OAKLAND UNIVERSITY, School of Engineering and Computer Science
CSE 436/536 Concurrent and Multicore Programming, Summer 01 2015

Instructor: Yonghong Yan (www.secs.oakland.edu/~yan), yan@oakland.edu
Office: 534 Engineering Center; **Tel:** (248) 370 4087
Office Hours: After class or by appointment
Meeting Time: 5:30 pm - 8:50 pm Monday and Wednesday; May 11 - Jul 01, 2015; (Check http://www.oakland.edu/important-dates for other important date/deadline for Summer 2015 semester)
Class Room: Engineering Center 550

Course Catalog Description:

This course will focus on concepts, theory, design and implementation of concurrent programs for multi-core computers, multi-core programming methodologies. Topics covered include mutual exclusion, memory model and thread-based parallelism, fork-join framework, locks, parallel control flow, concurrent data structures.
4.000 Credit hours
4.000 Lecture hours
Levels: Graduate, Post Bachelor, Graduate Professional Development, Doctoral & Ed Specialist, Undergraduate
Schedule Types: Main Campus Classroom, Lecture
Computer Science & Engineering Division Computer Science & Engineering Department

Requirements:

Minimum requirements include good reasoning and analytical skills and skills of C programming, e.g. the use of macro, pointer, array, struct, union, function pointer, and library for memory allocation and de-allocation (malloc and free). Knowledge or courses of computer architecture (memory hierarchy, cache, virtual address) and data structures will be necessary for preforming well for the class. Knowledge or courses of programming languages and compilers, and operating systems will also help. Familiarity with Linux environment will be important for the assignments.

Course Objectives:

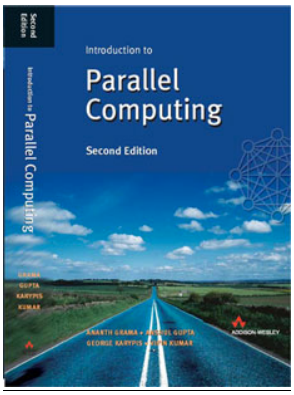
Upon completion of course, successful students shall be able to

1. Describe benefits and applications of concurrent and parallel programming.
2. Explain key concepts in parallel computer architectures, e.g. shared memory system, distributed system, NUMA and cache coherence.
3. Understand principles for concurrent program design, e.g. decomposition of works, task and data parallelism, processor mapping, mutual exclusion, locks.
4. Write parallel program using pthreads, OpenMP, CUDA, MPI model.
5. Perform analysis of parallel program problem.

Textbook and materials:

Most of the materials can be found from Internet and I will provide a list of links for those resources. There is no **required** textbook. The two recommended textbooks, if you really need ones, are:

Recommended Textbook:



Introduction to Parallel Computing, 2nd Edition
By Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar
Addison-Wesley, 2003
http://www-users.cs.umn.edu/~karypis/parbook/

Grade Assessment:

Course grade will be a combination of homework (70%), the final exam (30%) and 5% class participation. We will have 4 homework (15%, 15%, 20%, and 20% for total 70%) focusing on programming skills.

Behavioral Contract: (For lectures and homework/project)

- This class is offered in classroom with PCs and will include both lecture and lab practices; please read the following carefully, students will be asked to leave the labs if they do not follow this contract:
  - Digital devices such as: cell phones, tablets, ipod, mp3 players… etc need to be placed out of sight and must be set to silent. (I will keep my cell phone avail, for emergency preparedness)
  - No headphones are allowed.
  - Students are expected to use the PCs only for this class's material and applications.
  - Surfing the net for Social sites and being on Social Media are not allowed **during lecture hours**. Anyone who is not following this rule will be asked to leave the laboratory/lecture.

Attendance

- Attendance is required in all of the classes; it is part of a student's grade not an extra credit.
- Attendance is taken at the **beginning of class**. If you come in late (10 minutes after lecture starts), you will be logged in as **Late Arrival**, **2 Late Arrival = 1 Absence** or of you choose to leave early (more than 10 minutes before the lecture ends), you will be logged as **Left Early**. **2 Left Early = 1 Absence.**
- **If you miss more than 2 classes you will not receive any credit for attendance. (The 2 classes include excused absences.)**
- Class participation is part of your grade make sure to participate in our class practices.

Homework and Projects:

The homework will be given as lab assignments that you can do it either in the lab or from home computer. Unless it is announced as teamwork, all assignments and class activities will be completed **individually**.

Late Policy: (PLEASE READ CAREFULLY)

Each assignment has a due date and a cutoff date, which is 3 days after due date. You will have a total of 7 "slip days" throughout the semester that you can use at your discretion to turn in programming assignments past the posted due date. Slip days are used in whole day increments. Once your slip days are consumed, late programming assignments will be penalized at 10% per day. Assignment submission will not be accepted after the cutoff date.

Moodle:

A session specific website is located at https://moodle.oakland.edu/moodle. This website will include all the course materials (notes, schedules, assignments, etc) for our course. Assignment will be available for download from this site, and they should be submitted using Moodle only. Please check this site often for updates.

Academic Conduct: *Expected conduct on assignments and exams*

Although students may discuss an assignment, each student should complete his or her assignment individually. Copying of another's assignment is not permitted. It is assumed that ALL work throughout the term is your own. Discussions during an exam or quiz are not permitted. Cheating during an exam or quiz is not permitted. It is assumed that ALL WORK THROUGHOUT THE TERM IS YOUR OWN! **Discussion of lab assignments are permitted but copying of assignments is not! Handing in a lab assignment or exam that was essentially copied from someone else does constitute as cheating**. All of the tests are closed book unless it was told otherwise. Obtaining help from notes, another individual or from hand held computing devices during an exam is regarded as cheating. The Oakland University Academic Conduct Policy can be found at http://www4.oakland.edu/?id=1610&sid=75.Cheating on examinations, plagiarism, falsifying reports/records, and unauthorized collaboration, access, or modifying of computer programs are considered serious breaches of academic conduct. The Oakland University policy on academic conduct will be strictly followed with no exceptions. See catalog under Academic Policies and Procedures.

Tentative class content and schedule:

Week	Date	Week date	Class	Content	Assignment
	05/11	Monday	1	Introduction	
	05/11	Monday	2	Review of C programming	
	05/13	Wednesday	3	Parallel algorithm design	
1	05/13	Wednesday	4	Parallel program design practice and assignment 1	Assignment 1
	05/18	Monday	5	Parallel algorithm design	
	05/18	Monday	6	PThread	
	05/20	Wednesday	7	PThread and mutual exclusion	
2	05/20	Wednesday	8	OpenMP	
	~~05/25~~	~~Monday~~		~~Memorial holiday~~	
	~~05/25~~	~~Monday~~		~~Memorial holiday~~	
	05/27	Wednesday	9	OpenMP	Assignment 1 due
3	05/27	Wednesday	10	OpenMP practice and assignment 2	Assignment 2
	06/01	Monday	11	Parallel program measurement and analysis	
	06/01	Monday	12	Parallel program measurement and analysis	
	06/03	Wednesday	13	Cilk	
4	06/03	Wednesday	14	Parallel architecture	
	06/08	Monday	15	Parallel architecture and cache coherency	Assignment 2 due
	06/08	Monday	16	Manycore and GPU/CUDA	Assignment 3
	06/10	Wednesday	17	Manycore and GPU/CUDA	
5	06/10	Wednesday	18	GPU/CUDA practice and assignment 3	
	06/15	Monday	19	Manycore and OpenMP/OpenACC	
	06/15	Monday	20	Distributed memory systems	
	06/17	Wednesday	21	MPI	Assignment 3 due
6	06/17	Wednesday	22	MPI practice and assignment 4	Assignment 4
	06/22	Monday	23	PGAS and UPC	
	06/22	Monday	24	Parallel algorithms - dense matrix	
	06/24	Wednesday	25	Parallel algorithms - sorting	
	06/24	Wednesday	26	Chapel	
7	06/27	Friday		Last class day of Summer 01	Assignment 4 due
	06/29	**Monday**		**Final exam (6:30 - 9:30PM)**	
8	07/01	Wednesday		Grading completed	