DISCRETE EVENT SYSTEMS

Roger Wattenhofer
Chapter 0

INTRODUCTION

Roger Wattenhofer
Organization Matters

- **Lecture**
  - Thu, 1-3, ETZ E9
  - Roger Wattenhofer

- **Exercises**
  - Thu, 3-5, ETZ E9
  - Klaus-Tycho Förster, Tobias Langner, Jochen Seidel

- **Course Material**
  - Check www.disco.ethz.ch → courses
Some Comments

- **English vs. German** language

- Course material **pretty stable**
  - Slides/material on web site before lecture...

- **Differences** to last year’s course
  - A few new things... a few things dropped...

- **ITET vs. other types of students**...
Course Overview

• Part 1: Theory of Coke Vending Machines
  – Automata and Languages
  – Discrete Event Systems (DES) Models

• Part 2: Theory of Standing in a Line
  – Stochastic Processes
  – Markov Chains, Queuing Theory
  – Average-Case Analysis of DES

• Part 3: Theory of Renting Skis
  – Online & Streaming Algorithms
  – Worst-Case Analysis of DES

• Plus a few smaller parts
Motivation: Orthodox EE

- Science is often based on natural phenomena
- Laws of physics: mechanics, gravitation, electrodynamics
- Continuous variables for mass, velocity, power, etc.
- Can be solved by differential equations
Motivation: Discrete Events

• Some complex systems are not [primarily/only] continuous
  – Computer systems
  – Communication networks
  – Business processes (“workflow”)
  – Transportation systems
  – Software

• Instead systems are determined by discrete events
  – Telephone calls
  – Customers arrivals

• „Theoretical Computer Science for IT/EE students“
Motivation: System Classification

SYSTEMS
  └── STATIC
      ├── TIME-VARYING
      │     └── LINEAR
      │         └── TIME-DRIVEN
      │             └── DETERMINISTIC
      │                 └── DISCRETE-TIME
      └── DYNAMIC
           ├── TIME-INVARIANT
           │     └── NONLINEAR
           │         └── EVENT-DRIVEN
           │             └── STOCHASTIC
           └── DISCRETE EVENT SYSTEMS (DES)
                ├── CONTINUOUS-STATE
                │     └── TIME-DRIVEN
                │         └── DETERMINISTIC
                │                 └── DISCRETE-TIME
                └── DISCRETE-STATE
                     └── EVENT-DRIVEN
                          └── STOCHASTIC
                               └── CONTINUOUS-TIME
Some Literature

- **Part 1**
- **Part 2**
  - Thomas Schickinger, Angelika Steger: Diskrete Strukturen, Band 2. Springer, 2001. (Chapters 1, 2, and 4)
- **Part 3**
- Plus research papers...