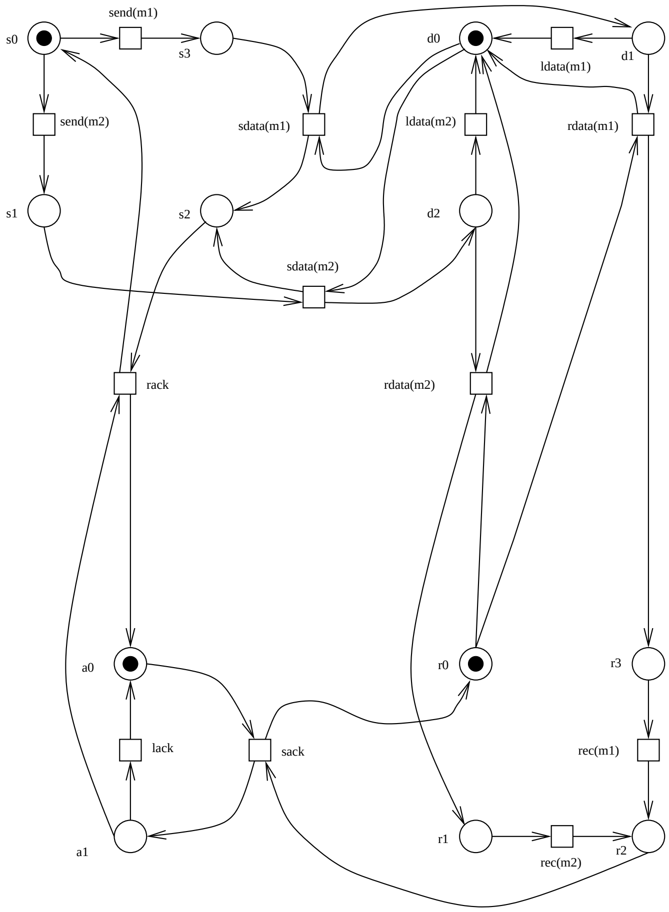
Tik-79.231 **Autumn 1999**
Parallel and Distributed Digital Systems
Answers to Tutorial 1
Sep 27, 1999

1. a) P/T net which is semantically equivalent with the LTS:



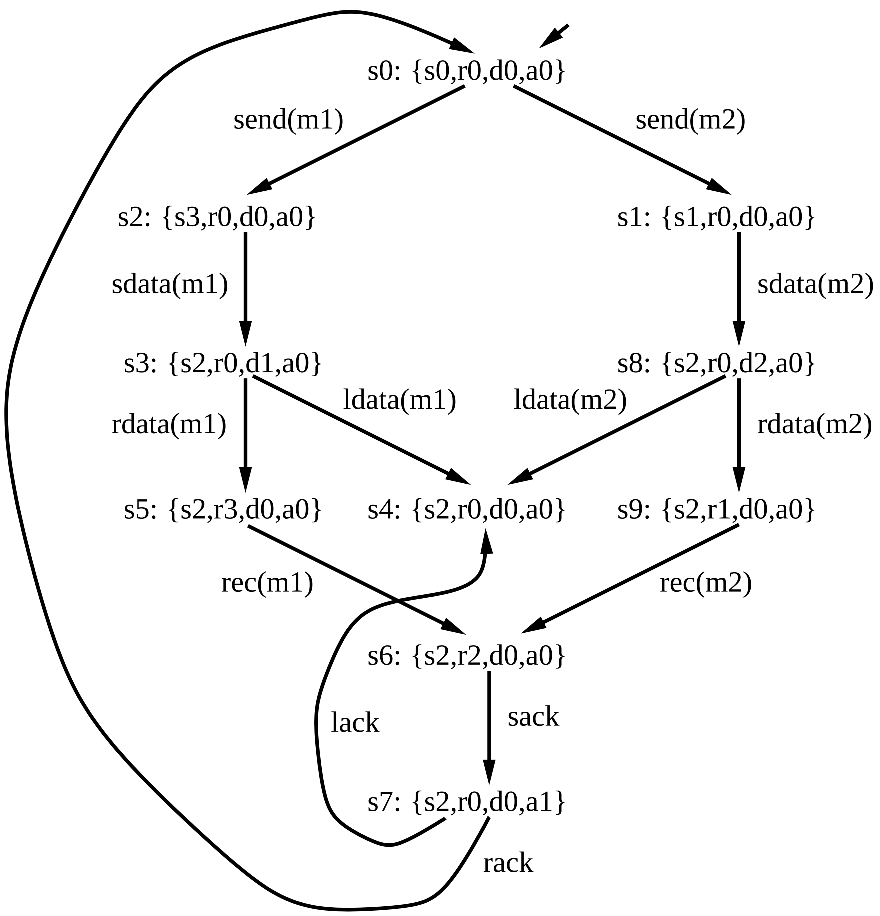
b) The reachability graph of the net is on the next page

c) Node 4 of the reachability graph is a deadlock, and it will be reached if one of the following transitions fires: *ldata(m1), ldata(m2)*, or *lack*.

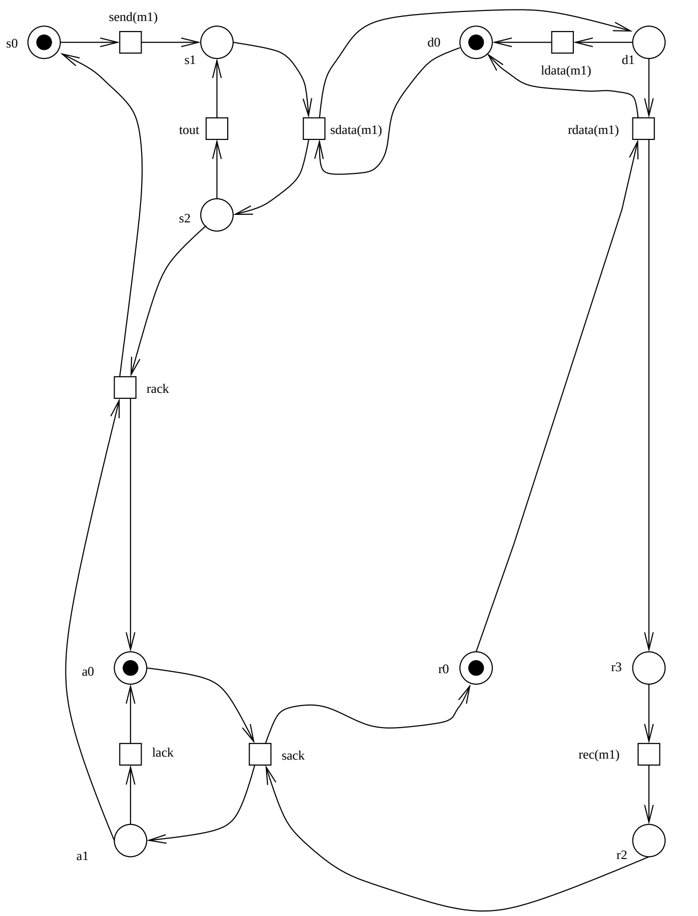
d) The model can be simplified by removing the message identities. If the message type 2 is removed we can delete transitions *send(m2), sdata(m2), ldata(m2), rdata(m2)*, and *rec(m2)* from the net. Correspondingly, the nodes 1, 8, and 9 are removed from the reachability graph (and, of course, arcs leading to said nodes.)

Another way to further simplify the model is to delete the transition *send(m1)* (or, equally well, the transition *rec(m1)*), and modify the transition *sdata(m1)* (and *rdata(m1)*, respectively) accordingly.

Reachability graph of the net:



2. a) P/T net which is semantically equivalent with the LTS:



b) The protocol no longer deadlocks but it still does not work correctly, since the recepient cannot distinguish a resent message from a new message.

In the reachability graph it is possible to detect a cycle where the recepient may perform arbitrarily many *rec(m1)* events without the sender doing any *send(m1)* events.

*) Adding the transition *tout* causes a drastic increase in the size of the state space. Below, given is the reachability graph of the net with 34 markings and 89 state transitions.

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