Storing CNF Equations

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This document contains information, such as magic bytes and grammars, about how SAT equations will be stored in this program.

1 Human Readable SAT `.hsat`

Magic Bytes The file starts with the bytes `SAT`

Grammar Contains a general unformated equation.

```
 S → SAT( EQ )
EQ → BINOP( EQ, EQ ) | NOT( EQ )
EQ → NUM | T | F
BINOP → AND | OR | XOR | NOR
```

2 Compressed CNF-SAT `.cnf`

A compressed CNF-SAT equation consists of three blocks, the `Headers`, `Solution Strings` and the `Equation String`.

Magic Bytes The file starts with the bytes `CNF` followed by a whitespace.

Comments The next block includes comments. These are ignored by the parsers. Every comment fills one line starting with `#` and ending with line break.

Dimension Bytes The following two bytes specify the size of disjunctions and variable storage.

The first magic byte specifies the size of variables n in bytes. (Constraint: $n \in [1, 8]$. Note for parser: Reading the symbol `#` refers to *comments*. See above. The first bit is always reserved for sign.)

The following magic byte specifies the size of a disjunction $D_{\max}$ magic bytes. (Constraint: $n \in [1, 8]$)

. . . Solutions The first block of the document provides some solutions to the logic equations given in the document.

Magic Byte Specifies the next state.

`00` **Finished State** There are no more solutions left.

`01` **Reading Full State** Next bytes describe a solution.

. . . Solution n bits, rounded up to bytes, of positional interpretations. A bit at position n is 1, if and only of the variable n is truthy.

`02` **Reading Semi State** Next bytes describe a solution.

. . . Solution n bits, rounded up to bytes, of positional interpretations. A bit at position n is 1, if and only of the variable n is truthy.

`FF` **Unknown State** There may be further solutions which are not provided in the document.

. . . Equation The rest of the document are iterations over disjunctions.

Disjunction Size Specifies how many variables will follow. Size of this magic byte is specified in the header.

Zero to indicate there are no more disjunctions.

. . . Variables Byte String of Variables, every variables size is specified in the headers. The first bit specifies if the variable is negated.

Grammar

S → CNF COMMENTS DIMENSION SOLUTION EQUATION
COMMENTS → # ... \n
DIMENSION → nD_{max}

```
SOLUTION → TODO
EQUATION → TODO
```

Example Here is an example of a word $w \in$ CNF divided into sections.

```
CNF
```

```
# Equation:  1 2 | 1 -2 -3 | -1 3
# Solutions:  -1 2 -3 | 1 3
```

```
1 1
```

```
1 01000000
2 01000000 01100000 0
0
```

```
2 00000001 00000010
3 00000001 10000010 10000011
2 10000001 00000011
0
```

The first section consists only of the magic bytes `CNF`. The second section consists of comments, every line begins with #. The magic bytes follow.

The forth divided section consists of the solutions. The first solution sets every variable and therefore starts with `1`. The interpretation is `010` filled with zeroes. The next solution does not specify all variables, therefore starts with `2`. The next bytes till `0` are variables with sign bit.

The last section is the equation. Every conjunction starts with the amount of literals, followed by the literal declarations themselves.