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Assignment 6 Writeup

**1. Describe any implmentation choices you made that you felt were important. Mention anything else we should know when evaluating your program.**

Nothing special here.

**2. What can you say about the time and space complexity of your program?**

This program is semi-decidable. Therefore, the worst case time and space complexities cannot be accurately calculated. However, if it could…

My time complexity of the last assignment was:

O(n\*p)

Where:

n = number of terms in predicate

p = number of predicate pairs

In this assignment, this time has to be performed k times, where k is the number of resolutions required to get to the empty clause. However, I have a hash table that keeps track of whether or not a literal has been resolved, and I only add that new literal to my set of support if it has *not*been resolved before. Unfortunately, that means I unify times, which in big O notation, turns into k2.

O(k2n + k2p) = O(2k2) = O(k2)

My space complexity is O(n), where n is the number of clauses that are resolved before coming to the final answer.

**3. What suggestions do you have for this assignment in the future?**

I thought assignment 6 was a ***lot*** more work than assignment 7. I got a rough solution of assignment 7 working in about 2 hours, where assignment 6 easily took 10+. In the future, my suggestion would be to have assignment 6 parse the grammar, and assignment 7 unify and resolve. Additionally, it was odd timing that our assignment 6 wasn’t given back to us until 2 days before assignment 7 was due. If a student had multiple problems with assignment 6 and was unaware of those problems, I feel that it would be hard for them to recover on such a short turnaround.

**KB And Query being solved by my solution (same problems as A6):**

***Bill Belichek is intelligent***

-bash-4.3$ ./wffs-to-cnf < football-kb.fol > output

-CanRead(x1) | Intelligent(x1)

-FootballPlayer(C1) | -CanRead(C1)

FootballPlayer(TomBrady)

-Quarterback(x1) | FootballPlayer(x1)

QuarterBack(AndyDalton)

Coach(BillBelichek)

-Coach(x1) | CanRead(x1)

-FootballPlayer(x1) | Rich(x1)

-Rich(x1) | Happy(x1)

--- negated query ---

-Intelligent(BillBelichek)

-bash-4.3$ ./run.sh < output

Picked up JAVA\_TOOL\_OPTIONS: -Xmx256m

1: -CanRead(c1x1) | Intelligent(c1x1)

2: -FootballPlayer(C1) | -CanRead(C1)

3: FootballPlayer(TomBrady)

4: -Quarterback(c4x1) | FootballPlayer(c4x1)

5: Quarterback(AndyDalton)

6: Coach(BillBelichek)

7: -Coach(c7x1) | CanRead(c7x1)

8: -FootballPlayer(c8x1) | Rich(c8x1)

9: -Rich(c9x1) | Happy(c9x1)

10: -Intelligent(BillBelichek)

10 and 1 give 11: -CanRead(BillBelichek)

11 and 7 give 12: -Coach(BillBelichek)

12 and 6 give 13: <empty>

6 total resolutions.

***Andy Dalton is a football player***

-bash-4.3$ ./wffs-to-cnf < football-kb.fol > output

…

--- negated query ---

-FootballPlayer(AndyDalton)

-bash-4.3$ ./run.sh < stephen-query3.cnf

Picked up JAVA\_TOOL\_OPTIONS: -Xmx256m

1: -CanRead(c1x1) | Intelligent(c1x1)

2: -FootballPlayer(C1) | -CanRead(C1)

3: FootballPlayer(TomBrady)

4: -Quarterback(c4x1) | FootballPlayer(c4x1)

5: Quarterback(AndyDalton)

6: Coach(BillBelichek)

7: -Coach(c7x1) | CanRead(c7x1)

8: -FootballPlayer(c8x1) | Rich(c8x1)

9: -Rich(c9x1) | Happy(c9x1)

10: -FootballPlayer(AndyDalton)

10 and 4 give 11: -Quarterback(AndyDalton)

11 and 5 give 12: <empty>

5 total resolutions.

***Andy Dalton can read (can’t be proven)***

-bash-4.3$ ./wffs-to-cnf < football-kb.fol > output

…

--- negated query ---

-CanRead(AndyDalton)

-bash-4.3$ ./run.sh < stephen-query2.cnf

Picked up JAVA\_TOOL\_OPTIONS: -Xmx256m

1: -CanRead(c1x1) | Intelligent(c1x1)

2: -FootballPlayer(C1) | -CanRead(C1)

3: FootballPlayer(TomBrady)

4: -Quarterback(c4x1) | FootballPlayer(c4x1)

5: Quarterback(AndyDalton)

6: Coach(BillBelichek)

7: -Coach(c7x1) | CanRead(c7x1)

8: -FootballPlayer(c8x1) | Rich(c8x1)

9: -Rich(c9x1) | Happy(c9x1)

10: -CanRead(AndyDalton)

No proof exists

3 total resolutions.

***Tom Brady is Happy***

-bash-4.3$ ./wffs-to-cnf < football-kb.fol > output

…

--- negated query ---

-Happy(TomBrady)

-bash-4.3$ ./run.sh < football-kb.cnf

Picked up JAVA\_TOOL\_OPTIONS: -Xmx256m

1: -CanRead(c1x1) | Intelligent(c1x1)

2: -FootballPlayer(C1) | -CanRead(C1)

3: FootballPlayer(TomBrady)

4: -Quarterback(c4x1) | FootballPlayer(c4x1)

5: Quarterback(AndyDalton)

6: Coach(BillBelichek)

7: -Coach(c7x1) | CanRead(c7x1)

8: -FootballPlayer(c8x1) | Rich(c8x1)

9: -Rich(c9x1) | Happy(c9x1)

10: -Happy(TomBrady)

10 and 9 give 11: -Rich(TomBrady)

11 and 8 give 12: -FootballPlayer(TomBrady)

12 and 3 give 13: <empty>

6 total resolutions.

**Validator running on sample problems:**

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./unify-validator ./run.sh < cnfs/e1.cnf >> a6-transcript

P(F(renamec1x), G(G(B)))

-P(F(renamec1x), G(G(B)))

All match!

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./unify-validator ./run.sh < cnfs/e2.cnf >> a6-transcript

G(F(T), R(T), T)

-G(F(T), R(T), T)

All match!

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./unify-validator ./run.sh < cnfs/e3.cnf >> a6-transcript

Bar(Val(renamec1x, BB), Val(renamec1x, BB))

-Bar(Val(renamec1x, BB), Val(renamec1x, BB))

All match!

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./unify-validator ./run.sh < cnfs/e4.cnf >> a6-transcript

P(renamec2e, C, A, B, A)

-P(renamec2e, C, A, B, A)

All match!

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./unify-validator ./run.sh < cnfs/e5.cnf >> a6-transcript

P(renamec2f, renamec2f, renamec2f)

-P(renamec2f, renamec2f, renamec2f)

All match!

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./unify-validator ./run.sh < cnfs/e6.cnf >> a6-transcript

All match!

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./unify-validator ./run.sh < cnfs/e7.cnf >> a6-transcript

P(C(A, renamec2t1), C(B, C(renamec1b0, renamec1l0)), C(A, C(B, C(B, C(A, Emp)))))

-P(C(A, renamec2t1), C(B, C(renamec1b0, renamec1l0)), C(A, C(B, C(B, C(A, Emp)))))

All match!

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./unify-validator ./run.sh < cnfs/p1.cnf >> a6-transcript

-Human(Socrates) | Mortal(Socrates)

Human(Socrates)

All match!

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./unify-validator ./run.sh < cnfs/p2.cnf >> a6-transcript

-Human(Socrates) | Mortal(Socrates)

Human(Socrates) | -Mortal(F(renamec2y))

-Human(F(renamec2y)) | Mortal(F(renamec2y))

Human(Socrates) | -Mortal(F(renamec2y))

All match!

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./unify-validator ./run.sh < cnfs/p3.cnf >> a6-transcript

-Human(Socrates, Socrates) | Mortal(Socrates)

Human(Socrates, Socrates) | -Mortal(Socrates)

-Human(renamec2y, Socrates) | Mortal(renamec2y)

Human(renamec2y, renamec2y) | -Mortal(renamec2y)

All match!

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./unify-validator ./run.sh < cnfs/p4.cnf >> a6-transcript

A(F(B), F(B))

-A(F(B), F(B))

All match!

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./unify-validator ./run.sh < cnfs/p5.cnf >> a6-transcript

All match!

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./unify-validator ./run.sh < cnfs/s1.cnf >> a6-transcript

-A(C, C) | B(C)

A(C, C) | -B(C)

-A(renamec2y, C) | B(renamec2y)

A(renamec2y, renamec2y) | -B(renamec2y)

All match!

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./unify-validator ./run.sh < cnfs/s2.cnf >> a6-transcript

-A(F(renamec2x), F(F(renamec2x))) | B(F(renamec2x), F(renamec2x))

A(F(renamec2x), renamec2x) | -B(F(renamec2x), F(renamec2x))

All match!

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./unify-validator ./run.sh < cnfs/s3.cnf >> a6-transcript

A(A, A, renamec2b) | B(C(A, A, renamec2b)) | C(renamec2b)

-A(A, A, renamec2b) | -C(D)

A(renamec1a, renamec1b, D) | B(C(renamec1a, renamec1b, D)) | C(D)

-A(A, A, renamec2b) | -C(D)

All match!

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./unify-validator ./run.sh < cnfs/test.cnf >> a6-transcript

A(A, A, renamec2b) | B(C(A, A, renamec2b)) | C(renamec2b)

-A(A, A, renamec2b) | -C(D)

A(renamec1a, renamec1b, D) | B(C(renamec1a, renamec1b, D)) | C(D)

-A(A, A, renamec2b) | -C(D)

All match!