Principles of Model Checking
Exercise class 6

Partial Order Reduction

Prof. Dr. Joost-Pieter Katoen, Dr. Taolue Chen, and Ir. Mark Timmer

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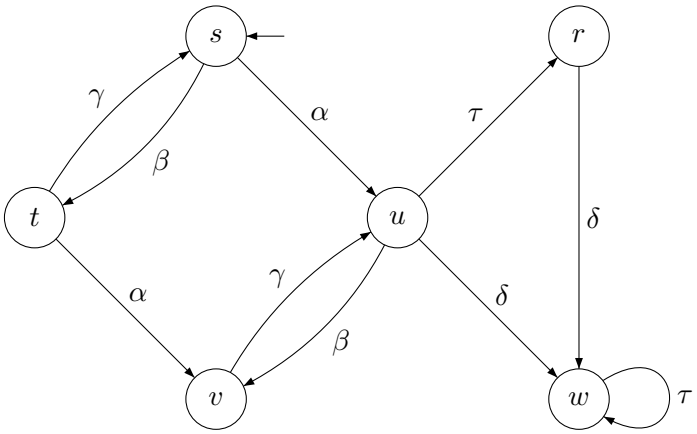
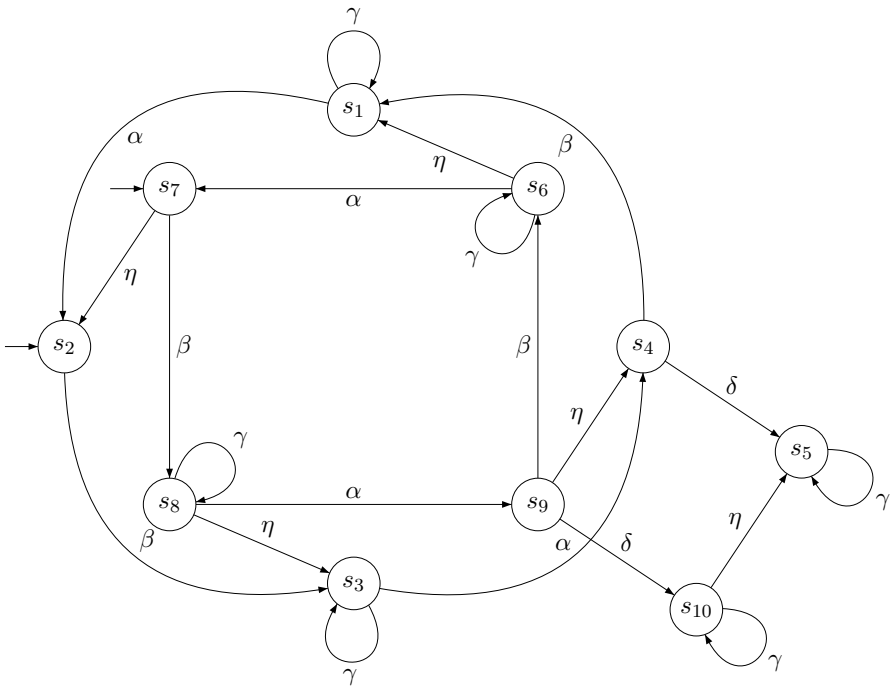
Problem 1

Consider the transition system TS below, with action set $Act = \{\alpha, \beta, \gamma, \delta, \tau\}$. Determine the pairs of independent actions.



Problem 2

Consider the transition system below:



The states labelling is as follows:

- $L(s_{10}) = \varnothing$
- $L(s_6) = L(s_7) = \{a\}$
- $L(s_3) = L(s_4) = L(s_5) = L(s_8) = L(s_9) = \{b\}$
- $L(s_1) = L(s_2) = \{a, b\}$

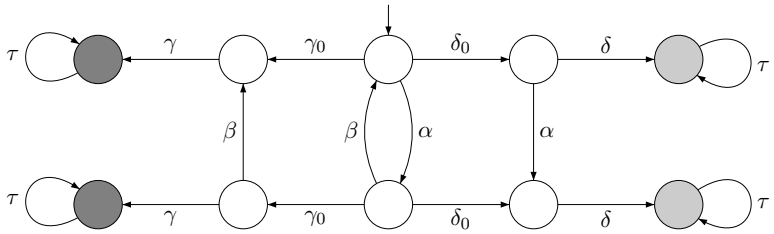
Prove or disprove that each of the following *ample sets* satisfy requirements *A1* through *A3*. Also check whether the requirement *A4* holds.

- $ample(s_6) = \{\gamma, \alpha\}$
- $ample(s_7) = \{\beta\}$
- $ample(s_8) = \{\alpha\}$
- $ample(s_9) = \{\alpha, \beta, \delta\}$
- $ample(s_{10}) = \{\gamma, \eta\}$

In case some of the conditions *A1* through *A4* do not hold, modify the *ample sets* in an appropriate way to fix it. Clarify your changes.

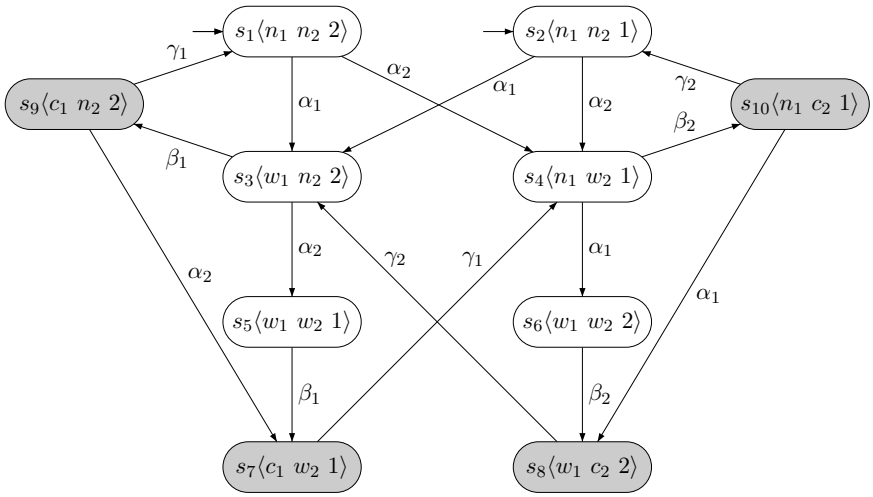
Problem 3

Consider the transition system TS shown in the following figure. Show that the ample set conditions (A1)-(A4) do not allow for any state reduction, although there is a smaller subsystem $\widehat{TS}$ that is stutter-trace equivalent to TS.



Problem 4

Consider the transition system TS_{Pet} below, which is for the Peterson mutual exclusion algorithm.



Questions:

(a) Which actions are independent?

(b) Apply the partial order reduction approach to get a reduced system equivalent to TS_{Pet}.