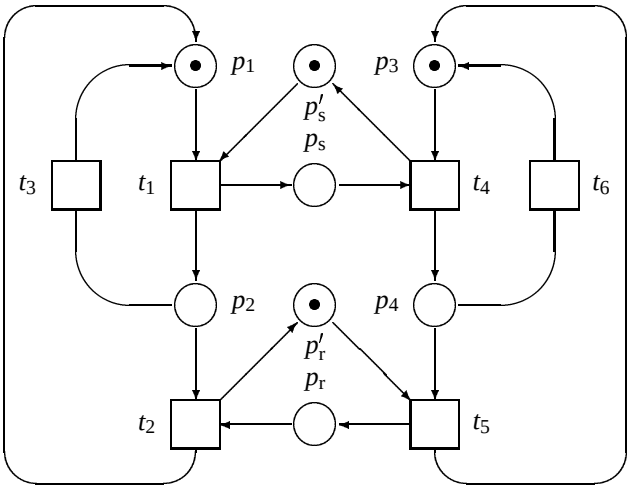
**T-79.231 Parallel and Distributed Digital Systems**
**Homework Assignment 1, October 6, 2003** **Marko Mäkelä**

# A simple client/server system

The system comprises a server and a client, which communicate via a reliable connection. The client initiates service requests ($t_1$) and awaits responses from the server ($t_2$). If there is no response within a reasonable amount of time, the client may repeat the request ($t_3$). Every now and then, the server may mix up things after receiving a request ($t_4$) and return to its initial state ($t_6$) without responding ($t_5$). The request channel is represented by the places $p_\mathrm{s}$ (request sent) and $p'_\mathrm{s}$ (no request), and the response channel is modelled by $p_\mathrm{r}$ ja $p'_\mathrm{r}$.




1. Generate the reachability graph of the system.
2. In the graph, indicate those states where a conflict occurs.
3. Consider 3 variations of the system, lacking one or both of the transitions $t_3$ and $t_6$. Draw their reachability graphs. (You may draw them in the same picture using colours or other mark-up.) Indicate deadlock states. Provide a verbal explanation for each deadlock.
4. If the initial marking of $p_1$ is replaced with $M_0(p_1) = n$, the model represents a system with $n$ indistinguishable clients. Transform the place/transition system into a high-level net, where the server does distinguish the clients from each other. (Hint: alter the domains of at least the places $p_1, p_2, p_\mathrm{s}, p_\mathrm{r}$ and let the initial marking of $p_1$ be $[1, 2, 3, \ldots, n]$.)
5. Unfold the high-level net to a place/transition system in the case $n = 2$.

Return the assignment to the mailbox located between rooms B 336 and B 337 in the Computer Science Building, 3rd floor by 8 p.m. on October 27, 2003. You may also return the answer in Postscript or PDF form to Jukka.Honkola@hut.fi.