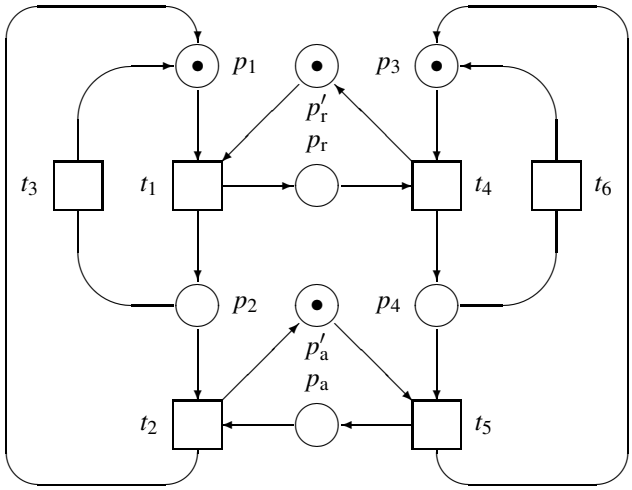
T-79.231 Parallel and Distributed Digital Systems
Homework 1, October 14, 2002 **Marko Mäkelä**

A simple client server system

A system consists of a server and a client which are connected together with a reliable connection (i.e. losses do not occur). The client sends requests (transition t_1) and expects an answer from the server (t_2). If an answer is not received within a reasonable time, the client will resend the request (t_3). The reception of the request by the server is represented with (t_4). The server may occasionally overlook the request and return immediately to its idle state (t_6). If the server works correctly, it will send a reply (t_5). The states of the request channel are represented with places p_r (request has been sent), and p'_r (no request has been sent). Similarly, the states of the acknowledgement channel are denoted with p_a and p'_a.



1. Construct the system's reachability graph (2 points)

2. Indicate on the reachability graph those markings where a race condition occurs. Hint: remember to find out the difference between a race condition and nondeterminism... (2 points)

3. Remove the transitions t_3 and t_6 separately and together from the system, and construct the reachability graph for each of the three cases. Indicate the deadlock states (if any) on the reachability graphs. Explain in each case why the deadlock occurs.

4. If we change the initial marking so that $M_0(p_1) = n$, the system represents a situation with n independent, indistinguishable customers. Transform the Place/Transition system to a High Level net, where the server distinguishes the different customers from each other. (Hint: change the data types of at least the places $p_1, p_2, p_\mathrm{r}, p_\mathrm{a}$ and change the initial marking of place p_1 to $[1,2,3,\ldots,n]$.)

5. Unfold the High Level net of the previous question in 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 4 PM on November 4, 2002. You may also return the answer in electronic form (either postscipt of pdf) to e-mail address Jukka.Honkola@hut.fi