METATEM:
A Framework for Programming in Temporal Logic *

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Abstract. In this paper we further develop the methodology of temporal logic as an executable imperative language, presented by Moszkowski [Mos86] and Gabbay [Gab87, Gab89] and present a concrete framework, called METATEM for executing (modal and) temporal logics. Our approach is illustrated by the development of an execution mechanism for a propositional temporal logic and for a restricted first order temporal logic.


Contents

1 Introduction
1.1 Motivation
1.2 The METATEM Approach
1.3 Related Work

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1 Introduction

The purpose of this paper is twofold:

1. to re-emphasise and further develop the methodology of temporal logic as an executable imperative language, presented by Moszkowski [Mos86] and Gabbay [Gab87, Gab89]

2. to present a concrete framework, called METATEM for executing (modal and) temporal logics, illustrated by the development of an execution mechanism for a propositional temporal logic and then for restricted first order temporal logic.

The main import of this paper is the latter, and it is developed within the more general framework of the former. This methodology can serve as the natural meeting ground for the declarative and imperative approaches in computing, namely imperative logic.

We have structured this presentation on METATEM as follows. Section 1 outlines the METATEM approach and compares it to other work on the execution of temporal logics. Section 2 illustrates this approach by the introduction of a propositional temporal logic for METATEM. An execution mechanism for this form of METATEM is described and an outline given for an interpreter. Section 3 expands the description of the interpreter and discusses some of the issues raised in the its design. Section 4 introduces a limited first order temporal logic and describes its execution mechanism. Section 5 concludes the paper by discussing a general framework in which the METATEM approach to executing temporal logic resides.

1.1 Motivation

We distinguish two views of logic, the declarative and the imperative. The declarative view is the traditional one, and it manifests itself both syntactically and semantically. Syntactically a logical system is taken as being characterised by its set of theorems. It is not important how these theorems are generated. Two different algorithmic systems generating the same set of theorems are considered as producing the same logic. Semantically a logic is considered as a set of formulae valid in all models. The model $M$ is a static