1 Lecture 7: Resolution

1.1 Resolution refutation

1. Using resolution refutation, prove the last sentence in each group from the rest of the sentences in the group.

(a) \( P \rightarrow Q \)
    \( \neg P \rightarrow R \)
    \( \neg Q \rightarrow R \)

(b) \((P \rightarrow Q) \lor (R \rightarrow S)\)
    \((P \rightarrow S) \lor (R \rightarrow Q)\)

(c) \( \neg(P \land \neg Q) \lor \neg(S \land \neg T) \)
    \( \neg(T \lor Q) \)
    \( U \rightarrow (\neg T \rightarrow (\neg S \land \neg P)) \)
    \( \neg U \)

2. Use resolution refutation to do problem 6.5 from R&N.

1.2 Unification

For each pair of sentences, give an MGU.

- Color(Tweety, Yellow)   \[ \text{Color}(x, y) \]
- Color(Tweety, Yellow)   \[ \text{Color}(x, x) \]
- Color(Hat(John), Blue)  \[ \text{Color}(\text{Hat}(y), y) \]
- R(F(x), B)              \[ R(y, z) \]
- R(F(y), x)              \[ R(x, F(B)) \]
- R(F(y), y, x)           \[ R(x, F(A), F(v)) \]
- Loves(x, y)             \[ \text{Loves}(y, x) \]
- F(G(w), H(w, J(x, y)))  \[ F(G(v), H(u, v)) \]
- F(G(w), H(w, J(x, u)))  \[ F(G(v), H(u, v)) \]
- F(x, F(u, x))           \[ F(F(y, A), F(z, F(B, z))) \]
2 Lecture 8

2.1 A silly recitation problem

symbolize the following argument, and then derive the conclusion from the premises using resolution refutation.

- Nobody who really appreciates Beethoven fails to keep silence while the Moonlight sonata is being played.
- Guinea pigs are hopelessly ignorant of music.
- No one who is hopelessly ignorant of music ever keeps silence while the moonlight sonata is being played.
- Therefore, guinea pigs never really appreciate Beethoven.

(Taken from a book by Lewis Carroll, logician and author of *Alice in Wonderland*.)

2.2 Another, sillier problem

You don’t have to do this one. It’s just for fun. Same type as the previous one. Also from Lewis Carroll

- The only animals in this house are cats
- Every animal that loves to gaze at the moon is suitable for a pet
- When I detest an animal, I avoid it
- No animals are carnivorous unless they prowl at night
- No cat fails to kill mice
- No animals ever like me, except those that are in this house
- Kangaroos are not suitable for pets
- None but carnivorous animals kill mice
- I detest animals that do not like me
- Animals that prowl at night always love to gaze at the moon
- Therefore, I always avoid a kangaroo