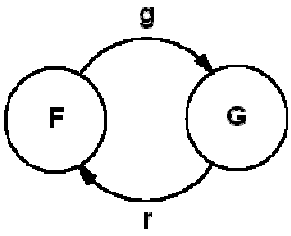
Discrete Event Systems

2014/15



Master of Science in Engineering – University of Siena

About the instructor

Ing. Simone Paoletti

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web page: http://www3.diism.unisi.it/~paoletti/

office hours: TO BE DECIDED

research interests:

- system identification
- robust control of uncertain systems
- smart grids

About the course (1/2)

- Students:
  - ✓ MSc Computer and Automation Engineering (1st year)
  - ✓ LM Ingegneria Gestionale (1st year)
  - ✓ others?
- 6 CFU (about 54 hours)
  - ✓ ~75% lectures and exercises
  - ✓ ~25% lab tutorials

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About the course (2/2)

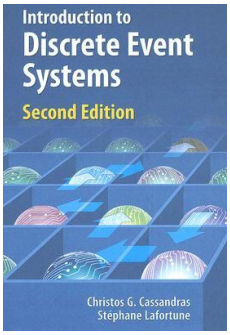
Basic background:

- Dynamical systems
- Probability

Textbook:

C.G. Cassandras, S. Lafortune,
"Introduction to discrete event systems", 2nd ed.
Springer, 2008

+ lecture notes available on-line



Exams (1/2)

- The final exam is both written and oral
  - ✓ admission to the oral exam is subject to a grade ≥18 obtained at the written exam
  - ✓ the oral exam should be given within the same session as the written exam
- One midterm and one endterm written exam during the course
  - ✓ admission to the oral exam is subject to an average grade ≥18 and both grades ≥15
  - ✓ during the winter session of exams, students may improve the grade of either the midterm or the endterm written exam

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Exams (2/2)

- The written exams may consist of both:
  - ✓ exercises “on the paper”
  - ✓ exercises with Matlab
- The language for oral exams can be either English or Italian

Course schedule

Duration: from October 1, 2014 to January 14, 2015

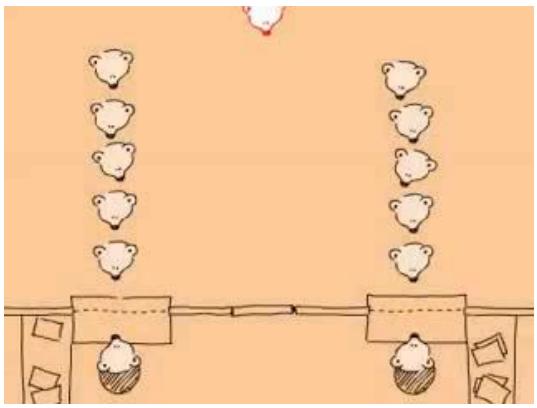
- Monday – from 9AM to 1PM (room F)
- Wednesday – from 2PM to 4PM (room F)

Web-page

General information, lecture notes, exercises, past exams, etc. are available on the course web page:

http://www3.diism.unisi.it/~paoletti/teaching/sed/1415/index.html

What is this course about?



Queueing systems are a particular case of discrete event systems…

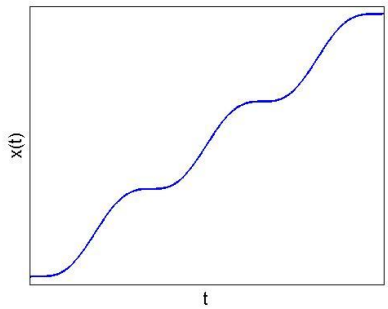
Discrete event systems (1/2)

A *discrete event system* (DES) is a dynamical system characterized by:

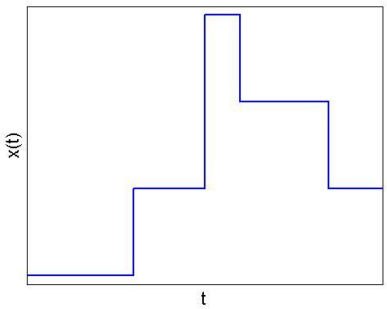
- a discrete set **E** of events
- a discrete state space **X**
- "event-driven" dynamics

the state changes only upon the (typically asynchronous) occurrence of *events*

Discrete event systems (2/2)



"time-driven" dynamics



"event-driven" dynamics

Examples of discrete event systems (1/3)

- a *manufacturing plant* with machines, workers, conveyor belts, buffers, etc.
- a *bank* with different types of customers and services (desks, ATMs, etc.)
- an *airport* with passengers in different states (check-in, security control, gate, boarding, etc.)
- a *computer system* with resources and processes needing access to resources
- a *road system* with cars, roads, crosses, traffic lights, etc.
- a *fast-food restaurant* with a staff and different types of customers

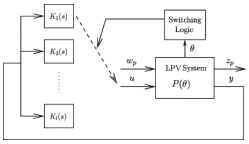
Examples of discrete event systems (2/3)

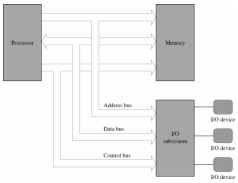
- a *switching control system* where it is possible to switch between different controllers
- an *electronic component* subject to deterioration and failures
- etc.

Examples of discrete event systems (3/3)

Summarizing, discrete event systems can be found in:

- control systems
- manufacturing systems
- computer systems
- information networks
- transportation networks
- communication networks
- etc.





Objective

Modelling, simulation and analysis of Discrete Event Systems

Main contents:

- modelling
- probability
- (programming)

Which types of models will be considered?

- Logical models (state automata)
- Timed models (deterministic/stochastic timed automata)
- Markov chains

Main application: queueing theory

Questions?