ICTiB/Proces modelling

Course Syllabus

Number of sessions: 6 (2 hours lecture and 1 hour exercise class per session)
Start/end date: 5th Februari 2010/12th March 2010
Final exam: 26th March 2010
Instructor: Drs. P.M. Kwantes

1 Course description

We have established in the course "ICT enabled process innovation" that process oriented thinking and the (re)engi-neering of business processes can change the way that companies carry out their business. In this second part we will focus on the process engineer, as an agent of this change, and provide him or her with a scientifically sound set of engineering methods and tools. During the course, the participants will become familiar with the look-and-feel of one formal approach to business process modelling, based on Petri nets, and gain hands-on experience with the tools supporting that approach in a realistic case study.

2 Learning objectives

By the end of this course the student should :

- understand the approach of formal business process modelling and analysis with Petri nets
- have an understanding of the theory behind Petri nets
- be able to create a Petri net model in a more or less realistic case
- be able to analyze that model to establish the properties of the process design even before implementation, i.e. on the "drawing board"
- be familiar with *Woped* and *CPN Tools*, both tools for creating and analyzing Petri nets.

3 Texts and other materials

We will use the book "Workflow management. Models, methods and tools", W. van der Aalst, K. van Hee, MIT Press, 2002. Furthermore, before each exercise class handouts will be provided with additional information, exercises and case assignments.

4 Grading

Exercise class : 35 %
Exam (written) : 65 %

Exercise class will be graded based on:

- presence during class
- the exercises and assignments handed out before the beginning of each exercise class
- the Petri net model of the running case (the order process at the LISTA company), that must be handed in before the end of the course.

5 Detailed course outline

Lecture: 1. Introduction

Topic: In this lecture some of the core concepts underlying a formal approach to business process modelling, analysis and design, that will be used throughout this course, will be introduced. The distinction and relationship between an informal description and a formal model of a business process is discussed. Elementary Petri nets as a formal process modelling language is presented and the advantages of formal analysis that come along with it are explained. Finally a first introduction will be given of the "Order process at LISTA" that will be used throughout the course as a modelling case.

Preparation:

Literature: Chapter 1 and 2 "Workflow management. Models, methods and tools", W. van der Aalst, K. van Hee, MIT Press, 2002

Date: Friday 5th Februari

Time: 13.30 - 15.15

Exercise class: Modeling with *Woped*

Topic: You will get acquainted with Woped, which is an advanced tool for modelling and analyzing so called ''classical'' Petri nets. Some exercises will be done to get familiar with the tool and increase understanding of the theory that was presented today. You will receive a handout with exercises and a description of the running case that we will use as a starting point for the first case assignment. The first running case assignment involves making a dataflow diagram of the current order process at the LISTA company.

Literature: Handout I

Date: Friday 5th Februari

Time: 15.30 - 16.30

Lecture: 2. Process modelling and analysis with high level Petri nets

Topic: In this lecture we will extend the toolbox for modelling and analysis of business processes with high(er) level Petri nets. High level Petri nets are more powerful as a modelling language than the Elementary Petri nets discussed in the first lecture. We will introduce Place transition nets as the first member of the class of high level Petri nets.

Preparation:

Literature: Chapter 2 and Appendix A1 in "Workflow management. Models, methods and tools", W. van der Aalst, K. van Hee, MIT Press, 2002

Date: Friday 12th Februari

Time: 13.30 - 15.15

Exercise class: Modeling with *Woped*

Topic: Some exercises will be done to increase understanding of the theory presented today. Furthermore we will translate the dataflow diagram of the "Order process at LISTA", created during the first exercise class, into a first sketch of a Place transition net.

Literature: Handout II

Date: Friday 12th Februari

Time: 15.30 - 16.30

Lecture: 3. Performance analysis with Petri nets

Topic: In this lecture we will first introduce a class of Petri nets called ''Workflow
These Petri nets are specifically taylored to model and analyze workflow proces
which can characterized as ''case-based'' business processes. An order process,
the order process at LISTA that we use as a running case, is a typical example
case-based business process.

Next we will increase the modelling power of the Petri net formalism by extendi
it with the concepts of time and ''colour''. This will enable us create more re
Petri models that are well suited for performance analysis.

Preparation:

Literature: Chapter 3 and par. 4.4. "Workflow management. Models, methods and tools",
W. van der Aalst, K. van Hee, MIT Press, 2002

Date: Friday 19th Februari

Time: 13.30 - 15.15

Exercise class: Modelling with CPN Tools

Topic: Some exercises will be done to increase understanding of the theory
presented today. Furthermore we will create a Petri net model of the
current order process at LISTA in CPN Tools, based on the sketch we
made in the second exercise class, and analyze its performance.

Literature: Handout II and III

Date: Friday 19th Februari

Time: 15.30 - 16.30

Lecture: **4. Simulation and Hierarchical Petri nets**

Topic: To complete the subject of performance analysis started in the previous lecture we will first discuss the subject of ''Simulation'' as a method of establishing the performance of a Petri net model. Next we will extend the concept of High level Petri nets with the option to model hierarchy, enabli modelling strategy.

Preparation:

Literature: Chapter 4 "Workflow management. Models, methods and tools", W. van der Aalst, K. van Hee, MIT Press, 2002

Date: Friday 26th Februari

Time: 13.30 - 15.15

Exercise class: Modelling with CPN Tools

Topic: Some exercises will be done to increase understanding of the theory presented today. Next, we will proceed with the development and analysis of our hierarchical timed coloured petri net model of the current order process at LISTA. Furthermore we will start with the creation and analysis of a Petri net model of an improved order process at LISTA. Comparing the measured performance of the model of the current order process with the performance of the model of the improved process allows a well founded management decision on the best choice for a new design of the order process at LISTA.

Literature: Handout IV

Date: Friday 26th Februari

Time: 15.30 - 16.30

Lecture: 5. Model checking

Topic: Because Petri nets have a formal semantics we can calculate a number of properties of the models we designed. This allows us to check whether a design is actually an improvement even before it leaves the drawing board. In this lecture we will learn more on the techniques that are available to analyze the qualitative properties of Petri net models.

Preparation:

Literature: To be decided.

Date: Friday 5th March

Time: 13.30 - 15.15

Exercise class: Modelling with CPN Tools

Topic: Some model checking exercises and finalizing the running case assignments.

Literature: Handout IV

Date: Friday 5th March

Time: 15.30 - 16.30

Lecture: **6. Formal process modelling: challenges and future directions**

Topic: The experience with formal process modelling gathered during the course is evaluated. Remaining issues and theoretical and practical challenges are discussed as well as possible directions for future research and application.

Preparation:

Literature: To be decided.

Date: Friday 12th March

Time: 13.30 - 15.15

Exercise class: Modelling with CPN Tools

Topic: Finalizing the running case assignments.

Literature:

Date: Friday 12th March

Time: 15.30 - 16.30