Programming Assignment

Problem Specification

Preliminaries

This assignment deals with boolean formulae. A boolean formula is comprised of boolean variables, the negation operator (boolean **not**) the conjunction operator (boolean **and**) and the disjunction operator (boolean **or**). We use **x1**, **x2** etc. to denote boolean variables.

Definition ***Clause***

A clause is a disjunction (or) of exactly boolean variables.

Definition ***Formula***

A formula is a conjunction of several clauses.

Example formula: (**x1** or **x2** or not-**x3**) and (not-**x2** or **x3** or **x4**) and (not-**x1** or not-**x3** or not-**x4**)

Note that there are three clauses in the above formula and that the formula is comprised of boolean variables **x1**, **x2**, **x3** and **x4**. An assignment for a formula is a setting of truth values (**true** or **false**) to the variables in the formula. An example assignment for the above formula is: **x1**, **x2** and **x4** are set to **true** and **x3** to **false**. We will write this assignment as (**x1, x2, x3, x4**) = (**true**, **true**, **false**, **true**). Observe that this assignment makes the above formula evaluate to **true**. On the other hand, the assignment (**x1, x2, x3, x4**) = (**true**, **false**, **true**, **true**) makes the above formula evaluate to **false**.

Definition ***Satisfying Assignment***

A satisfying assignment for a formula is an assignment that makes the formula evaluate to **true**.

For the example formula above, the assignment (**x1, x2, x3, x4**) = (**true**, **false**, **false**, **true**) is a satisfying assignment. Observe that a satisfying assignment has to make each clause in the formula evaluate to true (Things to think about: How many different satisfying assignments can you find for this example formula? Can you write a formula for which there is no satisfying assignment? How many possible assignments exist for a formula?)

Problem Definition

Given a boolean formula, compute a (any one) satisfying assignment for it. If no satisfying assignment exists, report that the formula is unsatisfiable. Your program will read a formula from a file, whose name will be input by the user. All input files will have the following format:

- Comment lines at the beginning of the file start with the character ‘c’.
- The first data line has the format “p cnf number-of-variables number-of clauses”.
- Note that variables are numbered starting at 1.
- The clauses are now specified, with one clause per line. A clause is specified by writing the numbers of the variables that occur in it followed by the value 0. Also note that negated variable number **i** is specified as **–i**. So the clause (not-**x12** or **x3** or **x41**) is specified in the file as **–12 3 41 0**

For example the above formula when specified as a file is:

c This is a comment line. I start with a c and there may be zero or more of me!
p cnf 4 3
1 2 -3 0
-2 3 4 0
-1 -3 -4 0