# Overview

## Implementation details

The program reads the input file line by line and parses it with space as a delimiter. All the variables are mapped to distinct integers. The sentence is then encoded into bits (in a long int variable); the bit values represent the presence of a variable in the sentence and its sign (if negated). Similarly the truth-value assignment of each variable is encoded in another long int variable.

## Important data-structures used

1. indexMap: This stores the mapping of a variable/symbol to its identification number.
2. symbolMap: This is the reverse mapping of indexMap.
3. kb: This stores the mapping of encoded sentence to its identification number.
4. kb2: This is the reverse mapping of kb.

# Program Outputs (Transcripts)

## Agent Problem #1

model = {}

Pure Symbol : stapler = false

model = {stapler: false, }

Pure Symbol : recharger = false

model = {stapler: false, recharger: false, }

Pure Symbol : welder = false

model = {stapler: false, recharger: false, welder: false, }

Pure Symbol : cutter = false

model = {stapler: false, recharger: false, welder: false, cutter: false, }

Unit Clause on {painter }: painter = true

model = {painter: true, stapler: false, recharger: false, welder: false, cutter: false, }

Unit Clause on {sander }: sander = true

model = {painter: true, stapler: false, recharger: false, welder: false, cutter: false, sander: true, }

Unit Clause on {gluer }: gluer = true

model = {painter: true, stapler: false, recharger: false, welder: false, cutter: false, sander: true, gluer: true, }

Unit Clause on {joiner }: joiner = true

model = {painter: true, stapler: false, recharger: false, welder: false, cutter: false, sander: true, joiner: true, gluer: true, }

Trying : h = false

model = {painter: true, stapler: false, recharger: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Trying : d = false

model = {painter: true, stapler: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Trying : f = false

model = {painter: true, stapler: false, f: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Unit Clause on {-a -f -d -h }: a = false

model = {painter: true, a: false, stapler: false, f: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Unit Clause on {a g f -recharger d }: g = true

model = {painter: true, a: false, g: true, stapler: false, f: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : c = false

model = {painter: true, a: false, c: false, g: true, stapler: false, f: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : e = true

Unit Clause on {c b -cutter h }: b = true

model = {painter: true, a: false, c: false, g: true, stapler: false, b: true, f: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : e = true

Unit Clause on {-a -c -e -d }: e = false

model = {painter: true, a: false, c: false, e: false, g: true, stapler: false, b: true, f: false, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Backtracking

Trying : f = true

model = {painter: true, stapler: false, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Trying : b = false

model = {painter: true, stapler: false, b: false, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Unit Clause on {c b -cutter h }: c = true

model = {painter: true, c: true, stapler: false, b: false, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : a = false

model = {painter: true, a: false, c: true, stapler: false, b: false, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : e = false

model = {painter: true, a: false, c: true, e: false, stapler: false, b: false, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : g = true

model = {painter: true, a: false, c: true, e: false, g: true, stapler: false, b: false, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Backtracking

Trying : b = true

model = {painter: true, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Trying : g = false

model = {painter: true, g: false, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Unit Clause on {-a -g -d -h }: a = false

model = {painter: true, a: false, g: false, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Unit Clause on {-a -c -g -d }: c = false

model = {painter: true, a: false, c: false, g: false, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : e = true

model = {painter: true, a: false, c: false, e: true, g: false, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Backtracking

Trying : g = true

model = {painter: true, g: true, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : a = false

model = {painter: true, a: false, g: true, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : c = false

model = {painter: true, a: false, c: false, g: true, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Pure Symbol : e = false

model = {painter: true, a: false, c: false, e: false, g: true, stapler: false, b: true, f: true, recharger: false, d: false, welder: false, cutter: false, h: false, sander: true, joiner: true, gluer: true, }

Satisfiable!

True props:

painter

g

b

f

sander

joiner

gluer

# iterations : 32

## Agent Problem #2

model = {}

Pure Symbol : stapler = false

model = {stapler: false, }

Pure Symbol : sander = false

model = {stapler: false, sander: false, }

Pure Symbol : gluer = false

model = {stapler: false, sander: false, gluer: false, }

Unit Clause on {cutter }: cutter = true

model = {stapler: false, cutter: true, sander: false, gluer: false, }

Unit Clause on {welder }: welder = true

model = {stapler: false, welder: true, cutter: true, sander: false, gluer: false, }

Unit Clause on {painter }: painter = true

model = {painter: true, stapler: false, welder: true, cutter: true, sander: false, gluer: false, }

Unit Clause on {joiner }: joiner = true

model = {painter: true, stapler: false, welder: true, cutter: true, sander: false, joiner: true, gluer: false, }

Unit Clause on {recharger }: recharger = true

model = {painter: true, stapler: false, recharger: true, welder: true, cutter: true, sander: false, joiner: true, gluer: false, }

Trying : h = false

model = {painter: true, stapler: false, recharger: true, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Unit Clause on {g h -gluer }: g = true

model = {painter: true, g: true, stapler: false, recharger: true, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Trying : d = false

model = {painter: true, g: true, stapler: false, recharger: true, d: false, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Unit Clause on {b d -sander }: b = true

model = {painter: true, g: true, stapler: false, b: true, recharger: true, d: false, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Pure Symbol : a = false

model = {painter: true, a: false, g: true, stapler: false, b: true, recharger: true, d: false, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Pure Symbol : c = false

model = {painter: true, a: false, c: false, g: true, stapler: false, b: true, recharger: true, d: false, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Pure Symbol : e = false

model = {painter: true, a: false, c: false, e: false, g: true, stapler: false, b: true, recharger: true, d: false, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Pure Symbol : f = true

model = {painter: true, a: false, c: false, e: false, g: true, stapler: false, b: true, f: true, recharger: true, d: false, welder: true, cutter: true, h: false, sander: false, joiner: true, gluer: false, }

Satisfiable!

True props:

painter

g

b

f

recharger

welder

cutter

joiner

# iterations : 17

## Abstract Boolean Problem

model = {}

Pure Symbol : f = false

model = {f: false, }

Pure Symbol : i = false

model = {f: false, i: false, }

Pure Symbol : j = false

model = {f: false, i: false, j: false, }

Pure Symbol : o = true

model = {f: false, i: false, j: false, o: true, }

Pure Symbol : e = false

model = {f: false, i: false, j: false, o: true, e: false, }

Pure Symbol : m = false

model = {f: false, i: false, j: false, m: false, o: true, e: false, }

Pure Symbol : h = false

model = {f: false, h: false, i: false, j: false, m: false, o: true, e: false, }

Pure Symbol : a = true

model = {a: true, f: false, h: false, i: false, j: false, m: false, o: true, e: false, }

Pure Symbol : b = true

model = {a: true, f: false, b: true, h: false, i: false, j: false, m: false, o: true, e: false, }

Pure Symbol : g = false

model = {a: true, f: false, g: false, b: true, h: false, i: false, j: false, m: false, o: true, e: false, }

Pure Symbol : l = true

model = {a: true, f: false, g: false, b: true, h: false, i: false, l: true, j: false, m: false, o: true, e: false, }

Pure Symbol : c = false

model = {a: true, f: false, g: false, b: true, h: false, c: false, i: false, l: true, j: false, m: false, o: true, e: false, }

Pure Symbol : k = true

Unit Clause on {-c k }: k = true

model = {a: true, f: false, g: false, b: true, h: false, c: false, i: false, l: true, k: true, j: false, m: false, o: true, e: false, }

Pure Symbol : d = true

Unit Clause on {h c n -m }: n = true

model = {a: true, f: false, g: false, b: true, h: false, c: false, i: false, l: true, k: true, j: false, n: true, m: false, o: true, e: false, }

Pure Symbol : d = true

Trying : d = false

model = {a: true, f: false, g: false, b: true, h: false, c: false, i: false, l: true, k: true, j: false, d: false, n: true, m: false, o: true, e: false, }

Satisfiable!

True props:

a

b

l

k

n

o

# iterations : 16

# Comparision

|  | Backtracking alone | Backtracking with the Unit Clause heuristic | Backtracking with both the heuristics |
| --- | --- | --- | --- |
| Agent Problem #1 | 57563 | 17 | 17 |
| Agent Problem #2 | 19855 | 17 | 17 |
| Boolean Problem | 150 | 16 | 16 |
| **Average** | 25856 | 16.67 | 16.67 |