

# 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  $P \wedge ((P \wedge Q) \rightarrow R) \wedge ((S \vee T) \rightarrow Q) \wedge T$   
Prove R using Resolution algorithm.

**Solution:-** We have

R1: P

R2:  $(P \wedge Q) \rightarrow R \equiv \sim (P \wedge Q) \vee R \equiv \sim P \vee \sim Q \vee R$

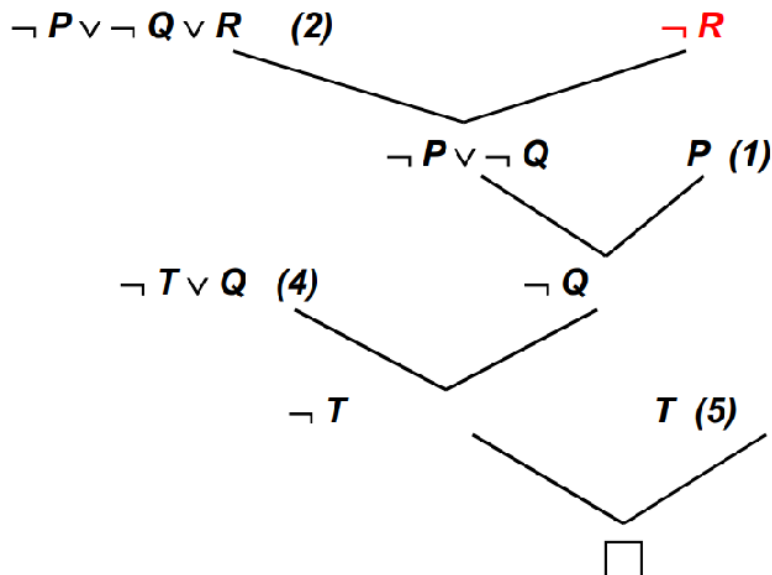
Next  $(S \vee T) \rightarrow Q \equiv \sim (S \vee T) \vee Q \equiv (\sim S \wedge \sim T) \vee Q \equiv (\sim S \vee Q) \wedge (\sim T \vee Q)$

R3:  $(\sim S \vee Q)$

R4:  $(\sim T \vee Q)$

R5: T

R6:  $\sim R$



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

## 2. Given

- John is in Paris or John is in Australia
- If John is in Paris, then It is raining
- If John is in Australia, then It is raining

DO the following

- Write the clauses
- Convert it in CNF form
- 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

- Write all the statements in clausal form
  - 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  $\rightarrow$  R)**  
 c. If John is in Australia, then It is raining. **R3: (Q  $\rightarrow$  R)**  
 To prove R include **R4:  $\sim$ R**

2. In CNF Form

$$\mathbf{R1: (P \vee Q)}$$

$$\mathbf{R2: (P \rightarrow R) \equiv \sim P \vee R}$$

$$\mathbf{R3: (Q \rightarrow R) \equiv \sim Q \vee R}$$

$$\mathbf{R4: \sim R}$$

3.

Step	Formula	Derivation
1	$P \vee Q$	Given
2	$\sim P \vee R$	Given
3	$\sim Q \vee R$	Given
4	$\sim R$	Negated conclusion
5	$Q \vee R$	1,2
6	$\sim P$	2,4
7	$\sim Q$	3,4
8	$R$	5,7
9	$\bullet$	4,8

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