CNF Files

CNF stands for Conjuctive Normal Form, a type of boolean expression that consists of conjuctions between disyunctions.

> **Example**
>
> CNF expression:
>
> $$(A \vee B \vee C) \wedge (A \vee \neg B \vee C)$$

Breakdown of CNF file

Example of the file:

```
c 3 variables, 6 clauses
p cnf 3 6
1 2 0
1 -2 0
3 2 0
-3 1 0
1 2 3 0
-1 -2 0
```

1. Comments:
   Comments are started with `c` (like the `#` in Python). Provides information to the human readers, think of it as metadata for the file

```
c 3 variables, 6 clauses
```

In this case, it indicates that there are 3 variables and 6 clauses.
2. Problem Definition:
Used for the problem specs, indicating the type of expression (e.g. `cnf`) and the number of clauses and variables:

```
p cnf 3 6
```

Starts with `p` to indicate that this line should be parsed by the reader program (the `p` comes from problem). `cnf` indicates the expression type, with `3` variables and `6` clauses in this particular case. This information may seem redundant by this line of code is actually relevant for the reader the program, the previous comment was just for the human reader.

2. Clauses:
   Now there are the clauses, for a number i in the file, there is a disjunction that includes the variables x_i. Each of the files is a literal that its separated by a conjuction.

- `1 2 0` means $x_1 \vee x_2$
- `1 -2 0` means $x_1 \vee \neg x_2$
- `3 2 0` means $x_3 \vee x_2$
- `-3 1 0` means $\neg x_3 \vee x_1$
- `1 2 3 0` means $x_1 \vee x_2 \vee x_3$

- `-1 -2 0` means $\neg x_1 \vee \neg x_2$
  Each line ends with a 0, as it indicates the end of the literal/clause.

The file results in the following expression:

$$(x_1 \vee x_2) \wedge (x_1 \vee \neg x_2) \wedge (x_3 \vee x_2) \wedge (\neg x_3 \vee x_1) \wedge (x_1 \vee x_2 \vee x_3) \wedge (\neg x_1 \vee \neg x_2)$$

In summary:

1. Lines starting with `c` are comments. Ignore them.
2. The line with `p` indicates the number of clauses and variables.
3. Each subsequent line is a clause in the CNF formula.
4. Each clause is a distinction of literals.
5. The line `0` indicates the ends of a clause.