

Errata Theorie van Concurrency

The errata marked YG were discovered by Yan Gao, December 2003.

- page 6, line 5. Change “ $n \geq 1$ ” into “ $n \geq 2$ ”.

YG– page 44, lines 16/17. It is claimed here that removal of p or q results in an EN system that is configuration equivalent with M . This is only correct if it is assumed that M is reduced (which we may assume by Theorem 36). In that case p and q are either both in C_{in} or both not in C_{in} . A counterexample for the non-reduced case is the EN system M with transitions s, t , places p, q, r_1, r_2 , $C_{in} = \{r_1, p\}$, and $\bullet s = \{r_1\}$, $s^\bullet = \bullet t = \{p, q\}$, $t^\bullet = \{r_2\}$.

- page 64. Replace the proof of **Lemma 72** by the following proof: Let $L = \{a_1, \dots, a_k\}$ with $a_1 \rho a_2 \rho \dots \rho a_k$. Since A is nonempty, L is nonempty and so $k \geq 1$. Then $a_1 \in {}^\circ N$, because otherwise there exists $a_0 \in A$ such that $a_0 \rho a_1$, and so $L \cup \{a_0\}$ would be a li-clique and L would not be maximal. Similarly $a_k \in N^\circ$.

- Replace Lemma 82 by the following sentence and new Lemma 82:

We first show that lines correspond to paths from ${}^\circ N$ to N° .

Lemma 82. Let $N = (P, T, F, {}^\circ N)$ be a process net with $P \neq \emptyset$, and let $L \subseteq X = P \cup T$. Then L is line of N iff there exist $x_1, \dots, x_k \in X$, $k \geq 1$, such that (1) $L = \{x_1, \dots, x_k\}$, (2) $x_1 \in {}^\circ N$ and $x_k \in N^\circ$, and (3) $x_i F x_{i+1}$ for every $1 \leq i \leq k-1$.

Proof. (\Rightarrow) Let L be a line of N , and let $L = \{x_1, \dots, x_k\}$ with $x_1 F^+ x_2 F^+ \dots F^+ x_k$. Since $P \neq \emptyset$, L is nonempty and so $k \geq 1$. By Lemma 72, $x_1 \in {}^\circ N$ and $x_k \in N^\circ$. To prove (3), suppose that not $x_i F x_{i+1}$. Then there exists $y \in X$ such that $x_i F^+ y F^+ x_{i+1}$, and so $L \cup \{y\}$ is a li-clique, contradicting the maximality of L .

(\Leftarrow) Obviously, by (1) and (3), L is a li-clique. Suppose now that there is a $y \in X - L$ such that $L \cup \{y\}$ is a li-clique. Consider the “position” of y in the sequence $x_1 F^+ x_2 F^+ \dots F^+ x_k$. Then either $y F^+ x_1$ (which is impossible because $x_1 \in {}^\circ N$) or $x_k F^+ y$ (which is impossible because $x_k \in N^\circ$) or $x_i F^+ y F^+ x_{i+1}$ for some $1 \leq i \leq k-1$. The last case is also impossible. In fact, in that case there exists $z \in X$ such that $x_i F z F^* y$. Thus, if $x_i \in P$, then x_i^\bullet contains both z and x_{i+1} , contradicting Definition 73(2). Otherwise, $x_{i+1} \in P$ and we get a similar contradiction by considering $z' \in X$ such that $y F^* z' F x_{i+1}$.

End of proof.

- YG– Replace the proof of **Theorem 83** by the following proof:

Proof. (1) Let M be a sequential component of N , and let $S = P_M$. Note that N is reduced, by Theorem 81(1). Using the characterization of a sequential component in Theorem 49(3), it easily follows that X_M contains a nonempty set $L = \{x_1, \dots, x_k\}$ satisfying the conditions of (the new) Lemma 82, i.e., L is a line. To show that $L = X_M$, let $y \in X_M$. By the same characterization, used “backwards”, X_M must contain y_1, \dots, y_m such that $y_1 \in {}^\circ N$, $y_1 F y_2 F \dots F y_m$, and $y_m = y$ (i.e., a path from ${}^\circ N$ to y). Since M contains at most one element of ${}^\circ N$ by Theorem 4.9(3)(i), we get that $y_1 = x_1$. Since $y_1^\bullet = x_1^\bullet$ is a singleton by Definition 73(2), we get that $y_2 = x_2$. Since $\#(y_2^\bullet \cap S) = 1$ by Theorem 4.9(3)(ii), we get that $y_3 = x_3$. Continuing like this we finally obtain that $y_m = x_m$ and so $y \in X_M$.

(2) Let $L = \{x_1, \dots, x_k\}$ as in (the new) Lemma 82. Using Theorem 49(3) it is easy to check that $S = L \cap P$ determines a sequential component: $(C_{in})_N \cap S = {}^\circ N \cap S = \{x_1\}$, $\#(\bullet t \cap S) = \#(t^\bullet \cap S) = 1$ for all $t \in L \cap T$, and finally $\#(\bullet t \cap S) = \#(t^\bullet \cap S) = 0$ for all $t \in T - L$ because of Definition 73(2) and the definition of ${}^\circ N$ and N° . From Lemma 46(1) it follows that S determines the sequential component as described in the statement of this theorem. In particular, its transitions are $\mathbf{nbh}_N(S) = L \cap T$ by Definition 73(2).

End of proof.

- page 69, 4th line of the proof of Theorem 84. Change “Lemma 82(2)” into “Lemma 82”.
- page 82. Replace the induction-part of the proof of **Theorem 101** by the following direct proof:
 Consider a path from v to w . Since the graph is acyclic, all nodes of the path are distinct. If the path contains a transitive edge (x, y) , replace that edge by a path of length ≥ 2 from x to y . By repeating this transformation, the path from v to w becomes longer and longer. Thus, since G is finite, the repetition has to stop and the resulting path from v to w contains nontransitive edges only.
- page 82, 2nd line after the proof of Theorem 102. Change T_M into $\mathbf{use}(T_M)$.
- page 86, 2nd line before Lemma 108. Again, change T_M into $\mathbf{use}(T_M)$.
- page 115, 4th line after Definition 156. Change “ $W(x, y) \leq 1$ ” into “ $W(x, y) = 1$ ”.
- YG– page 120, line 2. Change “Then after $|x|$ iterations” into “Suppose $C_{in}[y]C$. Then after at most $|y| + |x|$ iterations”.
- page 129, Theorem 187. Change “configuration” into “transition”.
- page 140, 2nd line of the proof of Lemma 203. Remove “since M is a marked graph”. This fact is needed for both cases, not only the second case.
- page 141. Alternative proof of **Theorem 204, (3) \Rightarrow (1)**:
 Assume that $C_{in}(\alpha) > 0$ for every cycle α . We will prove that M is live. Clearly, it suffices to prove that for every configuration $C \in \mathbb{C}_M$ there is a firing sequence $x \in T^*$ such that $C[x]_M C$ and every transition of T occurs in x . Consider an arbitrary $C \in \mathbb{C}_M$. By Lemma 203(2), $C(\alpha) > 0$ for every cycle α . Construct the net $N = (P', T, F')$ from M by changing every place $p \in P$ with $C(p) > 0$ into two places p_1 and p_2 , with $\bullet p_1 = \bullet p$, $p_1 \bullet = \emptyset$, $\bullet p_2 = \emptyset$, and $p_2 \bullet = p \bullet$. Since every cycle of M is marked by C , N is acyclic. Moreover, since M is a marked graph, every place of N has at most one input transition and at most one output transition. Hence, N is a process net. By Theorem 112 there exists $x \in T^*$ such that $\circ N[x]N^\circ$ and every transition of T occurs (exactly once) in x . Obviously, this implies that $C[x]_M C$.