PES University, Bangalore

Department of Computer Science and Engineering

Automata Formal Languages & Logic

Assignment for Propositional Theorem Proving- Inference Rule AND Resolution Algorithm

Problem:

1. Given axioms P Λ ((P Λ Q) -> R) Λ ((S V T)-> Q) Λ T
   Prove R using Resolution algorithm.
2. Show that the "Absorption of Λ" equivalence holds, given the other equivalences. *I.e.*, show $(a \vee b) \wedge b \equiv b$.
3. Show that the modus ponens rule, $a \wedge (a \Rightarrow b) \Rightarrow b$ always holds. I.e., show that it is a tautology, and thus equivalent to true.
4. What are the different steps to convert a sentence of propositional logic to clausal form or conjunctive normal form

5. **Write down the propositional form of the following argument: –**
   If my client is guilty, then the knife was in the drawer. Either the knife was not in the drawer or Jason Pritchard saw the knife. If the knife was not there on October 10, it follows that Jason Pritchard didn't see the knife. Furthermore, if the knife was there on October 10, then the knife was in the drawer and also the hammer was in the barn. But we all know that the hammer was not in the barn. Therefore, ladies and gentlemen of the jury, my client is innocent.

6. **Prove the following argument, using resolution.**
   The crop is good, but there is not enough water. If there is a lot of rain or not a lot of sun, then there is enough water. Therefore the crop is good and there is a lot of sun. (Use letters C, W, R, S)
   – C: the crop is good
   – W: there is enough water
   – R: there is a lot of rain
   – S: there is a lot of sun
   C ^ W' ^ ((R V S') -> W) -> C ^ S

7. Prove the following argument, using resolution

   • If the program is efficient, it executes quickly. Either the program is efficient, or it has a bug. However, the program does not execute quickly. Therefore it has a bug. (Use letters E, Q, B)

   – E: the program is efficient

   – Q: the program executes quickly

   – B: the program has a bug

8. **Given**

   a. John is in Paris or John is in Australia

   b. If John is in Paris, then It is raining

   c. If John is in Australia, then It is raining

   DO the following

   1. Write the clauses
   2. Convert it in CNF form
   3. **Prove** It is raining using Resolution.