

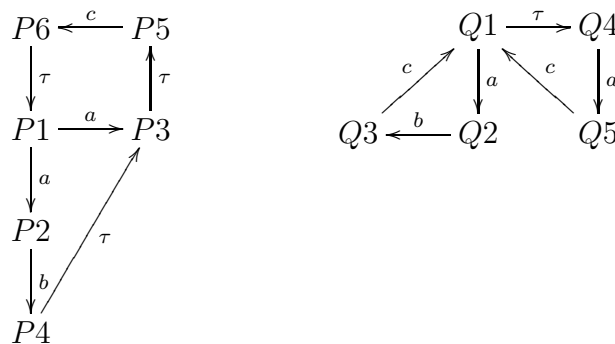
Introduction to Specification and Verification, separate exam January 18, 2011

- Examine, if the following processes are equivalent (weakly bisimilar). If they are, construct the weak bisimulation. If they are not, show why it is not possible to construct a weak bisimulation. The initial states in the figures are $P1$ and $Q1$.

a)



b)



- In the appendix there is the specification of the AB protocol with get and give messages as well as with a channel. In this specification, the timer may send timeouts too early. Modify the specification in such a way that the timer sends timeout only, when data messages or acknowledgments are really lost. (You have to use some kind of signal messages.)

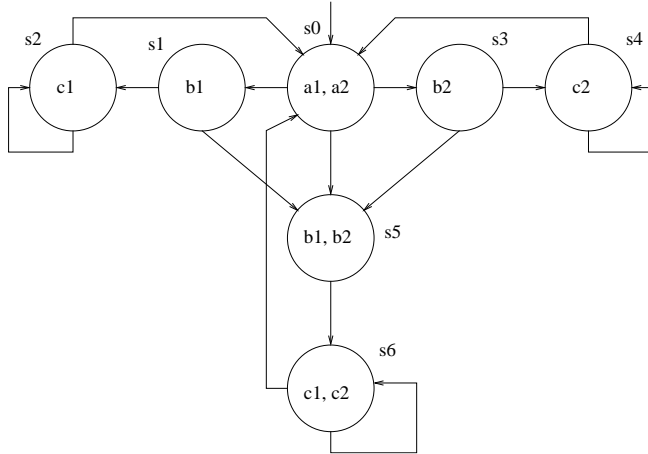
- Draw the transition systems corresponding the following Lotos processes. For every state in the transition diagram, write the Lotos expression the state represents.

a) $P[a,b] := a; (a;b;exit \ || \ b;exit) \ \gg \ P[a,b]$

b) $P[a,b] := a; stop \ [] \ b; P[a,b]$

c) $P[a,b,c] := a; P[b,c,a]$

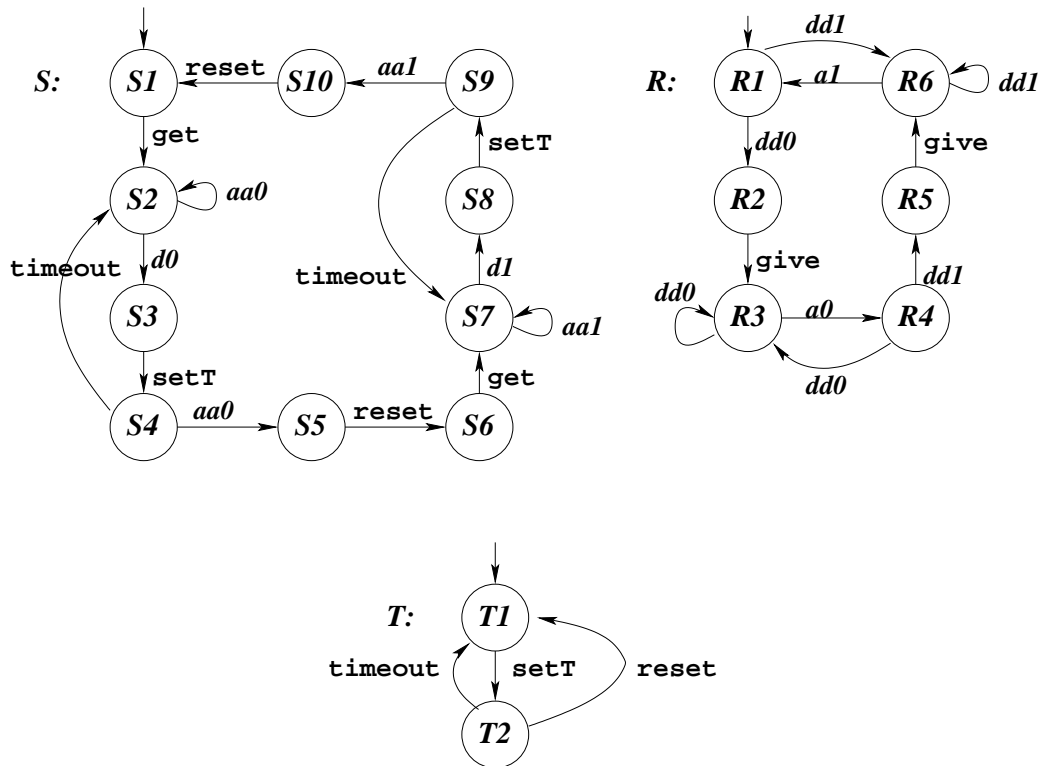
- Consider the following Kripke structure.

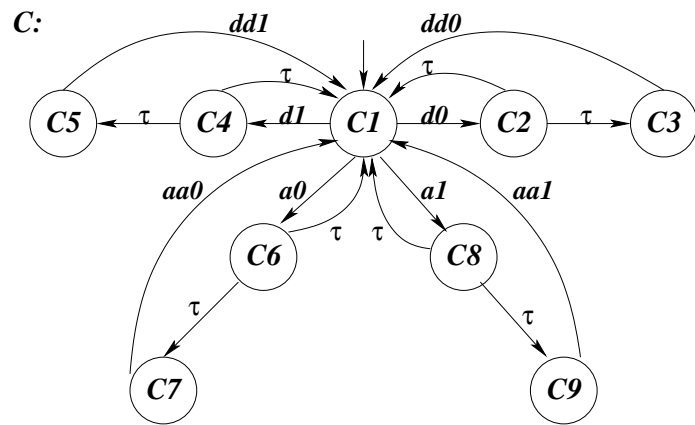


Examine the formulas a)-f). For every formula, determine the (infinite) path that satisfies the formula. Furthermore, which of the formulas are not true in this Kripke model. If a formula is not true, find a path which does not satisfy the formula.

- a) $(a_1 \wedge a_2) \wedge (a_2 \vee b_1) \wedge \neg b_2$
- b) $\Box(a_1 \vee \neg c_2)$
- c) $\Box(b_2 \Rightarrow \Diamond c_2)$
- d) $\Box(b_1 \Rightarrow \Diamond(c_1 \wedge \neg c_2))$
- e) $\Box \Diamond b_2 \Rightarrow \Box \Diamond c_2$
- f) $\bigcirc((b_1 \vee b_2) \mathcal{U} (c_1 \vee a_2))$

Appendix: The Specification of the AB Protocol





AB=((S [[timeout, reset, setT]] T)

[[d0,d1,aa0,aa1]]

C)

[[dd0,dd1,a0,a1]]

R