ECE1733 Topics in Switching Theory Assignment #3

DPLL SAT Solver

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**Introduction**

The program reads a BLIF file that contains a CNF function, and determine its satisfiability by using the DPLL algorithm. The program is written in C++.

**Instructions**

Execution Instruction (Windows)

1. Unzip the **1773\_A3.zip** file, you can find a folder called **DPLL\_SAT\_solver**. Go to the sub-folder called **DPLL** and then **Release** which contains the executable file called **DPLL.exe**.
2. Open the windows command shell **cmd.exe**, and cd to the folder contains the **DPLL.exe** executable file described in step 1.
3. Type: DPLL.exe <path to the BLIF test file>, you can find some test files in the **test\_nodes** folder within the **1773\_A3** folder.
4. The program should start, and shows the major steps it used to find the satisfiability of the CNF function.

Compile Instruction (Visual Studio 2015)

1. In the Solution Explorer, right click on the **DPLL** project and select **property**.
2. Change the **Configuration** to **Release**, **Platform** to **win32**.
3. Under Configuration Properties, go to C/C++ and click Precompiled Headers. Change the option on **Precompiled Header** to **Not Using Precompiled Headers**.
4. Under Configuration Properties, go to C/C++ and click Preprocessor. Add the following to the **Preprocessor Definitions**: **\_CRT\_SECURE\_NO\_WARNINGS**
5. **Build** the solution under the **Release** and **x86** configuration.

The program is also available on GitHub: <https://github.com/marmot1234/DPLL_SAT_solver>

**Execution Report**

Please see Appendix for the detailed information printed on the screen when the program is executed.

**Discussion**

This program prints every major step it took during the execution to the screen, which makes the debugging process easier.

**Appendix**

Detailed Execution Report, I used a Git BASH Shell to execute the program.

node1.blif:

$ ./DPLL.exe ../../test\_nodes/node1.blif

DPLL SAT SOLVER START!

READING FILE ../../test\_nodes/node1.blif

x1 x2 x3

1 1 -

1 0 -

0 - 1

0 - 0

x1 Branch 1 --- Resolve Variable: x1 (1)

x2 x3

- 1

- 0

Unit Clause Found with Variable: x3 --- Resolve Variable: x3 (1)

x2

-

Pure Literal Found: x2 --- Resolve Variable: x2 (0)

Back Track

x1 Branch 0 --- Resolve Variable: x1 (0)

x2 x3

1 -

0 -

Unit Clause Found with Variable: x2 --- Resolve Variable: x2 (1)

x3

-

Pure Literal Found: x3 --- Resolve Variable: x3 (0)

Back Track

The CNF function is Un-Satisfiable

node2.blif:

$ ./DPLL.exe ../../test\_nodes/node2.blif

DPLL SAT SOLVER START!

READING FILE ../../test\_nodes/node2.blif

x1 x2 x3 x4

0 0 - -

0 1 0 -

0 - 1 0

1 - - 1

x1 Branch 1 --- Resolve Variable: x1 (1)

x2 x3 x4

0 - -

1 0 -

- 1 0

Unit Clause Found with Variable: x2 --- Resolve Variable: x2 (0)

x3 x4

0 -

1 0

Unit Clause Found with Variable: x3 --- Resolve Variable: x3 (0)

x4

0

Unit Clause Found with Variable: x4 --- Resolve Variable: x4 (0)

The CNF function is Satisfiable with Solution:

x1(1) x2(0) x3(0) x4(0)

node3.blif:

$ ./DPLL.exe ../../test\_nodes/node3.blif

DPLL SAT SOLVER START!

READING FILE ../../test\_nodes/node3.blif

x1 x2 x3 x4 x5

0 0 0 0 1

0 0 1 0 0

0 0 1 1 0

0 0 1 1 1

0 1 0 0 1

0 1 0 1 0

0 1 1 0 0

0 1 1 1 1

1 0 0 0 1

1 0 0 1 1

1 0 1 0 0

1 0 1 1 1

1 1 0 0 1

1 1 0 1 0

1 1 0 1 1

1 1 1 0 0

1 1 1 1 0

1 1 1 1 1

0 1 0 0 0

1 0 0 0 0

1 0 1 0 1

1 0 1 1 0

x1 Branch 1 --- Resolve Variable: x1 (1)

x2 x3 x4 x5

0 0 0 1

0 1 0 0

0 1 1 0

0 1 1 1

1 0 0 1

1 0 1 0

1 1 0 0

1 1 1 1

1 0 0 0

x2 Branch 1 --- Resolve Variable: x2 (1)

x3 x4 x5

0 0 1

1 0 0

1 1 0

1 1 1

x3 Branch 1 --- Resolve Variable: x3 (1)

x4 x5

0 1

Pure Literal Found: x4 --- Resolve Variable: x4 (0)

x5

The CNF function is Satisfiable with Solution:

x1(1) x2(1) x3(1) x4(0) x5(1)

node4.blif:

$ ./DPLL.exe ../../test\_nodes/node4.blif

DPLL SAT SOLVER START!

READING FILE ../../test\_nodes/node4.blif

x1 x2 x3 x4

0 0 - 0

1 0 0 -

- 0 1 0

1 1 1 1

0 0 - 1

0 1 1 -

x1 Branch 1 --- Resolve Variable: x1 (1)

x2 x3 x4

0 - 0

0 1 0

0 - 1

1 1 -

Pure Literal Found: x3 --- Resolve Variable: x3 (1)

x2 x4

0 0

0 1

Pure Literal Found: x2 --- Resolve Variable: x2 (0)

x4

The CNF function is Satisfiable with Solution:

x1(1) x2(0) x3(1) x4(1)

node5.blif:

$ ./DPLL.exe ../../test\_nodes/node5.blif

DPLL SAT SOLVER START!

READING FILE ../../test\_nodes/node5.blif

a b c d

0 1 1 -

1 - 1 1

1 - 1 0

1 - 0 1

1 - 0 0

- 0 0 1

0 1 0 -

0 0 1 -

a Branch 1 --- Resolve Variable: a (1)

b c d

1 1 -

0 0 1

1 0 -

0 1 -

Pure Literal Found: d --- Resolve Variable: d (1)

b c

1 1

1 0

0 1

b Branch 1 --- Resolve Variable: b (1)

c

1

Unit Clause Found with Variable: c --- Resolve Variable: c (1)

The CNF function is Satisfiable with Solution:

a(1) b(1) c(1) d(1)