


Modern Birkhäuser Classics

Logic for Computer Scientists  
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Prolog Programming for Artificial Intelligence  
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# Resolution Refutation (Example)


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Note: The most of the information of these slides was extracted and adapted from Schöningh's book, "Logic for Computer Scientists". They are provided for COT-3541 students only. Not to be published or publicly distributed without permission by the publisher.



## Resolution Refutation Example



Given the following **set of axioms**:

- **A1.** If Bob has two days off, then if the weather is bad, Bob is not fishing.
- **A2.** If Bob is not fishing and is not meeting in a restaurant with his friends, then he is watching TV at home.
- **A3.** If Bob is working, then he is neither meeting in a restaurant with his friends nor watching TV at home.

Prove by **resolution refutation** that:

**C.** If Bob is not watching TV at home and he has two days off, then he is meeting in a restaurant with his friends provided that the weather is bad.

**ATOMIC FORMULAS**

**p:** Bob has two days off

**q:** weather is bad

**r:** Bob is fishing

**s:** Bob is meeting in a restaurant with his friends

**t:** Bob is watching TV at home

**u:** Bob is working

**FORMALIZATION**

**A1.**  $(p \rightarrow (q \rightarrow \neg r))$

**A2.**  $(\neg r \wedge \neg s) \rightarrow t$

**A3.**  $u \rightarrow (\neg s \wedge \neg t)$

**C.**  $(\neg t \wedge p) \rightarrow (q \rightarrow s)$

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## Resolution Refutation Example

### FORMALIZATION

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**C.**  $(\neg t \wedge p) \rightarrow (q \rightarrow s)$

### CONVERSION to CNF and CLAUSE FORM

**A1.**  $(p \rightarrow (q \rightarrow \neg r)) \Rightarrow \neg p \vee \neg q \vee \neg r \Rightarrow \{\neg p, \neg q, \neg r\}$

**A2.**  $(\neg r \wedge \neg s) \rightarrow t \Rightarrow \neg(\neg r \wedge \neg s) \vee t \Rightarrow r \vee s \vee t \Rightarrow \{r, s, t\}$

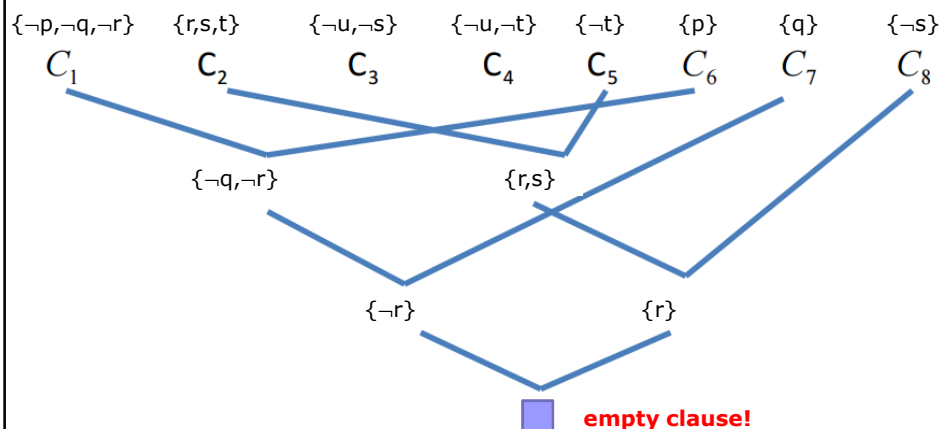
**A3.**  $u \rightarrow (\neg s \wedge \neg t) \Rightarrow \neg u \vee (\neg s \wedge \neg t) \Rightarrow (\neg u \vee \neg s) \wedge (\neg u \vee \neg t) \Rightarrow \{\neg u, \neg s\}; \{\neg u, \neg t\}$

**C.**  $(\neg t \wedge p) \rightarrow (q \rightarrow s) \Rightarrow \neg((\neg t \wedge p) \rightarrow (q \rightarrow s)) \Rightarrow (\neg t \wedge p) \wedge \neg(\neg q \vee s) \Rightarrow \neg t \wedge p \wedge q \wedge \neg s \Rightarrow \{\neg t\}; \{p\}; \{q\}; \{\neg s\}$

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## Resolution Refutation Example

**F** =  $\{\{\neg p, \neg q, \neg r\}, \{r, s, t\}, \{\neg u, \neg s\}, \{\neg u, \neg t\}, \{\neg t\}, \{p\}, \{q\}, \{\neg s\}\}$  is **unsatisfiable**???



**F is unsatisfiable  $\Rightarrow$  Claim is valid**

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