

ECE 673 / SYST 620 Discrete Event Systems (3.0:3)

Introduction to modeling and analysis of discrete event dynamical systems. Course covers elements of discrete mathematics and then focuses on Petri Net models and their basic properties such as locality and concurrency. Topics include Condition/event systems; Place/transition nets; Colored Petri nets; Reachability graphs (Occurrence nets); State Space analysis and Invariant analysis, Temporal and stochastic time issues in Petri nets. Stochastic Petri nets. Applications of the theory to modeling and simulation, executable models of architectures, and to systems engineering problems

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Fall 2012: Tuesdays 4:30 – 7:10 PM
Office Hours: Tuesdays 3:00 – 4:30 PM and by appointment

Hardware/Software Requirements:

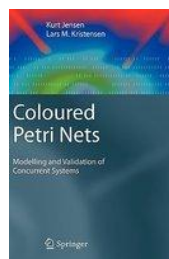
A major part of this course requires students to implement Colored Petri Net models using an application called *CPNTools*. The installer for *CPNTools* is available for download at <http://cpntools.org/download>. *CPNTools* is available for *Windows (XP, Vista, Windows 7 32/64 bit versions)* and *Linux* operating systems. Students are required to have the software ready for use on their individual computers before the second week of the classes.

For more information on the software, visit: <http://cpntools.org>

NOTE: Most of the class sessions will consist of a lecture and a workshop session. The lecture will present the theory and application of Discrete Event Systems while the workshop session will focus on the software application CPN Tools. There will be tutorials, demonstrations, and practice sessions. Students should bring their laptops to class.

Reading and reference material (available via MyMason):

- 1) **Text:** Kurt Jensen and Lars Kristensen, *Coloured Petri Nets: Modelling And Validation of Concurrent Systems*, Springer, Berlin



- 2) Class notes by A. H. Levis and A. K. Zaidi
- 3) Supplementary Readings: A set of papers and books on Petri Nets and CPN Tools made available via MyMason.gmu.edu

Student Evaluation Criteria: Homework 50%; Midterm 25%; Final 25%

COURSE OUTLINE
(Tentative)

	Lecture Topic	Workshop Topic
08/28/2012	1. Systems and Models; Graph Theory; Petri Net Basics	CPN Tools Preliminaries
09/04/2012	2. Set Theory; Essential Features of Petri Nets	Tutorial: CPN Tools I
09/11/2012	3. Symbolic Logic; Petri Net Models and Definitions	Tutorial: CPN Tools II
09/18/2012	4. Colored Petri Nets	Tutorial: CPN Tools III
09/25/2012	5. PN Properties	ML programming I
10/02/2012	6. Formal Definition of Colored Petri Nets (CPN)	ML programming II
10/09/2012	<i>Columbus Day Recess (Monday classes meet on Tuesday)</i>	
10/16/2012	7. Midterm Exam	
10/23/2012	8. Petri Nets with Time	Tutorial: Time in CPN Tools
10/30/2012	9. Timed CPN; Hierarchical Petri Nets	Tutorial: Creating Hierarchies
11/06/2012	10. State Space Analysis	Tutorial: State Space Analysis
11/13/2012	11. Structural Methods and Invariants	Tutorial: The Farkas Algorithm
11/20/2012	12. Stochastic Petri Nets	Tutorial: Simulation Based Analyses
11/27/2012	13. Engineering Applications of Petri Nets	Demonstration of Models
12/04/2012	14. Review	
12/19/2012	15. Final Exam	