Introduction to Real-Time Systems

Bulletin Description

This introduction to real-time systems begins with grouping such systems under several fundamental classifications. We will develop a model to reason about these systems and cover a sampling of scheduling algorithms for uniprocessor systems. We will prove tests for these scheduling algorithms that ensure the desired system behavior. As a means of introducing some of the complexities in real systems, students will implement simulations of several scheduling algorithms. We will also cover a limited preemption model and an introduction to multiprocessor scheduling. This course builds on the reasoning skills developed in COMP 283/MATH 381 and COMP 550, as well as knowledge of basic computer architecture covered in COMP 411. An introduction to the basic concepts of operating systems required for this course will be given.

General Course Info

Term:	Fall 2018
Course:	COMP 590-001
Time:	MW 9:05-10:20am
Location:	SN 011
Website:	http://www.cs.unc.edu/~jarretc/f18-590/

Instructor Info

Name:	Catherine Nemitz
Office:	FB 132
Email:	nemitz@cs.unc.edu
Web:	http://www.cs.unc.edu/~jarretc
Office Hours:	TBD And by appointment. Email to set up a time.

Target Audience

With the growing prevalence of real-time systems, students of computer science will benefit from an introduction to real-time systems. In addition to covering well-established results in the field, this course will introduce several topics of current research and train students to read papers of the latest research for comprehension of high-level concepts.

Prerequisites

COMP 401, COMP 410, COMP 411, COMP 283 or MATH 381, and COMP 550.

Goals and Key Learning Objectives

Upon successful completion of this course, students will be able to:

- Identify real-time systems and classify them as hard- or soft-real-time
- Discuss simplifications made to our model of real-time systems
- Illustrate schedules developed by EDF, RM, DM, and cyclic executive scheduling algorithms
- Apply schedulability tests properly
- Analyze resource access protocols in the context of real-time systems
- Discuss additional challenges that arise in multiprocessor systems as opposed to uniprocessor systems
- Read recent research papers at a basic level of comprehension

Course Requirements

Students must attend lectures and complete assigned readings, homework sets, and programming assignments to reinforce the content learned in lecture and from readings.

Attendance and Participation

Students are expected to attend every class. I expect active participation and for students to come to class ready to discuss the assigned reading for that class. Absences will be excused for university organized and sponsored activities, religious observances, and documented medical reasons if the student notifies me prior to missing class.

Laptops, tablets, phones, and other electronics other than calculators may not be used in class unless explicitly stated otherwise. Exceptions can be made to accomodate students registered with the Accessibility Resources and Service office (https://ars.unc.edu/).

Textbooks and Resources

Text: *Hard Real-Time Computing Systems: Predictable Scheduling Algorithms and Applications*, Giorgia Buttazzo, Springer, 1997. Available online through UNC Library.
Additional readings: Available on Sakai as material is covered.

Assignments

This course will have regular homework assignments, required reading, and programming assignments. Additionally, optional worksheets will be provided. All assignments will be posted on the course webpage. A CS account is required for the programming assignments; if you do not have a CS account, email help@cs.unc.edu.

Course Policies

All homework, programming, and reading assignments will be posted on the course webpage along with corresponding due dates. Students are allowed two "late days," which can be applied to any assignment(s). Each late day allows a 24-hour extension on an assignment with no penalty. Late assignments will not be accepted if a student has used all of their late days or after the last day of class, regardless of remaining late days. In the case of extenuating circumstances, contact me before the assignment is due.

Grading Criteria

Class Participation: 5%
Quizzes: 5%
Homework: 25%
Midterms: 30% (15% each)
Final: 35%

Key Dates

No class due to university holidays:
- September 3 (Labor Day)
- November 21 (Thanksgiving)

Expected exam dates:
- Midterm 1: September 24, 2018
- Midterm 2: October 29, 2018
- Final exam: December 8, 2018 at 8am

The course final is given in compliance with UNC final exam regulations and according to the UNC Final Exam calendar. This calendar can be found at http://registrar.unc.edu/academic-calendar/.

Course Schedule

What is a real-time system?
Categorizing real-time systems
Fundamental notation
Dynamic scheduling algorithms
Scheduler optimality
Schedulability tests
Static scheduling
Resource sharing on uniprocessors
Introduction to multiprocessor scheduling
Current research topics

Honor Code

All students are expected to abide by the Honor Code. No collaboration is allowed on any assignment or exam unless explicitly stated otherwise.

Disclaimer

The instructor reserves the right to make changes to the syllabus, including exam dates (excluding the officially scheduled final examination). These changes will be announced as early as possible so that students can adjust their schedules.

Additional resources

Coursework is not the only thing happening in life at or away from the university. UNC has resources for helping find balance at https://studentwellness.unc.edu.

If you need to talk to someone, the CAPS office has walk-in hours: https://caps.unc.edu/.

If you are concerned about someone, submit a Care Report: https://odos.unc.edu/carereferral.

Other resources: https://studentsuccess.unc.edu/student-resources-overview/.