

The Decision Problem for Linear Temporal Logic

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Introduction The aim of *temporal logic* is the analysis of arguments about events and processes in time. To achieve this aim, truth-functional logic is enriched by certain *tense operators*, among them:

- Pp p was the case (at least once)
 Fp p will be the case (at least once)
 $S(p, q)$ there has been an occasion when p was the case, ever since which q has been the case
 $U(p, q)$ there is going to be an occasion when p will be the case, up until which q is going to be the case.

Which sentences involving tense operators express valid principles of reasoning?

That turns out to depend on what is assumed about the structure of time. Consider, for instance, this example:

$$(Fp \wedge F(p \wedge \sim Pq) \wedge \sim(Pq \vee q)) \rightarrow Fq$$

“If p is sometime going to be the case,
but not until q has previously been the case,
and q hasn’t yet been the case,
then q is sometime going to be the case.”

If it is assumed (as it will be throughout this paper) that the earlier/later relation *linearly orders* the instants of time, then the above example counts as valid; but not, in general, otherwise. There are even examples (see the survey

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