CIS4930/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
TELEPHONE 352 505 1563
E-MAIL ADDRESS sanders@cise.ufl.edu (Please include Concurrent Programming in the subject line)
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

E-MAIL ADDRESS nakul02@ufl.edu
OFFICE HOURS TBA (see the course e-learning site)

MEETING TIMES MWF 7 (1:55 – 2:45)

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

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 C++11Android, MapReduce, X10, Scala
    Actors, Cilk, TBB as time permits.

ATTENDANCE AND EXPECTATIONS  Attendance at the following meeting times is mandatory:

Feb 26 (description of project)

April 21 and 23  (project posters and demos)

Attendance on other days is expected, but will not be recorded.  You are responsible for being aware of
announcements made in class and all material covered in the lectures.
GRADING – METHODS OF EVALUATION

Exams: 50% (midterm 15%, comprehensive final 35%)
Homework assignments: 10%
Project: 40%, including demo and poster presentation. COP5618 students must also submit a written report.

COP5618 assignments and exams will be more challenging than CIS4930 assignments and exams.

Note that the final exam will be given on the date and time scheduled for our course by the registrar: May 1 at 10am in the usual classroom. All students must take the exam at this time; plan your end of semester travel schedule accordingly.

GRADING SCALE Grades will be curved.

“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

MAK E-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.