

COMP 681 Formal Methods Spring 2008 Recitation 7—Solutions

Consider the following argument.

Deficits will go down if the Democrats win the midterm elections. Either deficits don't go down or investment increases. So, if the Democrats win, the economy will boom since it does whenever investment increases.

- a. Encode this argument as a propositional-logic inference. Be sure to define the meanings of the prime propositions that you use.

Answer

Let

$p =$ Deficits go down.

$q =$ The Democrats win the midterm elections.

$r =$ Investment increases.

$s =$ The economy booms.

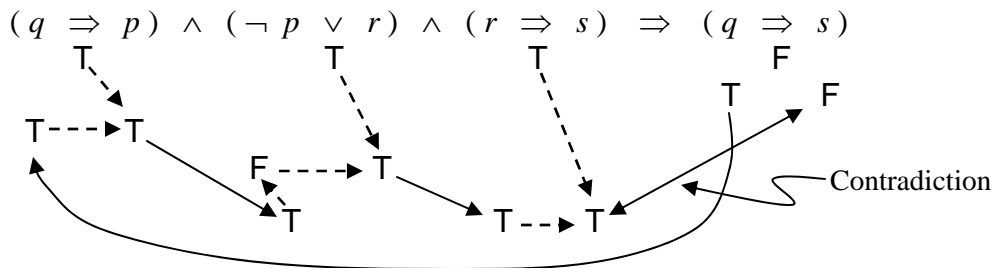
Then

$$q \Rightarrow p, \neg p \vee r, r \Rightarrow s \vdash q \Rightarrow s$$

- b. Use the shorter truth table method to show that this argument is valid.

Answer

We show that the following is a tautology. We use the shortcut of directly putting an F under the conclusion and T's under the premises.



- c. Prove that the argument is valid using inference rules and logical equivalences.

Answer

1. $q \Rightarrow p$ premise
2. $\neg p \vee r$ premise
3. $r \Rightarrow s$ premise
4. q assumption
5. p from 1 & 4, \Rightarrow_E (Modus Ponens)
6. r from 2 & 5, \vee_E (Disjunctive Syllogism)
7. s from 3 & 6, \Rightarrow_E (Modus Ponens)
8. $q \Rightarrow s$ from 4-7, \Rightarrow_I (Conditional Proof)