CS 3214 Syllabus

Overview

CS 3214 provides an introduction to computer systems as they are relevant to application programmers today, with an emphasis on operating systems principles. Topics covered include: operating systems design and architectures; processes, threads, synchronization techniques, deadlock; CPU scheduling; system call interfaces, system level I/O and file management; shell programming; separate compilation, loading and linking; inter-process communication (IPC); virtual and physical memory management and garbage collection; network protocols and programming; virtualization; performance analysis and optimization.

The topics will be accompanied by a series of exercises and programming projects that will give you hands-on experience in interacting with systems at different levels. Some projects will be done in a group, which gives you the added benefit of learning how to work in a team.

Staff Information and Meeting Times

Instructor: Dr Godmar Back

2202 Kraft Dr, Room VTKW-2211

540-231-3046

Office hours: T-B-A: please visit http://whenisgood.net/cs3214/fall2010 to indicate your availability.

Office hours will be held in McB 122.

I'm also available by appointment. Check my Google calendar before asking for an appointment.

Class website: http://courses.cs.vt.edu/~cs3214/

TAs: Scott Schneider (GTA)

Puran Bhattacharjee (1/2 GTA)

Xiaomo Liu (1/2 GTA)

Patrick Boyd (UTA)

Office hours will be held in the Systems Lab (McB 124 and/or McB 106 at the TA's discretion). Please see website for office hours. Additional office hours will be announced in the forum when projects are due.

The TAs are also available by appointment.

Email: To contact teaching staff, use cs3214-staff@cs.vt.edu

Forum: http://forum.cs.vt.edu/

Class Meeting Times:

GBJ 102 11:00am-12:15pm T R

Regular class attendance is not enforced, but is strongly recommended. Subjects taught in class closely correspond to the concurrently run exercises and projects.

Prerequisites

The formal prerequisites for this class consist of CS2506: Introduction to Computer Organization II and CS 2114 Software Design and Data Structures. Every student must prove that they have obtained a grade of C or better in those classes by submitting a Computer Science Prerequisite Form no later than Aug 31, 2010 for verification.

Objectives

Upon completion of the course, students should be able to

1. Explain the major components of an operating system and their respective functionality and interaction, including runtime libraries and systems programs

2. Use an operating system's command line interface to run shell scripts and perform productivity tasks

3. Describe the theories underlying CPU scheduling and their impact on applications

4. Describe proper synchronization techniques, deadlock prevention and avoidance

5. Describe the principles underlying virtual memory and their impact on applications

6. Design, implement, test, and debug:
    a. programs that interact directly with an operating system using its system call application programming interface (API)
    b. multi-process applications that use inter-process communication
    c. multi-threaded applications
    d. custom user-level memory allocators

      e. simple network applications

7. Describe the principles underlying virtualization

8. Measure application performance accurately and identify sources of overhead

Textbook

The required textbook is:

Computer Systems: A Programmer's Perspective, Second Edition (CS:APP2e) *Randal E. Bryant* and *David R. O'Hallaron* Prentice Hall, 2011, ISBN *0-13-610804-0.*

The first edition of this book dates from 2003; I strongly recommend that you use the 2nd edition.

I will post lecture notes after each lecture on the class website. Although I may not be able to discuss all slides during lecture, I consider them material you should know. As you work over the lecture when you study, be sure to ask questions if necessary.

In addition, the class website will link to other external resources.

Format

The course work consists of a mix of lectures, exams, exercises, and programming projects.

Midterm: There will be one in-class midterm. The midterm will cover material from the lectures and textbook. The midterm will also include questions related to the programming projects.

Final: There will be a final exam. The final exam will be comprehensive and include material from the lectures, textbook, and programming projects.

Exercises: Exercises are done individually. They consist of small tasks that reinforce necessary skills. Exercises run in parallel with projects, generally have a short deadline, and late submissions are not accepted.

Projects: There will be 5 medium-size projects. Projects are done in groups of 2 students.

Projects and exercises will be submitted electronically and grades will be posted electronically. Instructions will be posted on the class website.

Late Policy

Exercises are intended to ensure that you remain continuously engaged in the class and do not fall behind. Therefore, they must be submitted on time.

I am generally hesitant to grant individual extensions for projects. Instead, each student will have a budget of 4 late days that can be used to submit projects (not exercises!) late without penalty. You decide when you want to use your late days – there is no need to contact the instructor or GTA beforehand. Late days are granted in whole integer multiples of days: if your assignment is 5 minutes late, you will have used up an entire late day. *Submissions received after you have used up your late days will receive a zero score.* For some assignments, you may work in a team. If you are working in a team, late submissions will count against the budgets of all team members, so make sure that all of you have enough late days left or the team member with an insufficient number of days risks getting a zero.

These late days are intended to account for various minor emergencies, such as network outages, snow or flood days, minor (12 hours or less) lab/cluster downtime, or job interviews.

If you have family or other emergencies that prevent you from submitting assignments on time, please contact the Dean of Students Office (http://www.dos.vt.edu). They will make a determination as to what accommodations should be given, and inform the instructors of the classes in which you are enrolled of their decision. My policy is to provide you with as many additional late days as the note from DoS will say. For reasons of consistency and fairness, I will not make any calls myself about emergency accommodations; I will defer all such calls to them. If you have learning or other disabilities, please also see the section *Students With Disabilities* below.

Sickness: If you cannot complete an assignment due to sickness, I ask that you provide proof of visit to Shiffert health center or another health care provider (a scanned or photographed copy of the Visit Documentation slip will suffice). You should tell teaching staff how many days you were sick. All deadlines will be moved by this many days without counting against late days. The honor code and the university policy on class attendance apply.

In the case of a prolonged illness – defined as an absence that exceeds 5 days - Shiffert will provide an absence verification (see http://www.hokiehandbook.vt.edu/studentlife/).

Late Drop and Incomplete Policy

Less-than-hoped-for performance or realizing you have taken on too much work this semester, are not permissible reasons to grant

course withdrawal requests after Oct 1, 2010. This policy applies only to drop requests that have to be approved by the instructor; in particular, it does not apply to the course withdrawals for six credit hours to which you are entitled according to college policy.

I will not grant incompletes for this course unless truly extraordinary, unforeseen circumstances outside of your control are to blame. See also *Late Policy*.

Grading

Based on past offerings, I estimate that the contributions of the different portions to your final grade will be as listed below, but I reserve the right to adjust these weights as necessary:

12.5%	Midterm Exam
22.5%	Final Exam
42.5%	Projects
22.5%	Exercises

I expect the median final grade for this class to be between a B and B-. In other words, students who consistently perform above the median can expect a B or better. The sample population over which this median is computed includes all students who submit at least one piece of work for grading during the course of the semester. We will publish score distributions for all projects and the midterm to give you an indication of where you are. I reserve the right to adjust this curve in either direction, depending on the performance of the class.

Students who do not appear for an exam at the scheduled time will receive a zero score on the exam.

Auto-Fail Rules

For each of the 5 projects, a clearly defined subset of the overall project requirements is described as "minimum requirements."

To pass the class, you must meet the minimum requirements for all five projects by the end of the semester. If needed, I will accept late submissions for projects (beyond the late days discussed in the section *Late Policy* above) for the purpose of showing that you meet minimum requirements.

These requirements are necessary, but not sufficient conditions. You may still fail the class even if you avoid the auto-fail rules. This may happen if your midterm/final exam and/or exercise performance is too low in the judgment of the instructor.

"Passing the class" means a grade that is not an F.

Modes of Communication

Forum: I strongly encourage the use of the forum to ask question and discuss class-related topics. When using the forum, treat it like a public forum: ask questions and bring up topics where you have a reasonable belief that others may be interested in them (perhaps because they may be facing the same issue), or may be able to help you.

Website: The class website and the forum are the primary means of communication from us to you. We will post announcements there, which are binding. In addition, we will send email to you as needed.

Email etiquette:

- Class-related email should be sent to cs3214-staff@cs.vt.edu, with the exception of project-related questions, which should be posted in the forum. The email alias ensures that it reaches both the instructor and TAs, and ensures that it will be archived separately. I will answer questions posted in the forum before answering questions I receive by email.

- Please set your full name in your email client so it shows in the From: line in email you send. I may not respond to email sent from aawuhu24@vt.edu if I don't recognize the sender as a student. Email sent from certain accounts (e.g., hotmail) may end up in my spam folder and be overlooked. Do not send me attachments unless asked to do so.

Collaboration Policy and Honor Code

On the class website you will find links to the following policies applying to this class: University Policy of Class Attendance, the The Virginia Tech Undergraduate Honor System, the ACM and IEEE Code of Ethics, and the Departmental Policy on Koofers.

The tenets of the honor code will be strictly enforced in this course, and all assignments shall be subject to the stipulations of the Undergraduate Honor Code. For more information on the Honor Code, please refer to the Undergraduate Honor System Constitution, location online at http://www.honorsystem.vt.edu/.

If I suspect that an honor code violation has occurred, I generally file complaints directly with the honor system. I am not required to discuss suspected honor code violations with suspected students before filing charges, and typically will not do so.

In addition, we will enforce the Departmental Policy on Koofers, Old Programs, Cheating, and Computer Use, available at http://www.cs.vt.edu/undergraduate/handbook#Koofer

The following policies regarding collaboration apply in this class.

- All submitted work is expected to be the original work of the individual student unless otherwise directed by the instructor. Note the emphasis on "submitted" work – this includes work that is explicitly graded and work that may not be graded, regardless.

- Projects are to be the work of the individual student or team as specified. You may discuss general concepts, such as software libraries, Internet resources, or class and text topics, with others outside your team. However, discussion of project solutions, specific code, or detailed report content is an honor code violation. All source material used in project code and reports must be properly cited.

- For the projects, you will team up in groups of 2 students. While teaming up is voluntary, we strongly recommend that you work with a partner. You may switch teams or form new teams, but only between projects. You may work with at most one group on a given project.
  Students must contribute equally to the project within a team. It is not acceptable for students to either not contribute to the project or not to let the other group member contribute equally to the project. Please bring any problems in this regard to the instructor's attention early on.

- You are required to read-protect your work on shared file space so students outside of your team will not have access. Failing to do so is an honor code violation.

- Borrowing code or hiring someone to perform the work for you is an egregious violation of the honor code. We will use plagiarism detection software such as MOSS to screen out students attempting to do this.

- Forum rules: you are not allowed to post code that is part of your solution on the forum. An exception is a single line if it causes a compile-time or runtime error. Posting debugging output, including backtraces, is ok.

- You may not post detailed descriptions of your design or solution on the forum. You may not post answers to design document questions on the forum.

- Not having read the honor code and its stipulations is no excuse for violating it.

- If you have any doubt about what is and is not allowed, it is your obligation to ask the instructor beforehand.

Students with Disabilities

If you need adaptations or accommodations because of a disability (learning disability, attention deficit disorder, psychological, or physical), if you have emergency medical information to share with the instructor, or if you need special arrangements in case the building must be evacuated, please meet with the instructor as soon as possible.