Example of Assignment Submission
COMP 3400   Assignment 0

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1. Consider the following information:

"If Superman were able and willing to prevent evil, he would do so. If Superman were unable to prevent evil, he would be impotent; if he were unwilling to prevent evil, he would be malevolent. Superman does not prevent evil. If Superman exists, he is neither impotent nor malevolent."

(a) Represent this information in propositional logic.
(b) Explain what it means in relation to (a) that *"Superman does not exist"* follows as a consequence.
(c) Use Otter to establish (b), explaining your methodology first.

REMARK (delete for submission): Notice that the statement of the problems MUST be included before your solution. Not following the instructions will make you lose points. **END.**

Figure 1: My Superhero

REMARK (delete for submission): Only computer generated figures are allowed. If you have to draw something, you can use MS PowerPoint, etc. (nothing sophisticated will be needed). **END.**

Solution: (a) We introduce the following "propositional variables", with the following intended meanings: (cf. Figure 1)

a: *Superman is able to prevent evil*

w: *Superman is willing to prevent evil*

i: *Superman is impotent*

m: *Superman is malevolent*

p: *Superman prevents evil*

e: *Superman exists*

Now, the given information can be represented by means of the following set of propositional formulas:

φ_0: $(a \wedge w) \rightarrow p$.

   Meaning: "If Superman is able to prevent evil and is willing, then Superman prevents evil"

φ_1: $(\neg a \rightarrow i) \wedge (\neg w \rightarrow m)$

   Meaning: Etc.

φ_2: $\neg p$

   Meaning: Etc.

φ_3: $e \rightarrow (\neg i \wedge \neg m)$

   Meaning: Etc.

(b) We have to prove that $\neg e$ is a consequence of $\varphi_0, \ldots, \varphi_3$.

(c) We do this by contradiction, establishing by means of Otter that the set of formulas: $\{\varphi_0, \ldots, \varphi_3, \neg\neg e\}$ is contradictory.
   For this, $\varphi_0, \ldots, \varphi_3$ go into the "usable" list, and e goes into the "sos" list.

REMARK (delete for submission): Notice from above that before you do anything with the automated reasoner, you have to explain what you will do and why. **END.**

REMARK (delete for submission): Below you have to include the main parts of your input/output files. The complete files have to be provided as appendices, not here. **END.**

   The main part of the input file, "sup.in" (attached) is as follows:

```
    set(binary_res).

    formula_list(usable).
    (a & w) -> p.
    (-a -> i) & (-w -> m).
    -p.
    e -> (-i & -m).
    end_of_list.

    formula_list(sos).
    e.
    end_of_list.
```

The main part of the output file "sup.out" (attached) is:

```
formula_list(usable).
a&w->p.    (-a->i)& (-w->m).     -p.     e-> -i& -m.
end_of_list.

-------> usable clausifies to:

list(usable).
1 [] -a|-w|p.
2 [] a|i.
3 [] w|m.
4 [] -p.
5 [] -e| -i.
6 [] -e| -m.
end_of_list.

formula_list(sos).
e.
end_of_list.

-------> sos clausifies to:

list(sos).
7 [] e.
end_of_list.

======= end of input processing =======

=========== start of search ===========

given clause #1: (wt=1) 7 [] e. ** KEPT (pick-wt=1): 8
[binary,7.1,6.1] -m. ** KEPT (pick-wt=1): 9 [binary,7.1,5.1]
-i. 8 back subsumes 6. 9 back subsumes 5.

given clause #2: (wt=1) 8 [binary,7.1,6.1] -m. ** KEPT
(pick-wt=1): 10 [binary,8.1,3.2] w. 10 back subsumes 3.

given clause #3: (wt=1) 9 [binary,7.1,5.1] -i. ** KEPT
(pick-wt=1): 11 [binary,9.1,2.2] a. 11 back subsumes 2.

given clause #4: (wt=1) 10 [binary,8.1,3.2] t. ** KEPT
```

```
(pick-wt=0): 12 [binary,10.1,1.2,unit_del,11,4] $F.

-----> EMPTY CLAUSE at   0.00 sec ---->
                       12 [binary,10.1,1.2,unit_del,11,4] $F.

Length of proof is 4.  Level of proof is 2.

---------------- PROOF ----------------

 1 [] -a| -w|p.
 2 [] a|i.
 3 [] w|m.
 4 [] -p.
 5 [] -e| -i.
 6 [] -e| -m.
 7 [] e.
 8 [binary,7.1,6.1] -m.
 9 [binary,7.1,5.1] -i.
 10 [binary,8.1,3.2] w.
 11 [binary,9.1,2.2] a.
 12 [binary,10.1,1.2,unit_del,11,4] $F.

------------ end of proof -------------
```

This run (output file) shows that Etc. Etc. Etc.

REMARK (delete for submission): Unless it is really clear, you have to explain your output right after showing it! It is not the role of the marker to interpret your output! The onus is on you ...   **END.**

Appendix: Input/Output Files

REMARK (delete for submission): Here you can use the verbatim environment, or attach the pdf versions of your files. **Everything has to to form a single PDF submission file. No (compressed) folders accepted. END.**