George Mason University **The Volgenau School of Engineering**

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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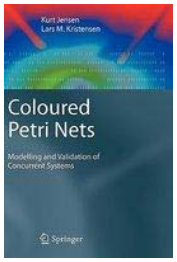
Hardware/Software Requirements:
A major part of this course requires students to implement Colored Petri Net models using an application called *CPNTools*. The installer for *CPNTools* (*Windows*) is made available at the course's Blackboard site for download. *CPNTools* is available for *Windows (XP, Vista 32 bit)* 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://wiki.daimi.au.dk/cpntools/_home.wiki

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 Blackboard):

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

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

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COURSE OUTLINE

	Lecture Topics	**Workshop topic**
8/30/2010	1. Systems and Models; Graph Theory; Petri Net Basics	CPN Tools Preliminaries
9/13/2010	2. Set Theory; Essential Features of Petri Nets	Tutorial: CPN Tools I
9/20/2010	3. Symbolic Logic; Petri Net models and Definitions	Tutorial: CPN Tools II
9/27/2010	4. Colored Petri Nets	Tutorial: CPN Tools III
10/4/2010	5. PN properties	ML programming I
10/12/2010	6. Formal Definition of CPN	ML programming II
10/18/2010	7. Petri Nets and Time	ML programming III
10/25/2010	**8. Midterm Exam**	
11/1/2010	9. Timed CPN; Hierarchical Petri Nets	
11/8/2010	10. State Space Analysis	Tutorial: State Space analysis tools
11/15/2010	11. Structural Methods and Invariants	Tutorial: The Farkas Algorithm
11/22/2010	12. Stochastic Petri Nets	Tutorial: Simulation based analysis
11/29/2010	13. Engineering applications of Petri Nets	
12/6/2010	14. Review	
12/20/2010	**15. Final Exam**	