Note that every non-persistent net must have a pair of transitions which is in a structural conflict, but not every net having a pair of transitions in a structural conflict is non-persistent. For example, t_1 and t_2 in Fig. 3.4(a) are in a structural conflict but not in a behavioral conflict, and this net is persistent.

3.7 Synchronic Distance

The notion of synchronic distances is a fundamental concept introduced by C. A. Petri [181]. It is a metric closely related to a degree of mutual dependence between two events in a condition/event system. We define the synchronic distance between two transitions t_1 and t_2 in a Petri net (N, M_0) by

$$d_{12} = \underset{\sigma}{\mathrm{Max}} \mid \bar{\sigma}(t_1) - \bar{\sigma}(t_2) \mid \qquad (3\text{-}1)$$

where σ is a firing sequence starting at any marking M in $R(M_0)$ and $\bar{\sigma}(t_i)$ is the number of times that transition t_i, i = 1, 2 fires in σ.

The synchronic distance given by (3-1) represents a well-defined metric for condition/event nets [184] and marked graphs (see Chapter 8). However, there are some difficulties when it is applied to a more general class of Petri nets [182]. For further information on synchronic distances, the reader is referred to [105, 181-186].

Example 3.5: In the net shown in Fig. 3.4(d), d_{12} = 1, d_{34} = 1, $d_{13} = \infty$, etc. In the net shown in Fig. 2.4, where transitions t_2 and t_3 represent two parallel events, d_{23} = 2 because after firing t_3 there is a firing sequence $\sigma = t_2\, t_4\, t_1\, t_2$ in which $\bar{\sigma}(t_2) = 2$ and $\bar{\sigma}(t_3) = 0$. The net shown in Fig. 3.5(a) represents a simple resource-sharing system where two users p_1 and p_2 are sharing a common resource p_3 without any (fair) control. The synchronic distance between t_1 and t_2 in this net is given by $d_{12} = \infty$, since one user can use the resource infinitely often while the other user is not using at all. However, if we add