Real-Time Scheduling Theory

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2008 Fall

Major References:
Real-Time Systems，國立臺灣大學, 郭大維教授
Real-Time Computing，國立交通大學, 張立平教授

Course Information

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- Course Information
  - 課程代碼：CS5103701
  - 上課時間：五 234
  - 上課教室：T4-304
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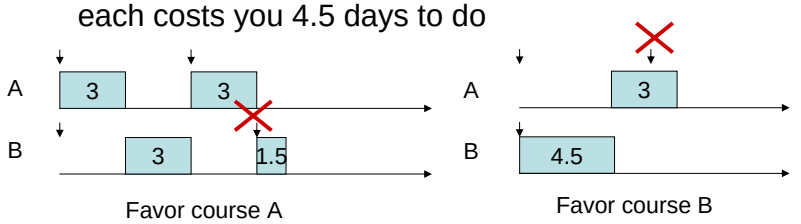
  - RB-501

Motivation (1/3)

- Take yourself as an example
  - Naturally you have a number of things to do with time pressure
    - Project deadlines
    - Meeting time
    - Class time
    - …
  - Some of them regularly recur but some don't
    - Attend the class every Friday (periodic)
    - Go to the movies on 8:00pm (aperiodic)
    - Date with a girl/boy friend (sporadic)
    - …

Motivation (2/3)

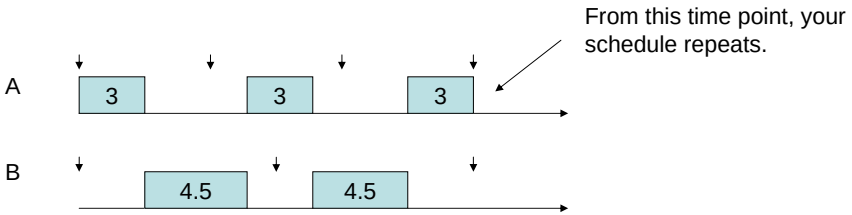
- You schedule yourself to meet deadlines
  - Course A: one homework is announced every 6 days, each costs you 3 days to do
  - Course B: one homework is announced every 9 days, each costs you 4.5 days to do



- You miss deadlines of one course if your policy favors either one course.

Motivation (3/3)

- Schedule to meet deadlines
  - Course A: (3, 6)
  - Course B: (4.5, 9)
- All deadlines are met if you do whatever has the closest deadline.



Introduction to Real-Time Systems

- What is a real-time system?

  Any system where a timely response by the computer to external stimuli is vital!
- Examples:
  - multimedia systems, virtual reality, games.
  - avionics, air traffic control, nuclear power plant
  - stock market, trading system, information access, etc.
- Does the definition make every computer a real-time computer?

  Yes! It is if we need some response from a computer within a finite time!!

Course Objectives

- Real-time scheduling theory, however, usually can't be directly applied to realistic systems
  - Then why should we lean theoretical matters?
  - That's to avoid choosing bad designs, and, of course, to come to a good design, e.g., a frequently overloaded system should provide stable prioritization rather than high resource utilization

Concepts for Real-Time Systems

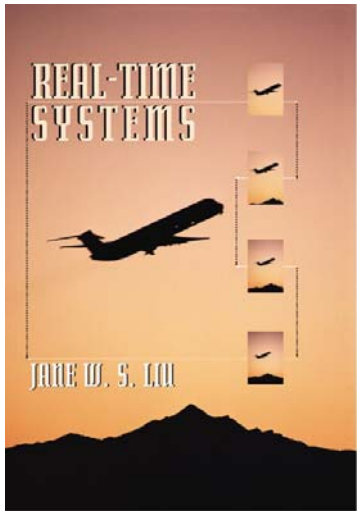
- Guarantee, guarantee, and guarantee
  - Real-time systems are not high-performance systems

  - How to provide performance guarantees with low hardware cost?
    - To answer this question, you have to know how to analyze your system.

Reference

Real-Time Systems

- Jane W. S. Liu



- ISBN: 0-13-099651-3
- Publisher: Prentice Hall
- Copyright: 2000
- Format: 624 Pages
- Published: 04/13/2000

Outline of the Course

- Priority-Driven Scheduling of Periodic Tasks
  - Fixed-Priority vs. Dynamic-Priority Algorithms
  - Exact Schedulability Test
  - Sufficient Schedulability Conditions
  - Practical Factors
- Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems
  - Deferrable Servers
  - Sporadic Servers
  - Constant Utilization, Total Bandwidth, and Weighted Fair-Queueing Servers
  - Scheduling of Sporadic Jobs

Grading Policy

- 2 Quizzes (20%)
- Midterm (30%)
- Final (35%)
- Paper Presentation (10%)
- Lecturer’s Flexibility (5%)