Description Logics and formal Ontologies
Exercise Sheet 4

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1 A Modal Reasoner, Documentation

The python program/script **tableux.py** is a modal reasoner. Running it in its current form will prompt the user to type a modal formula in the command line. The formula is then tested for satisfiability with the tableux algorithm for modal logic. After evaluation, the program prints *True* if the formula is satisfiable and *False* if it is not satisfiable.

The program **tableux.py** consists of the following high-level functions:

input_formula():
Prompts the user to type a modal logic formula. It also specifies the format in which the formula should be written into the command line.

tableux_representation(phi):
Parses the modal logic formula *phi* of type string into a tree structure of lists and tuples, which represents the hierarchical and unary/binary structure of a (modal) logic formula.

tableux_method(repr): Does the actual work of the tableux algorithm. Evaluates the parsed formula representation *repr* for satisfiability. Returns *True* if the formula *phi* is satisfiable and *False* if it is unsatisfiable.

The program also has the four functions **generate_formula_series_1(n)**, **generate_formula_series_2(n)**, **generate_formula_series_3(n)**, **generate_formula_series_4(n)**, which take an integer n as input and generate a formula series of length n.

Formula series 1 is generated by the function **generate_formula_series_1(n)**. Formula series 1 is the satisfiable series of formulae from exercise 2 on sheet 3. The formula series 2, 3, and 4 are simplifications of series 1 and series 4 is unsatisfiable.

These four formula series were used to measure the performance of the tableux algorithm implementation in the program **tableux.py**. This is depicted in Figure 1.

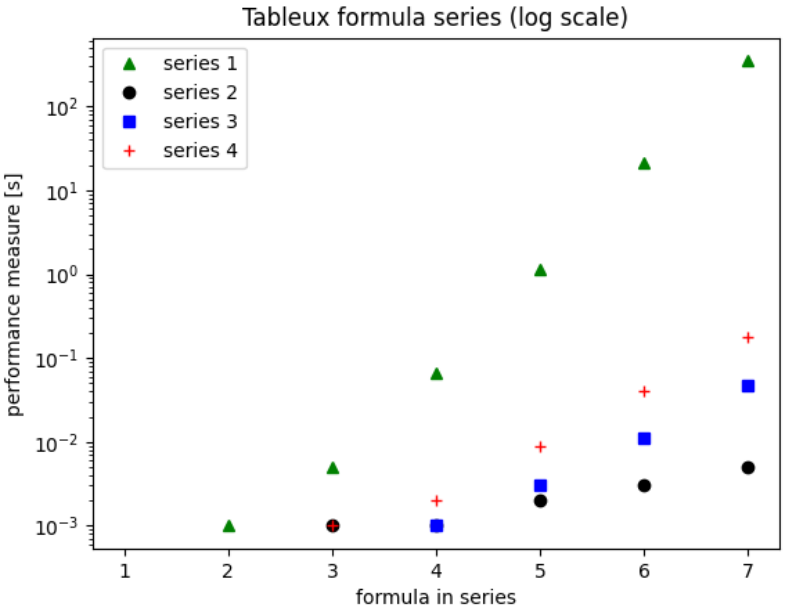

Figure 1: Exponential blow-up of the running time of the tableux algorithm implementation.

The tablaux algorithm implementation in **tableux.py** already takes 348.168 s = 5.8 min to evaluate the seventh formula of series 1. The eighth formula in this series already runs longer than an hour.

The code implementing the performance measurement is also within the program **tableux.py**, but is commented out. The program **performance-plot.py** created the plot in Figure 1. Also in comment are 40 propositional logic formulae and over 20 modal logic formulae including the propositional logic formulae from exercise 1, 2 sheet 1 and modal logic formulae from exercise 1 sheet 3. These formulae were used for testing and the tableux implementation evaluated them correctly.