CSE 3100 Systems Programming – Spring 2022
Updated 03/24/22

Lecture
Mon/Wed 10:10am–11:00am, Storrs Hall WW16

Lab
Section 001L: F 12:20PM - 2:10PM, E2 306
Section 002L: F 10:00AM - 11:50AM, E2 306
Section 003L: F 2:30PM - 4:20PM, E2 306
Section 011L: F 2:30PM - 4:20PM, ITE 134
Section 012L: F 10:00AM - 11:50AM, ITE 134
Section 013L: F 12:20PM - 2:10PM, ITE 134

Instructor
Ion Mandoiu
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M/W/F 11:30am–12:30pm
ITE 261

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M 1-3pm, Tu 6-7pm
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For latest office hours see Piazza

Catalog Description
Introduction to system-level programming with an emphasis on C programming, process management and small scale concurrency with multi-threaded programming. Special attention will be devoted to proficiency with memory management and debugging facilities both in a sequential and parallel setting.
Prerequisite: CSE 2050 or 2100
Course objectives
The goal of the course is to introduce students to basic operating systems concepts, programming techniques, and modern development tools such as integrated development environments, debuggers, and profilers that enable them to design and implement efficient systems programs. Specific objectives include:

- Becoming proficient at C programming including the use of pointers and memory management.
- Understanding inter-process communication primitives such as pipes and sockets and how to use them to build client-server applications.
- Understanding intra-process concurrency primitives, in particular, POSIX threads and synchronization primitives such as mutexes and condition variables needed to write multi-threaded applications.

Learning Outcomes
Upon successful completion of the course, students are be able to:

- Write C programs that use dynamic memory allocation.
- Write C programs that create, manage and terminate processes and threads on UNIX.
- Write C programs that use UNIX synchronization primitives.
- Develop simple client-server applications that communicate across a network.

Required Textbook
Al Kelley and Ira Pohl
*A Book on C*, 4th Edition
Addison-Wesley
Book website including source code for all examples:
https://users.soe.ucsc.edu/~pohl/abc4.html

Optional Textbooks
Brian W. Kernighan and Dennis M. Ritchie
*The C Programming Language*, 2nd Edition
Prentice Hall

David R. Butenhof
*Programming with POSIX Threads*, 1st Edition
Addison-Wesley

Online platforms
**Moodle.** We will use a course website hosted using Moodle at edx.engr.uconn.edu. Please use the Moodle site to access quizzes, interactive videos, programming assignments, grades, and other course materials.

**Piazza.** For electronic class discussions we will be using Piazza, which can be accessed from Moodle (the first access will ask you to confirm joining our Piazza class if you have not done it already). You are strongly encouraged to ask class-related questions and communicate with other students, the instructors,
and the TAs via Piazza rather than e-mail. Please observe basic etiquette by keeping your messages polite, concise, and on-topic. Before posting new messages do take a look at the postings that are already there—it is possible that your question has already been answered. Appropriate questions include general questions about the material covered in class and clarifications on the assignments. Keep in mind that the collaboration policy is in effect and you must not post extensive code fragments in public messages. For questions that are specific to your work use direct messages to the instructors or the TAs.

**Code-server IDE.** To ensure a consistent development environment, each student will have access to a VS Code IDE running on a 4-core virtual machine and accessible via any modern web browser at code.engr.uconn.edu after NetID login.

**Grading**

Asynchronous course content (graded interactive videos and quizzes) will be posted weekly on Moodle. It is essential that you review the asynchronous content and complete associated quizzes by the due date (typically before each class meeting) to ensure you are prepared to participate in class discussions. In addition to interactive videos and quizzes, grading will be based on weekly labs, programming projects, and three exams. Labs are short C programming exercises designed to give you hands-on practice with common programming tools and an opportunity to apply the concepts covered in lectures. Programming projects will require you to write more complex C programs, often building on a provided code base. The exams will consist of programming tasks similar to those in the labs and homework assignments.

**Grade breakdown**

- Labs: 10%
- Quizzes & interactive videos: 20%
- Programming projects: 25%
- Three exams: 15% each

The lowest lab score and lowest programming project score will be dropped from the overall grade calculation.

**Collaboration policy**

Unless otherwise indicated, assignments must be completed individually. All programs and documents you hand-in must be your own work. You may discuss course related topics with others, but must not share code or quizz answers. Reasonable use of published materials (including web resources) is allowed, but all sources must be explicitly acknowledged in your submissions. Violations will be reviewed and sanctioned according to the University Policy on Academic Integrity. An example of unreasonable use is submitting copied solutions with minor changes like renaming variables. If you need additional clarifications regarding the collaboration policy, please contact the instructor.

**Students with disabilities:**

If you have a documented disability for which you are or may be requesting an accommodation, please contact the Center for Students with Disabilities by the end of the third week of the semester to ensure that any accommodations you need can be implemented in a timely fashion.
<table>
<thead>
<tr>
<th>Dates</th>
<th>Lecture/Lab topics</th>
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<tbody>
<tr>
<td>Jan 19</td>
<td>Course introduction; C overview</td>
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<tr>
<td>Jan 21</td>
<td><strong>NO LAB MEETINGS</strong></td>
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<tr>
<td>Jan 24 &amp; 26</td>
<td>Expressions and basic data types, control flow (ABC Ch. 2-4)</td>
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<td>Jan 28</td>
<td>Lab1: code-server IDE; basic terminal commands; <strong>make</strong></td>
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<td>Jan 31 &amp; Feb 2</td>
<td>Functions, arrays, and structures (ABC Ch. 5-6 &amp; 9)</td>
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<td>Feb 4</td>
<td><strong>Lab canceled due to inclement weather</strong></td>
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<tr>
<td>Feb 7 &amp; 9</td>
<td>Pointers and dynamic memory allocation (ABC Ch. 6)</td>
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<tr>
<td>Feb 11</td>
<td>Lab2: Debugging</td>
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<tr>
<td>Feb 14 &amp; 16</td>
<td>Pointer arithmetic and I/O (ABC Ch. 6 &amp; 11)</td>
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<td>Feb 18</td>
<td>Lab3: <strong>valgrind</strong></td>
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<tr>
<td>Feb 21 &amp; 23</td>
<td>Miscellaneous C topics and review for exam #1</td>
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<tr>
<td>Feb 25</td>
<td><strong>Lab canceled due to inclement weather</strong></td>
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<tr>
<td>Feb 28 &amp; March 2</td>
<td>Processes, upgrades, &amp; intro to redirections (ABC Ch. 11 &amp; 12)</td>
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<td>March 4</td>
<td><strong>EXAM 1</strong></td>
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<tr>
<td>March 7 &amp; March 9</td>
<td>Inter-process communication using pipes (ABC 12.3) &amp; I/O</td>
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<td>March 11</td>
<td>Lab4: pipes</td>
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<tr>
<td>March 21 &amp; 23</td>
<td>Intro to sockets and client-server communication (Beej’s guide)</td>
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<tr>
<td>March 25</td>
<td>(March 21 meeting cancelled due to power outage)</td>
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<tr>
<td>March 28 &amp; 30</td>
<td>Lab5: sockets</td>
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<td>Apr 1</td>
<td>Signals (ABC Ch. 12)</td>
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<td>Apr 4 &amp; 6</td>
<td>Lab6: Debugging multi-process applications</td>
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<td>April 8</td>
<td><strong>EXAM 2</strong></td>
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<tr>
<td>April 11 &amp; 13</td>
<td>Basic thread management and synchronization</td>
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<td>April 15</td>
<td>Lab7: thread management</td>
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<td>April 18 &amp; 20</td>
<td>Thread synchronization</td>
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<td>April 22</td>
<td>Lab8: thread synchronization</td>
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<td>April 25 &amp; 27</td>
<td>False sharing; threads scheduling and priority inversion; review for exam #3</td>
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<tr>
<td>Apr 29</td>
<td><strong>EXAM 3</strong></td>
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