PES University, Bangalore

Department of Computer Science and Engineering

Automata Formal Languages & Logic

Q&A for Propositional Theorem Proving- Inference Rule AND Resolution Algorithm

Problem:

1. Given axioms P ∧ ((P ∧ Q) -> R) ∧ ((S V T)-> Q) ∧ T

   Prove R using Resolution algorithm.

Solution:- We have

R1: P

R2: (P ∧ Q) -> R ≡ ~ (P ∧ Q) V R ≡ ~P V ~Q V R

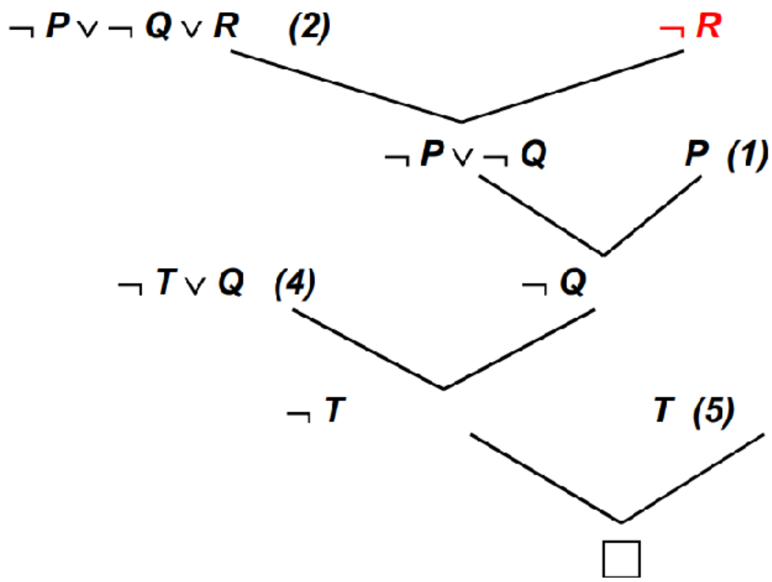
Next (S V T)-> Q ≡ ~ (S V T) V Q ≡ (~S ∧ ~T) V Q ≡ (~S V Q) ∧ (~T V Q)

R3: (~S V Q)

R4: (~T V Q)

R5: T

R6: ~R



Received an empty clause, which is equivalent to False. Empty clause represents a contradiction and hence "R" is true.

2. **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.

Solution:-

Let

P : John is in Paris

Q: John is in Australia

R: It is raining

To prove R: It is raining

1. Write all the statements in clausal form
   a. John is in Paris or John is in Australia**. R1: (P V Q)**

b. If John is in Paris, then It is raining. **R2: (P-> R)**
c. If John is in Australia, then It is raining. **R3: (Q-> R)**
To prove R include **R4: ~R**

2. In CNF Form
R1: (P V Q)
R2: (P-> R) ≡ ~P VQ
R3: (Q-> R) ≡ ~Q V R
R4: ~R
3.

Step	Formula	Derivation
1	P v Q	Given
2	¬ P v R	Given
3	¬ Q v R	Given
4	¬ R	Negated conclusion
5	Q v R	1,2
6	¬ P	2,4
7	¬ Q	3,4
8	R	5,7
9	•	4,8

Received an empty clause, which is equivalent to False. Empty clause represents a contradiction and hence "R" is true.