Comment/Correction: Dependability Modeling Using Petri Nets

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Abstract — Two arcs are missing in a figure of Malhotra & Trivedi (1995); these arcs are necessary for the proper functioning of the GSPN. Also, priorities of immediate transitions in that figure must be clearer. This note presents a correctly drawn GSPN and describes the priority assignment to immediate transitions in this GSPN.

1. CORRECTION

Acronyms

GSPN generalized stochastic Petri net  
SRN stochastic reward net.

Two arcs are missing from the GSPN in [1: figure 19]; these arcs are necessary for the proper functioning of the GSPN. This was explained to the authors of [1] by the authors of [2] when a similar approach was used in [3]. Upon further discussion, we found that priorities of immediate transitions in the same figure need to be stated explicitly because they might not be clear enough.

Figure 1 shows the corrected GSPN. The arcs that were missing from the original GSPN are the 2 outgoing arcs from immediate transition TM1 to place P4 and from immediate transition TM2 to place P5. These 2 arcs are necessary for the proper flushing of tokens from place P1 to P2, and from place P2 to P3, respectively. The priorities of immediate transitions in this GSPN must be stated explicitly.

2. PRIORITY SETTING

The priorities of the various immediate transitions in figure 1 should be assigned as shown in table 1. The framed part of the GSPN in figure 1 consists of 2 modules, M1 and M2; each one contains exactly 1 place in which tokens are deposited before they can be pushed through the module. In figure 1, these places are P1 & P2, and are denoted as input places. Generally, if there are n repairable components, a GSPN for modeling the FCFS repair discipline contain n - 1 modules.

The setting of priorities must ensure that all tokens that are deposited in the input place of module Mj are flushed out into the input place of the next module before another set of token(s) reaches the input place of the same module. This basic principle leads to the priority assignment as shown in table 1 for the GSPN in figure 1.

<table>
<thead>
<tr>
<th>Names of Transitions</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Td11, Td21, Td31</td>
<td>1</td>
</tr>
<tr>
<td>Td12</td>
<td>2</td>
</tr>
<tr>
<td>Td22</td>
<td>3</td>
</tr>
<tr>
<td>Td32</td>
<td>4</td>
</tr>
<tr>
<td>TM1, TM2</td>
<td>5</td>
</tr>
<tr>
<td>TM1, TM1</td>
<td>6</td>
</tr>
<tr>
<td>TM2, TM2</td>
<td>7</td>
</tr>
<tr>
<td>TM2</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 1. Priorities of the GSPN

Flushing tokens from place P1 (P2) requires a token to be in place P4 (P5). After the flushing is complete, the token remaining in P4 (P5) needs to be removed before anything else is done. This is why the priority of transitions TM1 & TM2, are higher than the rest of the transitions. The remaining transitions in the modules follow the rule that priorities of transitions in the higher module, Mj, are higher than priorities of transitions in the lower module (Mk). The presence of 3 tokens in place P3 enables the transitions Td32, Td22, Td12. However, we wish only Td32 to fire. Hence the priorities of these 3 transitions are assigned in the order: Pr(Td32) > Pr(Td22) > Pr(Td12).

From this discussion, the following rules emerge for assigning priorities:
1. Pr(TM1) > Pr(TM2), for j, k ∈ {1,3} and i > 0;
2. Pr(TM1, i) > Pr(TM2, j), for i > 0;
3. Pr(TM1, i) > Pr(TM2, j), for j ∈ {1,3} and i > 0.

The priority settings in table 1 satisfy these rules.
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REFERENCES