2 3 0
2 -3 0
```

Output:

```
SAT
-1 -2 -3 0
```



```
root@DESKTOP-FRHB3O7:~/minisat# nano input.cnf
root@DESKTOP-FRHB3O7:~/minisat# minisat -verb=2 input.cnf output.txt
WARNING: for repeatability, setting FPU to use double precision
============================[ Problem Statistics ]=============================
|                                                                             |
|  Number of variables:             3                                         |
|  Number of clauses:               3                                         |
|  Parse time:                   0.00 s                                       |
|  Garbage collection:             64 bytes =>           28 bytes             |
|  Garbage collection:             28 bytes =>           12 bytes             |
|  Garbage collection:             12 bytes =>            0 bytes             |
|  Eliminated clauses:           0.00 Mb                                      |
|  Simplification time:          0.00 s                                       |
|                                                                             |
============================[ Search Statistics ]==============================
| Conflicts |          ORIGINAL         |          LEARNT          | Progress |
|           |    Vars  Clauses Literals |    Limit  Clauses Lit/Cl |          |
===============================================================================
===============================================================================
restarts              : 1
conflicts             : 0              (0 /sec)
decisions             : 1              (0.00 % random) (441 /sec)
propagations          : 0              (0 /sec)
conflict literals     : 0              (-nan % deleted)
Memory used           : 11.00 MB
CPU time              : 0.00227 s

SATISFIABLE
root@DESKTOP-FRHB3O7:~/minisat#
```

Overall Architecture

Two Main Files

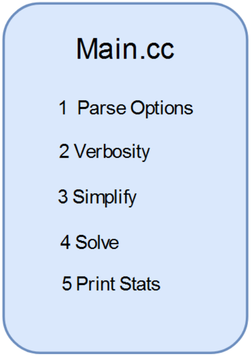
- `Main.cc`
- `Solver.cc`

Main.cc

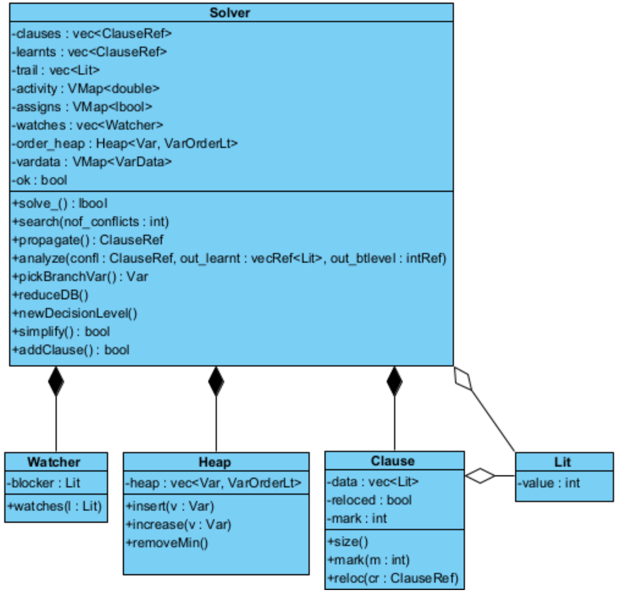
- `Entry Point`
- `Overall Flow`

Solver.cc

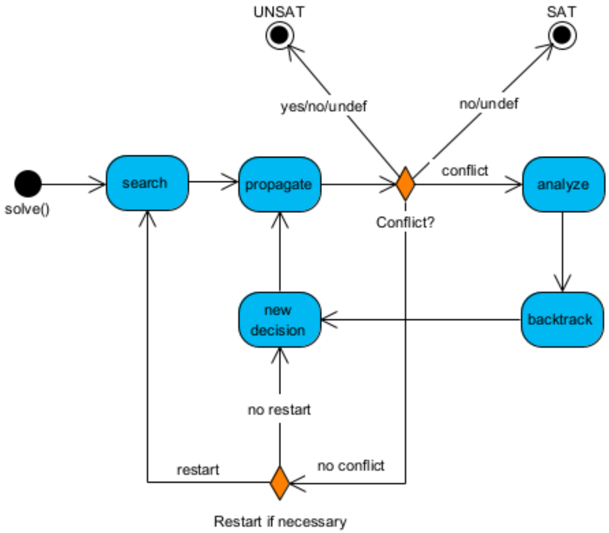
- `Handles the Solving Process`



Class Structure & Key Components



SAT Solving Process - CDCL, Propagation & Heuristics



Automating the Execution of MiniSat for .cnf Files

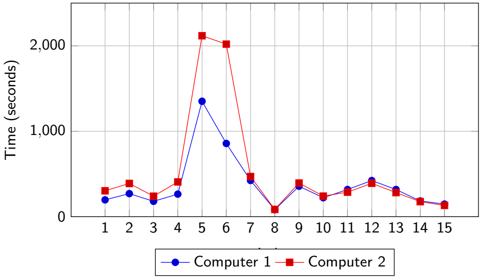
1. **Objective**: Automating the execution of MiniSat with a time limit per file (e.g., 5 hours).
   - `limita_ore=5`
2. **Set Time**: Convert the time limit into seconds (5 hours → 18,000 seconds).
   - `limita_secunde=$((limita_ore * 3600))`
3. **File Iteration**: Process all .cnf files in the directory.
   - `for file in *.cnf; do`
4. **Generated Outputs**: Create output and log files for each .cnf file.
5. **Execution**: Run MiniSat with the -cpu-lim option and check for errors.
   - `minisat -cpu-lim="$limita_secunde" "$file" "$output"`
6. **Results**: Save the outputs and logs for each test.

Benchmark Results

Table: Benchmark Results for 15 Executions from the Software Verification Family

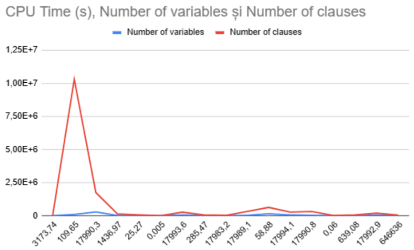
Execution	CPU Time (Comp 1)	Memory Used (Comp 1)	CPU Time (Comp 2)	Memory Used (Comp 2)
1	197 s	5383 MB	303 s	5384 MB
2	270 s	6091 MB	389 s	6090 MB
3	180 s	4907 MB	240 s	4906 MB
4	264 s	5823 MB	407 s	5825 MB
5	1351 s	5365 MB	2118 s	5366 MB
6	857 s	739 MB	2020 s	738 MB
7	424 s	7617 MB	470 s	7618 MB
8	82 s	2495 MB	85 s	2495 MB
9	357 s	7201 MB	394 s	7203 MB
10	222 s	4785 MB	241 s	4783 MB
11	318 s	5772 MB	287 s	5771 MB
12	423 s	7485 MB	391 s	7488 MB
13	318 s	5876 MB	282 s	5875 MB
14	184 s	3780 MB	176 s	3778 MB
15	147 s	3636 MB	132 s	3637 MB

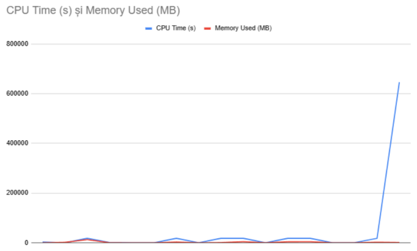
Figure: Visual comparison of the execution times



Benchmark Results

Family: Scheduling					
Nr	CPU Time (s)	Memory Used (MB)	Number of variables	Number of clauses	OUT
1	3173,74	83	2010	11953	UNSATISFIABLE
2	109,65	1838	93713	10295409	SATISFIABLE
3	17990,3	12646	282525	1743751	INDETERMINATE
4	1436,97	310	14756	141683	UNSATISFIABLE
5	25,27	38	14400	63874	UNSATISFIABLE
6	0,005	11	221	1084	UNSATISFIABLE
7	17993,6	2977	49869	264805	INDETERMINATE
8	285,47	71	14174	66704	SATISFIABLE
9	17983,2	894	1015	21642	INDETERMINATE
10	17989,1	4443	26286	319289	INDETERMINATE
11	58,88	187	145943	625454	SATISFIABLE
12	17994,1	4122	53844	270141	INDETERMINATE
13	17990,8	4377	28830	320272	INDETERMINATE
14	0,06	12	3890	14187	SATISFIABLE
15	639,08	147	6397	60575	UNSATISFIABLE
16	17992,9	2306	37028	187771	INDETERMINATE
17	646636	1187	14560	48075	SATISFIABLE


CPU Time (s), Number of variables și Number of clauses
Number of variables
Number of clauses
1,25E+7
1,00E+7
7,50E+6
5,00E+6
2,50E+6


CPU Time (s) și Memory Used (MB)
CPU Time (s)
Memory Used (MB)