SAT SOLVER

Algorithm used: DPLL

DPLL logic:

This makes the use of **backtracking algorithm.** The algorithm basically chooses a literal, assigns a truth value to it, simplifies the formula accordingly and then recursively checks if the simplified formula is SATISFIABLE. If in this case, the formula is UNSATISFIABLE, the same recursive check is done assuming the opposite truth value. To simplify this, if a variable is interpreted as False, then it is removed from all the relevant clauses and if a literal is interpreted as True, then the clause to which the literal belongs is removed.

RULES OF DPLL ALGORITHM:

- **Unit Propagation:**
  If a clause is a unit clause (the clause contains only one literal), this clause can only be satisfied by assigning a particular truth value to the literal. Therefore, we have only one choice. In unit propagation, every clause containing a unit clause's literal is removed and the complement of that literal is discarded from every clause containing that complement.

UNSATISFIABILITY of a given partial assignment is detected if one clause becomes empty, i.e. if all its variables have been assigned in a way that makes the corresponding literals false.

UNSATISFIABILITY of the complete formula is detected after exhaustive search, i.e. when the formula fails to be satisfiable.

SATISFIABILITY of the formula is detected either when all variables are assigned without generating any empty clause, or if all clauses are satisfied.

DPLL algorithm(pseudo code) :

```
dpll(CNF, literals) {
remove clauses containing literals
if (CNF contains no clauses) return true //this implies that the formula is SATISFIABLE
shorten clauses containing ! literals
if (CNF contains empty clause) return false // this implies that the formula is UNSATISFIABLE
if (CNF contains a unit literal U)
        return dpll (CNF, U)
choose a literal L in CNF
if (dpll(CNF, !L)) return true   //as the  formula is SATISFIABLE in this case
return dpll(CNF,L)
}
```

Limitation of DPLL: Implementing this algorithm is somewhat memory intensive.

Assumptions: No assumptions were taken