
COP5618 CONCURRENT PROGRAMMING

CATALOG DESCRIPTION Overview of principles and programming techniques. Reasoning about concurrency, synchronization, program structuring, multi-threaded server applications. (3 credit hours)

PRE-REQUISITES AND CO-REQUISITES COP 3100 and COP3530 or equivalent. Ability to program in Java and C.

COURSE OBJECTIVES A concurrent program contains several "threads of control" that execute at the same time. Each thread may have its own processor, or the system may switch between threads, simulating parallelism. In either case, writing correct and efficient concurrent programs is fundamentally more difficult than normal sequential programs. In the past, concurrent programming has been primarily done by specialists. Now, due to the ubiquity of GUI and web-based applications whose performance can often be improved significantly with the use of concurrency, as well as the ubiquity of multicore PCs and accelerators such as GPUs, concurrent programming promises to become much more widespread. The objectives of this course are to provide an in-depth overview of underlying principles as well as practical programming techniques that will enable students to construct well-engineered concurrent programs that are both correct and performant. Students will also be exposed to the most important concurrent and parallel programming environments.

INSTRUCTOR Beverly A. Sanders

OFFICE LOCATION CSE 358

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CLASS WEB SITE Announcements and course materials will be posted on the course e-learning site: lss.at.ufl.edu

OFFICE HOURS : Thursday 4 (10:40-11:35)

TEACHING ASSISTANT Nakul Jindal

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OFFICE HOURS TBA (see the course e-learning site)

MEETING TIMES T 2-3, R 3 (Tuesday 8:30-10:25, Thursday 9:35-10:25)

CLASS/LABORATORY SCHEDULE One 100 minute and one 50 minute lecture per week.

MEETING LOCATION CSE 119

MATERIAL AND SUPPLY FEES none

TEXTBOOKS AND SOFTWARE REQUIRED

Textbooks: No textbook is required. Course slides and/or notes developed by the instructor will be provided

Software: Java, C, possibly including additional opens source software if required by student's project choice.

Recommended Reading:

Goetz, et. al. Java: Concurrency in Practice. Addison Wesley. 2006
Mattson, Sanders, and Massingill. Patterns for Parallel Programming. Addison Wesley. 2005
Andrews. Concurrent Programming: Principles and Practice. Benjamin/Cummings. 1991.
Herlihy and Shavit. The Art of Multiprocessor Programming. Morgan Kaufman. 2008.

COURSE OUTLINE

1. Overview
2. Processes and threads
3. Atomicity and synchronization
4. Conditional synchronization
5. Additional synchronization mechanisms: readers/writers locks, semaphores, futures, barriers, etc.
6. Cancellation, deadlocks
7. Concurrent data structures
8. A closer look at the memory hierarchy: Relaxed Memory Models and Lock implementations
9. Linearizability and correctness
10. Non-blocking algorithms and data structures
11. Parallel programming: finding the concurrency
12. Fork/Join parallelism and OpenMP
13. SPMD and MPI
14. Data Parallelism and OpenCL
15. Parallel programming environments: Examples may include MapReduce, X10, Scala Actors, Cilk, TBB as time permits.

ATTENDANCE AND EXPECTATIONS Although attendance will not be recorded, *students are expected to attend all class meeting periods*. Any material covered during class, whether covered in handout material or not, may appear on exams. Attendance is mandatory on Tuesday, December 4, which will be devoted to project poster presentations.

All deadlines will be strictly enforced. Please do not ask for extensions.

GRADING – METHODS OF EVALUATION

Exams: 50% (midterm 20%, comprehensive final 30%)

Homework assignments: 10%

Project: 40%, including written report , demo, and poster presentation

Note that the final exam will be given on the date and time scheduled for our course by the registrar: Tuesday, Dec 10 at 5:30pm-7:30pm. *All students must take the exam at this time;* plan your December travel schedule accordingly.

The final class period on Tuesday, December 4 will be devoted to a poster session to present results from the project. Attendance on this day is mandatory.

GRADING SCALE

Grades will be curved at a level appropriate for a graduate course

“Undergraduate students, in order to graduate, must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

MAKE-UP EXAM POLICY – No makeup exams will be given. Students may be excused from an exam only for documented medical reasons and emergencies. In such cases the overall course grade will be determined based on work that has been completed.

HONESTY POLICY - All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

ACCOMMODATION FOR STUDENTS WITH DISABILITIES – Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

UF COUNSELING SERVICES – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

SOFTWARE USE – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.