Comments on "A Petri Net Model for Temporal Knowledge Representation and Reasoning"

Shyi-Ming Chen and Woei-Tzy Jong

***Abstract*—In the above paper[1], Yao has presented a unified time Petri net model (TPN) for temporal knowledge representation and reasoning, where the TPN model presented has a good contribution in the aspect of temporal knowledge representation and reasoning. However, there are a number of errors which should be corrected. The purpose of this paper is to identify these errors, and the corrections provided permit the readers who have been confused by the errors to gain a better understanding of the good ideas presented.**

I. Introduction

Yao presented a unified time Petri net model (TPN) for representing temporal information including metric, qualitative interval, higher-order expression, and repeated activities. Yao also introduced the firing rules and extended state graphs (ESG) and then related them to temporal reasoning. The TPN model presented in Yao has a good contribution in the aspect of temporal knowledge representation and reasoning. However, there are a number of errors appearing which should be corrected. The purpose of this paper is to identify the errors, and the corrections provided permit the readers who have been confused by the errors to gain a better understanding of the good ideas presented in Yao.

II. Corrections of the Errors

First, we can see that the corresponding TPN of the interval relation "X finishes Y" shown in Fig. 3 contains an error (i.e., the symbol "t_x" corresponding to the proposition Y should be corrected into "t_y"). Thus, Fig. 3 should be corrected as shown.

In Fig. 7, the figure should at least mark one place, i.e., the Fig. 7 shown here is correct or better.

In Fig. 8, an arc from t_{13} to p_{16} should be added to ensure the correctness. Thus, Fig. 8 should be corrected as shown.

In Fig. 9, an arrow directed from t_6 to p_4 should be added to model correctly the example system, such that after firing transition t_6, one token is deposited into place p_4, and the other token is deposited into place p_6, where the tokens in places p_4 and p_6 represent "Johnson" and "Eric," respectively. Furthermore, in Fig. 9, "t_1" should be changed to "$t_1[0, 0]$" as used in Fig. 8. Thus, the TPN representation of Example 2 should be corrected as shown.

In Fig. 10, the states ES8 and ES9, and the theta value associated with the directed edge labeled t_4 directed from state ES9 contain a number of errors due to the fact that from the left column of p. 1380, line 9 of Yao, we can see the time that Johnson needs to have breakfast (t_4) is 30–40 min rather than 30–35 min as shown in the firing interval set I8: $t_4[30, 35]$, $t_8[25, 25]$ of the state ES8. Thus, Fig. 10 should be corrected as shown.

Finally, in the left column of p. 1381, lines 37–44, the author found that both transitions t_4 and t_8 are firable under the same sate ES4. Thus, he concluded that it is possible that Johnson has breakfast and Eric reads newspaper at some time. Furthermore, the author claimed that there exists only one event sequence to reach the state ES4, i.e.,

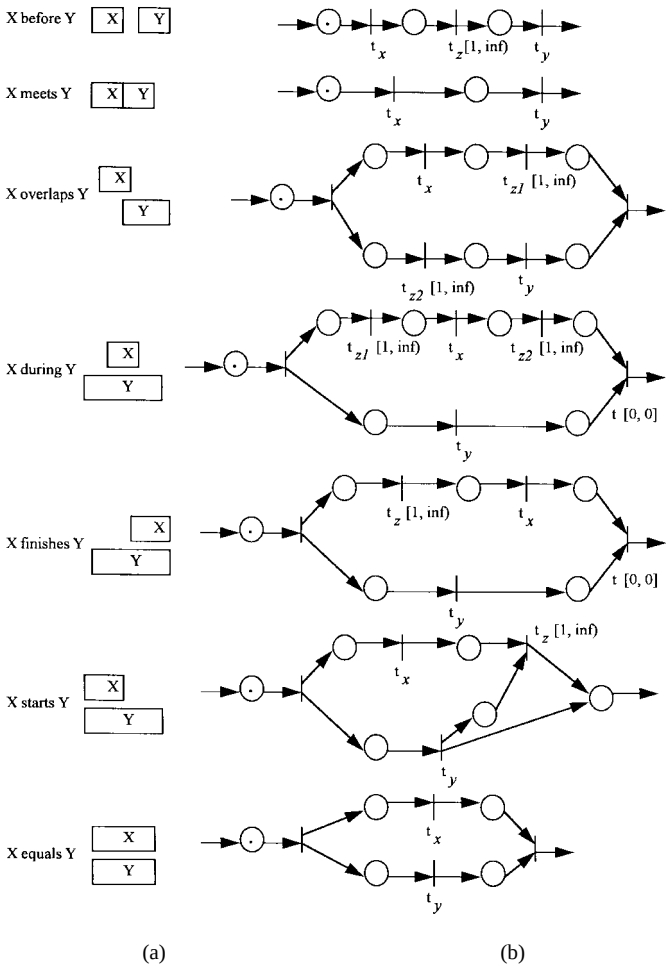

Fig. 3. (a) Interval relations and (b) corresponding TPN.

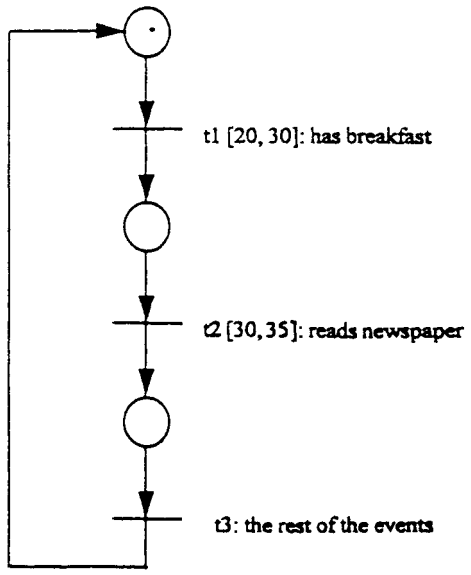

Fig. 7. TPN representation of repeated activities.

[1] Y. Yao, *IEEE Trans. Syst., Man, Cybern.*, vol. 24, no. 9, pp. 1374–1382, Sept. 1994.

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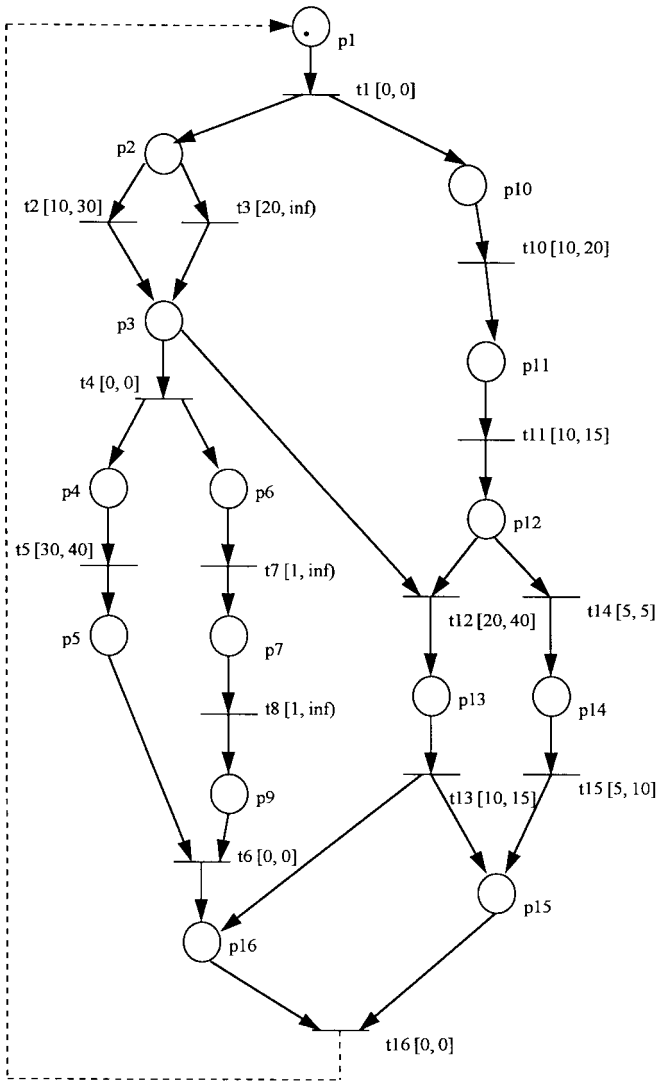

Fig. 8. TPN representation of Example 1.

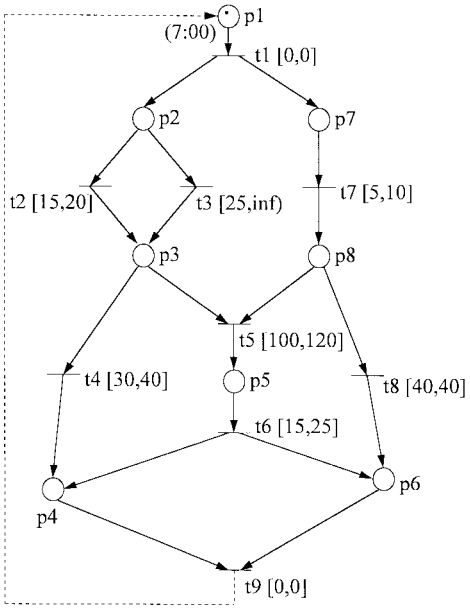

Fig. 9. TPN representation of Example 2.

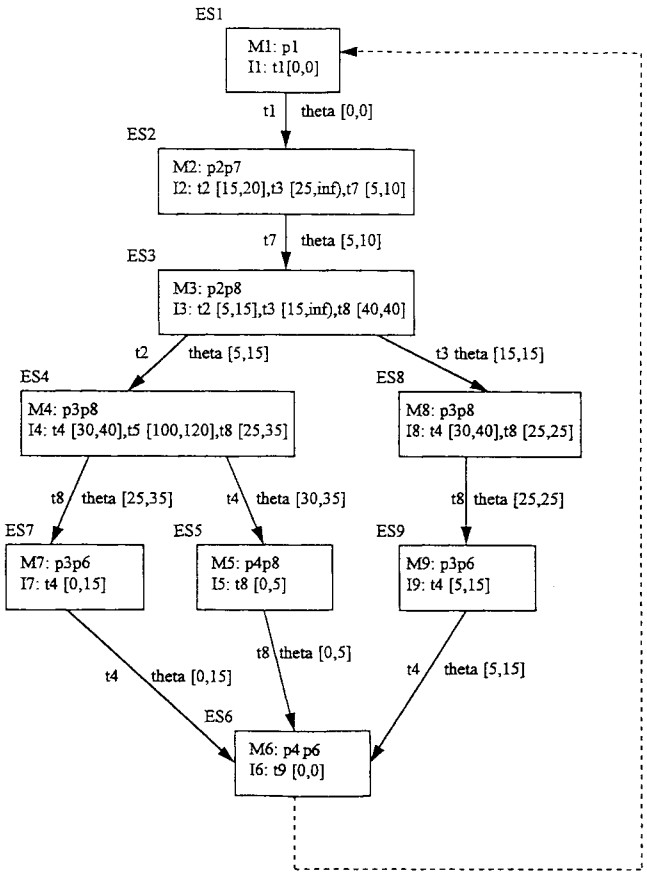

Fig. 10. The ESG of the Fig. 9.

$t_1t_7t_2$, which means to reach this situation, Johnson has to take the train, and the author concluded that it is impossible that the situation occurs if Johnson goes to school by bus. However, there is an error in the author's conclusion, i.e., the above sentence "it is impossible that the situation occurs if Johnson goes to school by bus" should be corrected into "it is possible that the situation occurs if Johnson goes to school by bus." The reason for the correction is explained as follows. From Fig. 8, we can see that the time that Johnson needs to have breakfast (t_4) starts at 7:25 if he goes to school by bus, and Johnson will take 30–40 min to have breakfast; we also can see the time when Eric starts to read the newspaper (t_8) is between 7:05 and 7:10, and Eric will take 40 min to read the newspaper. Thus, it is obvious that it is possible that Johnson has breakfast and Eric reads the newspaper at some time if Johnson goes to school by bus. Therefore, in the left column of p. 1318, lines 43–44, the sentence "it is impossible that the situation occurs if Johnson goes to school by bus" should be corrected to "it is possible that the situation occurs if Johnson goes to school by bus."

III. Conclusion

In this comment, we have identified a number of errors appearing in Yao, where the TPN model presented has a good contribution in the aspect of temporal knowledge representation and reasoning. We hope that the identification of the errors, and the corrections provided, will permit the readers who have been confused by the errors to gain a better understanding of the good ideas in the aspect of temporal knowledge representation and reasoning presented.