COMP102P. Model checking coursework

Robin Hirsch

December 8, 2015

This coursework is compulsory and assessed, the deadline for submitting your program is 15th January 2016, details of the electronic submission process will follow, nearer the deadline.

In this coursework you have to parse first order formulas in a language with no function symbols and one binary predicate symbol 'X' denoting the edge relation in a graph, so $X[xy]$ means that there is an edge from x to y. A binary connective is a character 'v', '^' or '>' (denoting or, and, implies). A variable is a character 'x', 'y' or 'z' (three variables should be enough for this coursework). There are no constants and no function symbols, so a term is just a variable. A formula is defined by

$$\phi ::= X[ts] \mid -\phi \mid (\phi \circ \phi) \mid Ez\ \phi \mid Az\ \phi$$

where $\circ$ is a binary connective, t, s, z are variables.

Have a look at the file graph.c This is a skeleton program for you to complete. The critical method is called "eval". Its first parameter is a string (the formula to be evaluated), the next two parameters are the list of edges and the number of nodes (in other words a description of the graph). The final parameter is a variable assignment for our three variables. The method is supposed to work out whether the formula is true in the graph under the given variable assignment or not. I suggest you start by parsing the formula and then evaluate it according to its type.

Here are some sample formulas and graphs with the expected output.

fmla	nodes	edges	var_assig	true?
$AxEyX[xy]$	3	$\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 2 \end{pmatrix}$	$(1,1,1)$	yes
$AxEyX[yx]$	3	$\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 2 \end{pmatrix}$	$(1,1,1)$	no
$ExAyX[yx]$	3	$\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 2 \end{pmatrix}$	$(1,1,1)$	yes
$(X[xy] \to -X[yx])$	3	$\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 2 \end{pmatrix}$	$(1,1,1)$	yes
$(X[xy] \to -X[yx])$	3	$\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 2 \end{pmatrix}$	$(0,2,1)$	yes
$(X[xy] \to -X[yx])$	3	$\begin{pmatrix} 0 & 0 & 1 & 2 \\ 1 & 2 & 2 & 2 \end{pmatrix}$	$(2,2,1)$	no