

# Decision procedures and verification - DPLL

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## 1 Experimental evaluation

Some smaller Uniform Random-3-SAT examples from SATLIB Benchmark Problems were used for experimental evaluation of DPLL algorithm (dpll3) and DPLL algorithm with watched literals (dpll3-wl).

### 1.1 SAT examples

In the case of SAT problems of sizes 20, 50, 75, 100, 125 and 150 the first few examples (usually between 5 and 10) were selected for the experimental evaluation. Their resulting CPU times, number of decided variables and propagated variables were averaged, and the results can be found in the following figure [1].

### 1.2 UNSAT examples

In the case of UNSAT problems of sizes 50, 75, 100, 125 and 150, the first few examples (usually between 5 and 10) were selected for the experimental evaluation. Their resulting CPU times, the number of decided variables and propagated variables were again averaged, and the results can be found in the following figure [2].

### 1.3 Conclusion

As we can see, the DPLL algorithm with watched literals is significantly faster, but it usually needs to decide more variables and also derives more variables using unit propagation. This may be caused by the lazy evaluation of satisfied clauses. In this case, the algorithm stops and returns SAT if and only if all of the variables were assigned. On the other hand, the original DPLL algorithm without watched literals stops and returns SAT if and only if all clauses were satisfied, which may take considerably less variable decisions and variable derivations.

size	time-dpll3	time-dpll3-wl	dec-dpll3	dec-dpll3-wl	unit-prop-dpll3	unit-prop-dpll3-wl
20	0.003908	0.004084	8.5	10.8	20.0	24.5
50	0.078588	0.081632	38.0	78.5	195.9	437.3
75	1.046928	0.396739	312.5	355.7	2678.2	2979.1
100	6.187898	2.823121	1137.5	2074.4	12127.1	20882.4
125	27.652291	4.551175	3539.1	2804.1	42652.8	31352.5
150	484.729539	295.671237	30944.2	109526.2	435702.8	1438649.0

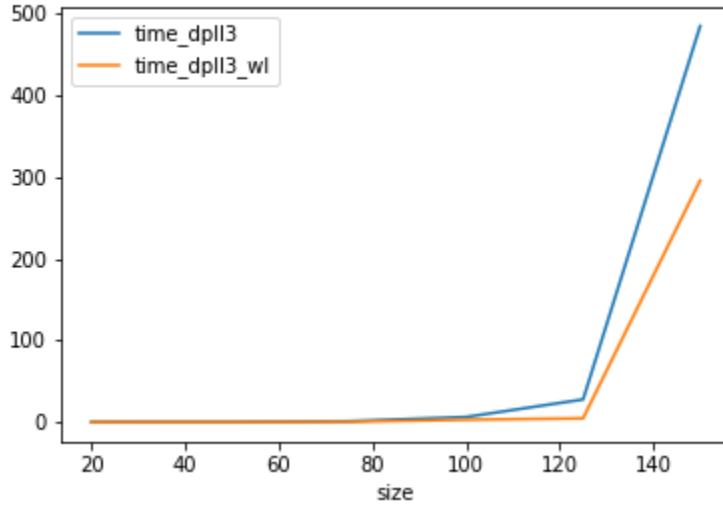


Figure 1: Averadge results of SAT examples

size	time-dpll3	time-dpll3-wl	dec-dpll3	dec-dpll3-wl	unit-prop-dpll3	unit-prop-dpll3-wl
50	0.331029	0.194026	123.3	155.8	877.2	1080.3
75	3.996612	2.217751	852.0	1295.2	7305.0	10699.2
100	32.024899	13.589121	4130.0	6077.2	42936.2	62715.6
125	206.260527	69.706866	18036.0	26638.0	220951.8	313781.8
150	1180.829584	431.704132	73426.8	139255.6	995856.4	1819359.0

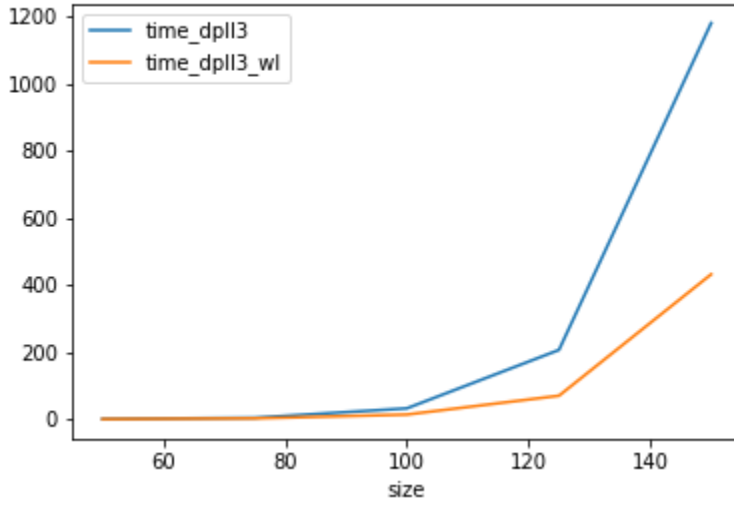


Figure 2: Average results of UNSAT examples