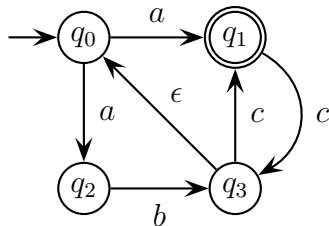


Examination Automata and Processes

Code 2IJ55, February 2, 2007, 9.00 - 12.00

This examination consists of 10 problems all counted by the same weight.
The problems should be solved either in Dutch or in English.
For all problems holds: motivate your answer.

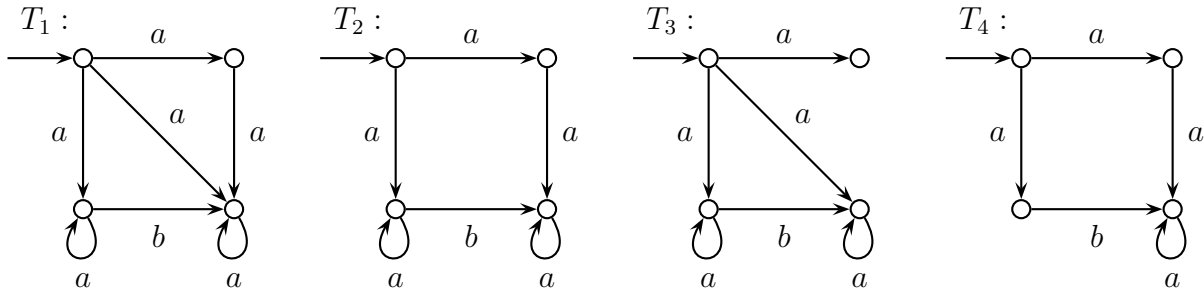
For problems 1 to 3 the nfa M is given by the following transition graph:



1. Give a regular expression r satisfying $L(r) = L(M)$.
2. Draw the transition graph of a dfa M' satisfying $L(M') = L(M)$.
3. Give a right-linear grammar G satisfying $L(G) = L(M)$.
4. Consider the language consisting of all strings over $\{a, b\}$ that contain exactly two a 's and three b 's. Draw the transition graph of a dfa accepting this language.
5. The language L is defined by $L = \{a^n b^m c^n b^k \mid n, m, k > 0\}$. Give a context-free grammar G satisfying $L(G) = L$.

(Please turn over)

For the problems 6 to 8 the transition systems T_1, T_2, T_3, T_4 are defined as follows.



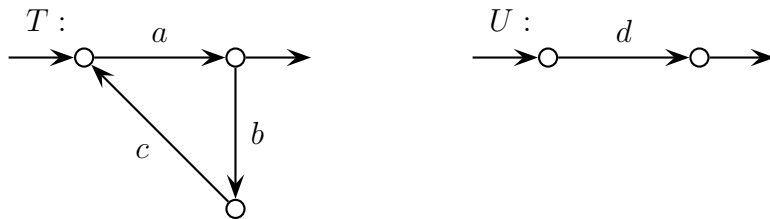
6. For any two of the systems T_1, T_2, T_3, T_4 check whether they are language equivalent and whether they are trace equivalent.

7. For any two of the systems T_1, T_2, T_3, T_4 check whether they are bisimulation equivalent. If so, then give a corresponding bisimulation.

8. For any two of the systems T_1, T_2, T_3, T_4 that are not bisimulation equivalent give a formula in Hennessy-Milner logic proving this.

9. Compute $\partial_H(T \parallel_\gamma U)$ for

- T, U given by



- $\gamma(b, d) = \gamma(d, b) = c$, and γ is undefined elsewhere, and
- $H = \{b, d\}$.

10. Compute T^* and $T + (U \cdot T)$ for T, U as defined in problem 9.