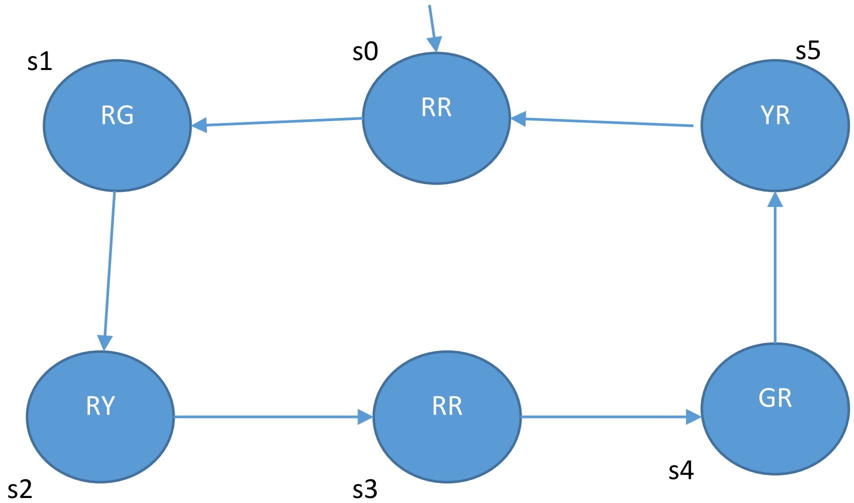
Counter-example for an LTL formula for Normal Mode Traffic Lights

A simple module of VTL+ is having just running in normal mode.



$S = \{s1, s2, s3, s4, s5\}$

$I = \{s0\}$

$T = \{(s0, s1), (s1, s2), (s2, s3), (s3, s4), (s4, s5), (s5, s0)\}$

$We\ have\ two\ state\ variables: s[0](for\ north/south)\ and\ s[1](for\ east/west).$

$These\ variables\ will\ resolve\ to\ true\ if\ Green(G)\ else\ false.$

$We\ wish\ to\ verify\ the\ liveness\ property: Each\ road\ will\ eventually\ get\ a\ green\ light$

$This\ can\ be\ specified\ as\ AFq_1 \wedge AFq_2\ where\ q_1(s) = s[0]\ and\ q_2(s) = s[1]$

$The\ counter\ example\ is\ then\ EGp_1 \vee EGp_2\ where\ p_1(s) = \neg s[0] and\ p_2(s) = \neg s[1]$

$In\ this\ bounded\ model, we\ will\ consider\ paths\ of\ length\ k = 5.$

$Call\ the\ states\ s_0, s_1, s, s_2, s_3, s_4, s_5.$

$Constraints\ guarantee\ that\ (s_0, s_1, s, s_2, s_3, s_4, s_5) is\ a\ witness\ for\ EGp_1 \vee EGp_2$

$(a\ counter\ example\ for\ AFq_1 \wedge AFq_2$

$Constraining\ (s_0, s_1, s, s_2, s_3, s_4, s_5)\ to\ be\ a\ valid\ path\ start\ from\ the\ initial\ state.$

$We\ obstain\ the\ propositional\ formula\ [M] = I(s_0) \wedge T(s_0, s_1) \wedge T(s_1, s_2) \wedge T(s_2, s_3) \wedge T(s_3, s_4)$

$Constraining\ the\ path, we\ find\ that\ there\ is\ no\ self - loop, hence\ [Gp] is\ false.$

$where\ [Gp] = p(s_0) \wedge p(s_1) \wedge p(s_2) \wedge p(s_3) \wedge p(s_4)$

$Hence\ the\ counter\ example\ is\ not\ satisfied, and\ the\ liveness\ property\ satisfies.$