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Lectures on Petri Nets I: Basic Models

Advances in Petri Nets

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Preface Volume One

Since Petri nets were introduced by C. A. Petri in his seminal PhD thesis in 1964, both the theory and the applications of this model have been flourishing. Although many other models of concurrent and distributed systems have been developed since then, Petri nets are still a central model for concurrent systems with respect to both the theory and the applications. They are often used as a yardstick for other models of concurrency.

The main attraction of Petri nets is the way in which the basic aspects of concurrent systems are captured both conceptually and mathematically. The intuitively appealing graphical notation makes Petri nets the model of choice in many applications. The natural way in which Petri nets allow one to formally capture many of the basic notions and issues of concurrent systems has contributed greatly to the development of a rich theory of concurrent systems based on Petri nets.

"Petri nets" is actually a generic name for a whole class of models which can be divided into three main layers. The first layer is the layer of fundamental research — the basic model here is that of *elementary net systems*. For modeling real-life systems of nontrivial size, elementary net systems may explode in size and become much too large to be managed effectively. The second layer allows one to collapse the repetitive features of elementary net systems in order to get more compact representations. The basic model here is *place/transition systems*. Finally, the third layer is that of high level nets, where one uses essentially algebra and logic to yield compact nets suitable for real-life applications. *Coloured Petri nets* and *predicate/transition nets* are the best known high level models.

For many practical applications, one needs to consider the execution time and/or stochastic processes. This leads to *timed and stochastic Petri nets*.

The two volumes are based on the Advanced Course on Petri Nets, held in Dagstuhl (Germany) in September 1996. Some material not presented in Dagstuhl is also included, in order to give a more balanced presentation of the area of Petri nets. The two volumes address those who are

- interested in systems design and would like to learn to use Petri nets,
- familiar with subareas of the theory or the applications of nets and wish to become acquainted with the whole area,

- interested in learning about recent results presented within a unified framework,

- going to learn how to apply Petri nets in various practical situations,

- interested in the relationship of Petri nets to other models of concurrent systems.

Previous Advanced Courses on Petri Nets were held in Hamburg (1978) and in Bad Honnef (1986).

The bulk of current research is presented annually at the International Conference on Application and Theory of Petri nets (ICATPN). This conference is oriented towards a broad audience. It is preceded by two days of tutorials and workshops, covering a wide variety of topics on both elementary and advanced level.

As a further service to the community, the news group on Petri nets provides a forum for news and views about all aspects of Petri nets (PetriNets-request@daimi.aau.dk). The *Petri Net Newsletter*, a communication forum for researchers in Petri nets, can be ordered through Gesellschaft für Informatik, Wissenschaftszentrum, Ahrstr. 45, 53175 Bonn, Germany.

This volume presents basic classes of Petri nets, some central research issues concerning these classes, and the relationship to other models of concurrency. Together with the companion volume on applications, it provides a broad and balanced picture of current trends in the theory and the applications of Petri nets.

Acknowledgements

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Berlin — Wolfgang Reisig
Leiden — Grzegorz Rozenberg

June 1998

Table of Contents Volume One

Table of Contents Volume Two