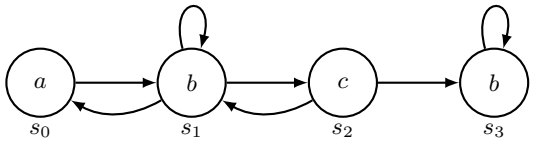
VU Programm- und Systemverifikation
Homework 3b: Temporal Logic and Model Checking

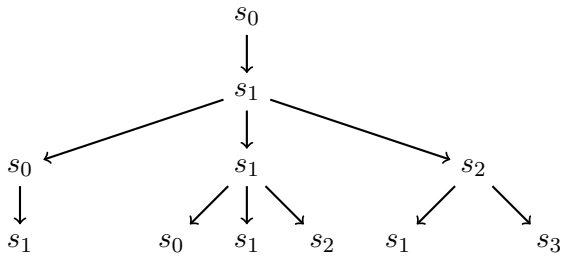
(10 points)

May 29, 2019

Consider the following Kripke Structure:



1. Fix s_0 as the initial state and give the computation tree for three steps. [1 point]



2. Describe the following formulas in natural language. For each formula, in which states of the Kripke structure does it hold? (Note that we do not consider s_0 as special initial state here.) [4 points]

   (a) $\mathbf{A}\,(b \wedge \mathbf{X}\,b)$

   $\boldsymbol{s_3}$

   (b) $\mathbf{A}\,(\mathbf{F}\,\mathbf{G}\,b)$

   $\boldsymbol{s_3}$

   (c) $\mathbf{F}\,\mathbf{G}\,c$

   none

   (d) $\mathbf{E}\,(\mathbf{G}\,\mathbf{F}\,c)$

   $\boldsymbol{s_0, s_1, s_2}$

3. Encode the following statements in temporal logic using the propositions given in quotes: [5 points]

   (a) In all traces, "p" happens at least three times in a row.

   $\mathbf{A}\,(\mathbf{F}\,(p \wedge \mathbf{X}\,p \wedge \mathbf{X}\,\mathbf{X}\,p)$

(b) From some time on, all is "good" forever.
$\mathsf{F}\,\mathsf{G}\,good$

(c) Eventually, something "good" happens.
$\mathsf{F}\,good$

(d) If there are infinitely many requests "req", then there will be infinitely many responses "resp".
$\mathsf{G}\,\mathsf{F}\,req \rightarrow \mathsf{G}\,\mathsf{F}\,resp$

(e) There is a trace that leads to a "bad" state.
$\mathsf{E}\,\mathsf{F}\,bad$

Upload a pdf file with your solutions to TUWEL by June 2, 2019.