CENG 424 - Logic for Computer Science
2023-1
Homework 4

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1. Let's define the followings:

   A: "Horse is an animal."
   P: "Horse is a plant."
   S: "Some stableman groom the horse."

   Premises:

   1) $A \longrightarrow S \equiv \neg A \vee S$

   2) $P \longrightarrow \neg S \equiv \neg P \vee \neg S$

   Goal: $A \longrightarrow \neg P \equiv \neg A \vee \neg P$

   Negated Goal: $A \wedge P$

1. $\{\neg A, S\}$	Premise
2. $\{\neg P, \neg S\}$	Premise
3. $\{A\}$	Negated Goal
4. $\{P\}$	Negated Goal
5. $\{S\}$	1, 3
6. $\{\neg S\}$	2, 4
7. $\{\}$	5, 6

   We obtained empty clause for negated goal. Therefore, we have proven the goal.

2. (a) **Unit Resolution**

1. $\{T\}$	Premise
2. $\{\neg S, \neg T, \neg R\}$	Premise
3. $\{\neg T, R\}$	Premise
4. $\{S, \neg R\}$	Premise
5. $\{R\}$	1, 3
6. $\{\ S\}$	4, 5
7. $\{\neg T, \neg R\}$	2, 6
8. $\{\neg T\}$	5, 7
9. $\{\}$	1, 9

(b) **Input Resolution**

1. $\{T\}$	Premise
2. $\{\neg S, \neg T, \neg R\}$	Premise
3. $\{\neg T, R\}$	Premise
4. $\{S, \neg R\}$	Premise
5. $\{\neg T, \neg R\}$	2, 4
6. $\{R\}$	1, 3
7. $\{\neg R\}$	1, 5
8. $\{S\}$	4, 6
9. $\{\neg T\}$	3, 7
10. $\{\}$	1, 9

(c) **Linear Resolution**

1. $\{T\}$	Premise
2. $\{\neg S, \neg T, \neg R\}$	Premise
3. $\{\neg T, R\}$	Premise
4. $\{S, \neg R\}$	Premise
5. $\{\neg T, S\}$	3, 4
6. $\{S\}$	1, 5
7. $\{\neg T, \neg R\}$	2, 6
8. $\{\neg T\}$	3, 7
9. $\{\}$	1, 8

3. I will reorder each premise clause as follows:

$\neg Q \vee R \vee P \qquad R \vee \neg P \qquad \neg Q \vee \neg R \qquad Q$

I impose the order $Q > R > P$

1. $< \neg Q, R, P >$	Premise
2. $< Q >$	Premise
3. $< \neg Q, \neg R >$	Premise
4. $< R, \neg P >$	Premise
5. $< R, P >$	1, 2
6. $< \neg R >$	2, 3
7. $< \neg P >$	4, 6
8. $< P >$	5, 6
9. $<>$	7, 8

As you can see above, we obtained $<>$ at step 9, which corresponds to empty clause $\{\}$.

Also, you can see that ordering is satisfied in the tree below. I first eliminate Q's in the first depth of the tree, then elimnate R's in the second depth and P's in last depth.