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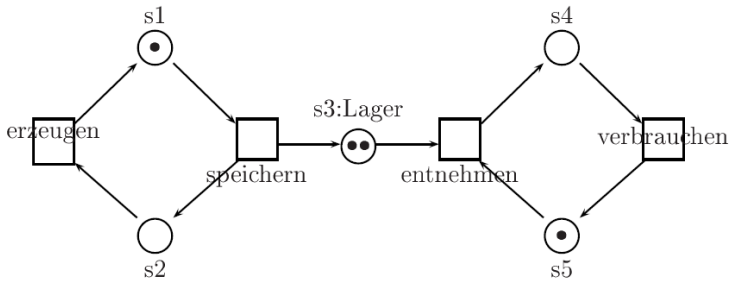
Formal Foundations of Information Systems
Summerterm 2009
30.06.2009

7. Exercise Set: Petri Nets: P/T Nets

Exercise 26 (Erreichbarkeit, Überdeckung und Beschränktheit, 1+1+1+1=4 Punkte)
Let $N := (P, T, F, V, m_0)$ be a P/T-Net and m a marking. Prove or disprove the following two claims.

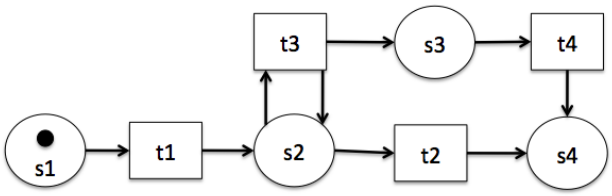
a) If m is reachable in N, then m is also coverable in N.
b) If m is coverable in N, then m is also reachable in N.
c) If N is bounded (in german: *beschränkt*), then its reachability graph $EG(N)$ is finite.
d) If N is bounded, then the set of all words $L_N(m_0)$ that can fire on N is finite.

Exercise 27 (Beschränktheit, 1+2=3 Punkte)
The following Petri Net N describes a producer-consumer setting. The producer creates a product that is stored in a warehouse and the consumer consumes it by taking it out of the warehouse.



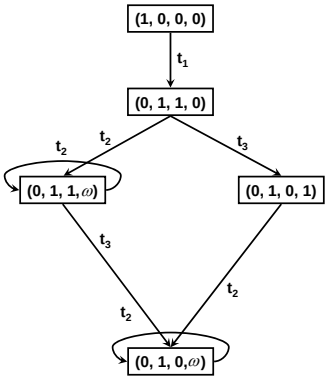
a) Describe this Petri Net. What are the possible markings that are reachable? How many producers and consumers are modeled in this net?
b) The warehouse can store infinitely many elements, which is not applicable in a real world scenario. Therefore change P to P' (by insertion of places and transitions), so that the warehouse does not hold more than k elements at any time. Prove that P' is bounded.

Exercise 28 (Beschränkte Stellen und Überdeckungsgraph, 5 Punkte)
Consider the following P/T-Net:

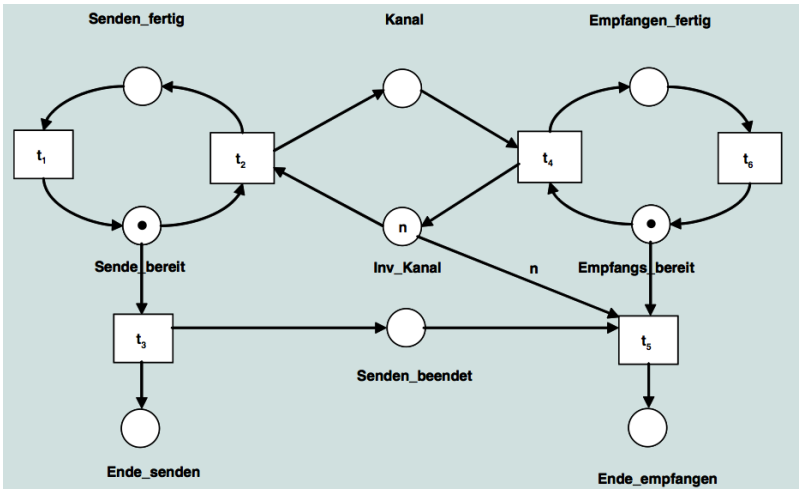


Identify all bounded places. Use the coverage graph to solve this exercise. Also provide the help graph used to construct the coverage graph.

Exercise 29 (Überdeckungsgraph, 3 Punkte)
Model one possible Petri Net for the following coverage graph.



Exercise 30 (Motivation Invarianten, Bonusaufgabe: 5 Punkte)
Consider the following P/T-Net:



Try to prove or disprove the following claims using the tools from the lecture, in particular using the reachability graph. Which claims require new techniques to be solved properly?

a) At most n messages can be transmitted in parallel.
b) The sender is either in his final state (*Ende_senden*), ready (*Senden_bereit*), or finished (*Senden_fertig*).
c) The receiver is either in his final state (*Ende_empfangen*), ready (*Empfangs_bereit*), or finished (*Empfangen_fertig*).
d) The final state of the receiver can be reached if and only if the channel is empty and the sender has reached his final state.

Due by: 07.07.2009