Operating Systems (Honors)

Bulletin Description

Types of operating systems. Concurrent programming. Management of storage, processes, devices. Scheduling, protection. Case study. Course includes a programming laboratory.

General Course Info

Term: Fall 2014  
Department: COMP  
Course Number: 530H  
Section Number: 001  

Time: Fridays 11:00 – 12:15  
Location: SN 115  
Website: http://www.cs.unc.edu/~jeffay/courses/comp530H

Instructor Info

Name: Dr. Kevin Jeffay  
Office: FB 116  
Email: jeffay@cs.unc.edu  
Phone: 919-560-6238  
Web: http://jeffay.web.unc.edu  
Office Hours: By appointment

Teaching Assistants

The teaching assistant is Alex Blate, blate@cs.unc.edu, in SN 137.

Textbooks and Resources

The Honors course also has a different laboratory component wherein you will modify various parts of the Linux operating system. The programs will be written on a Linux virtual machine machine. Strong C programming and Linux programming environment will be necessary for this lab. The lab will have a required text:


An additional suggested reference text is:


Course Description
This course is an adjunct to COMP 530 Operating Systems. All students enrolled in COMP 530H are expected to also be enrolled in COMP530 or to have previously taken COMP 530. The goal of the course is to explore the basic concepts of operating systems (processes, scheduling, etc.) but do so within the context of the Linux operating system kernel through a study of Linux source code and the development of loadable kernel modules that will students to modify and experiment with the kernel.

The course will consist of a number of experiments with the Linux kernel.

Target Audience

The course is geared towards advanced undergraduate computer science majors and first year graduate students in computer science who desire to learn more about the internals of the Linux operating system. Students must have strong C programming language skills and substantive experience developing programs on Linux.

Prerequisites

COMP 410, 411, and COMP 530 (or co-enrollment in COMP530). These are hard prerequisites.

Additionally, students are expected to demonstrate proficiency with the C programming language as well as with the Linux operating system as a program development environment. These proficiencies will be assessed by the instructor through an interview process to be conducted during the first week of classes.

Goals and Key Learning Objectives

Students will learn how to write concurrent programs, how to synchronize concurrently executing processes, and how to communicate data between such processes. They will learn how to allocate system resources such as memory and processor cycles to processes and how such allocation decisions effect system performance. They will also learn how system resources can be virtualized and shared between processes so as to provide the abstraction that each process is executing on a dedicated machine. Students will study these concepts via an in depth examination of the Linux operation system.

Course Requirements

The class will be taught in a traditional lecture format. The lectures will largely be guided tours of Lunix kernel code and data structures. Outside of class, students will complete a number of laboratory programming exercises as described above.
Key Dates

The Final Exam is scheduled for Friday, December 5 at 12 Noon.
More importantly, Fall Break is October 16 & 17!

Grading Criteria

Your grade in this class will be based on:
- Programming assignments (approximately 60%),
- 3 "tri"-term examinations (approximately 20%),
- Final examination (approximately 20%), and

Course Policies

Programming assignments will be assigned approximately every two to three weeks. You can expect to always have an outstanding programming assignment throughout the semester.

All assignments will be submitted via email before the start of class on the day on which they are due.

All assignments submitted after their deadline is considered late. Assignments may be submitted up to 5PM on the date due for a 15% grade deduction penalty. Assignments will not be accepted after 5PM on the date due.

Exceptions to this requirement must be approved by the instructor in advance of the date due.

The course final is given in compliance with UNC final exam regulations and according to the UNC Final Exam calendar.

Honor Code

Students are encouraged to work together on written homework assignments. Acceptable collaboration on written homework assignments includes:

- discussing the assigned problems to understand their meaning, and
- discussing possible approaches to assigned problems.

In all cases you must explicitly acknowledge any and all substantive help received from other individuals during the course of the preparation of your homework solution. That is, if you collaborate with other individuals then you must include an explicit acknowledgment in your homework solution of the persons from whom you received aid. You should include the acknowledgement with your Honor Code pledge. Acknowledging others, if done properly, will not adversely affect your grade.
Unacceptable collaboration on written homework includes:

- Copying (verbatim or substantially similar use) of physical papers or computer files,
- Working with individuals who are not presently members of the course, and
- Submission of solutions that are jointly authored, or authored either wholly or in part by other individuals.

The general rule to be followed is that the strategy and approach of solutions may be developed jointly but all actual solutions (i.e., the final solution) must be constructed and written up individually. Work done jointly should not be done in sufficient detail as to make it a final solution. For example, solutions may sketched out jointly, however each student must construct the final form of their solution individually and write-up their own solution.

For programming assignments absolutely no code may be shared between students. If you copy or transcribe one or more lines of code from any other student (including students/persons not in this course) you are in violation of the Honor Code.

Unacceptable collaboration will be considered a violation of the UNC Honor Code and will be reported to the Student Attorney General.

Should questions arise the course of working on a problem please feel free to immediately contact the instructor either by telephone, electronic mail, or by an office visit. In principle, if you work with others in good faith and are honest and generous with your attributions of credit you will have no problems.

Course Schedule (Approximate!)

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Assignments</th>
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<tbody>
<tr>
<td>Aug. 20</td>
<td>COMP 530 course introduction &amp; mechanics</td>
<td>HW 0 assigned, due Aug. 29</td>
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<tr>
<td>Aug. 22</td>
<td>COMP 530H course introduction &amp; mechanics</td>
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<tr>
<td>Aug. 29</td>
<td>Programming Tools and Resources Including VM Setup</td>
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<tr>
<td>Sept. 5</td>
<td>Developing Linux Kernel Modules</td>
<td>HW 1 assigned, due Sep. 12</td>
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<td>Sept. 12</td>
<td>Linux Organization and Process Implementation</td>
<td>HW 2 assigned, due Sep. 26</td>
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<td>Sept. 19</td>
<td>Linux Processes, Interrupts, and Preemption</td>
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<td>Sept. 26</td>
<td>Linux Process Blocking and Wait Queues</td>
<td>HW 3 assigned, due Oct. 10</td>
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<td>Oct. 3</td>
<td>Linux Conditional Waiting and Signaling</td>
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<td>Date</td>
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<tr>
<td>Oct. 10</td>
<td>Linux Scheduler Implementation</td>
<td>HW4 assigned, due Oct. 31</td>
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<td>Oct. 17</td>
<td>Fall Break</td>
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<td>Oct. 24</td>
<td>Linux “Real-Time” Scheduling</td>
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<td>Oct. 31</td>
<td>Linux Memory Organization</td>
<td>HW 5 assigned, due Nov. 14</td>
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<td>Nov. 7</td>
<td>Linux Virtual Memory</td>
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<td>Nov. 14</td>
<td>Linux Disk I/O Scheduling</td>
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<td>Nov. 21</td>
<td>TBA</td>
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<td>Nov. 28</td>
<td>Thanksgiving break</td>
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<td>Dec. 3</td>
<td>TBA</td>
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<tr>
<td>Fri. Dec. 5</td>
<td>Final Exam</td>
<td>12 Noon</td>
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Disclaimer

“The professor reserves to right to make changes to the syllabus, including project due dates and test dates. These changes will be announced as early as possible.”