CSC 246-601 Concepts and Facilities of Operating Systems - 3 Credit Hours - Spring 2024

Instructor and Teaching Assistant

Instructor: **Alan Watkins**
> **Office Hours:** Thursday 2-4pm by appointment only.
> Note that I do not have a physical office on campus...just give me a call at the number below if it's something that can be handled over the phone!
>
> **Email:** awwatkin@ncsu.edu
> Emails are responded to within 24 hours, emails after hours on Friday will be responded to by noon the following Monday
>
> **Phone:** 919-793-5548
> You are welcome to call/leave a message...email is definitely quicker as I am in and out throughout the day.

Teaching Assistant: **Xuanhao Luo**
> **Email:** xluo26@ncsu.edu
> **Office:** TBD
> **Office Hours:** TBD
> **Office Phone:** TBD

Course Description

The history and evolution of operating systems, concepts of process management, memory addressing and allocation, files and protection, deadlocks and distributed systems.

Lectures and Textbook

Lectures may be viewed online at link on the course webpage (https://wolfware.ncsu.edu - Login, choose current class). Follow the flow of the course on the website. If under week#1 it lists lecture#1, it means you should watch lecture#1 sometime that week, etc.

We use the following textbook in the course:

Silberschatz, Galvin, and Gagne *Operating System Concepts 10th Edition, © 2018* ISBN: 978-1-119-32091-3
Errata for version 10 of the textbook: https://codex.cs.yale.edu/avi/os-book/OS10/errata-dir/index.html

or

Silberschatz, Galvin, and Gagne *Operating System Concepts 9th Edition, © 2013* ISBN: 978-1-118-06333-0
Errata for version 9 of the textbook: http://codex.cs.yale.edu/avi/os-book/OS9/errata-dir/os9c-errata.pdf

You are free to get this book anywhere, but there is a link to get an electronic copy on the course website.

Grading

Work		Total
Homework		50%
Tests	Test 1 15%	30%
	Test 2 15%	
	Final Exam	20%

Letter Grades

Letter grades will be assigned using the following:

Range	Letter Grade
$97 \le X \le 100$	A+
$93 \le X < 97$	A
$90 \le X < 93$	A-
$87 \le X < 90$	B+
$83 \le X < 87$	B
$80 \le X < 83$	B-
$77 \le X < 80$	C+
$73 \le X < 77$	C
$70 \le X < 73$	C-
$67 \le X < 70$	D+
$63 \le X < 68$	D
$60 \le X < 63$	D-
$X < 60$	F

Homework Policy

Homework is due by midnight Eastern Time on the date posted on the course web site. Homework is submitted through the course web site.

We really do not have enough homework assignments in this class to justify dropping one, but I will accept homework late according to the following policy:

Time Past Due	Penalty
<= 1 day	-10%
>1 day <=2 days	-20%
>2 days <=3 days	-30%
> 3 days	Not accepted

There is a late homework submission area on the course website - please email the TA if you submit something to the late homework area.

NOTE: Any questions about a grade on a homework must be handled within one week of when the homework grade is posted in the grade book.

Course Topics

- History and Vocabulary of Operating Systems
- Overview of Computer Architecture and Operating System Architecture
- Processes and Process Management
- The Unix Process Model
- Threads
- POSIX Thread (pthreads) and Java Thread Creation
- Process/Thread Scheduling
- Real-time Scheduling
- Process/Thread Synchronization and Communication
- POSIX Threads (pthreads) and Java Thread Synchronization
- Deadlocks
- Memory Management
- Virtual Memory

Learning Outcomes

Upon successful completion of this course, a student will be able to...

- **Processes and Threads**. describe states and transitions of processes/threads; explain non-local transfers of control; determine context switching details.
- **Synchronization**. list different synchronization models; explain the operational characteristics of these models; use these facilities in concurrent programming models; contrast these models; utilize synchronization for contemporary architectures; select a suitable synchronization paradigm for a given problem.
- **Virtual Memory**. reiterate the principles of hardware and software support for virtual memory; express operational properties of address translation; perform the calculations of address translation; predict the impact on TLB misses; judge the merits and shortcomings of virtual memory usage. Describe how address translation hardware can be used to implement essential features like shared memory and how and why different programming techniques are connected to locality of reference and performance.
- **Scheduling**. recite different scheduling paradigms; paraphrase qualitative and quantitative properties of these paradigms; derive a schedule for given parameters; model quantitative properties of scheduling paradigms; exploit existing scheduling models supported by systems; contrast different scheduling approaches.
- **I/O and File Management**. reiterate the principles of file systems in terms of data structures; understand access control; interface with directory services on the system API level; judge the merits and shortcomings of contemporary file systems.
- **Protection and Security**. list different protection mechanisms; explain security measures in operating systems such as access control.
- **Communication and Networking**. reiterate basic communication paradigms and networking protocols in terms of their functionality; explain differences and functionalities of communication modes and layers; design and implement communicating client-server applications.
- **Computer organization**. Enumerate and explain the operation of the functional components of a computer, including CPU (cores, registers & ALU), cache, buses, memory, devices and interrupt

processing. Describe and compare non-traditional models of parallel computation, including GPU, TPU, FPGA and ASIC.

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01. Violations of academic integrity will be handled in accordance with the Student Discipline Procedures (NCSU REG 11.35.02). Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Statement for students with disabilities:

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (NCSU REG 02.20.01).

Exam Policy

Exams must be taken **individually** by each student. Collaboration is **not** permitted, and each student is honor-bound to observe this policy. Exams will require a proctor. For those of you close enough to campus, you can use DELTA as your proctor. Remote students must find a proctor and have them approved. Further information about proctors will be sent from the EOL office around the end of the first week of class.

All exams must be taken on or before the exam date on the course website unless approved by me at least 48 hours in advance. There is a one week exam window for each exam ending on the date of the exam on the course website. For example, if the exam is scheduled on a Wednesday, students may take the exam from the previous Thursday through the day on the website for the scheduled exam. Students who take/schedule an exam after the exam date will receive a 10 point deduction per day, and will receive a 0 if they do not take the exam within 2 days after the scheduled exam date.

NOTE: Make sure exams are turned in on time. 2 points per minute will be deducted if you go over the time limit for an exam. Let your proctor know this - if they say on the exam that you took 92 minutes on a 90 minute exam, then you went over 2 minutes.

Grade disputes

Any questions about a grade on a homework must be handled within one week of when the homework grade is posted in the grade book.
Any questions about a grade on a test must be handled within one week of when the email about returning tests for remote students is sent or the physical test is returned for those that take the exam live.

Digital Course Components

The course material is hosted on the NCSU Moodle platform and lectures are posted via Panopto.

Students may be required to disclose personally identifiable information to other students in the course, via the digital tools, such as email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Please Evaluate this Course

Please give us your feedback and evaluate this course at https://classeval.ncsu.edu at the end of the semester when you are emailed about doing so.

Be aware, however, that the window for doing this is relatively short (about a week).

If you need help with this evaluation procedure, please write to classeval@help.ncsu.edu

We appreciate your input!

Additional NC State Rules and Regulations

Students are responsible for reviewing the NC State University Policies, Rules, and Regulations (PRRs) which pertain to their course rights and responsibilities, including those referenced both below and above in this syllabus:

   Equal Opportunity and Non-Discrimination Policy Statement https://policies.ncsu.edu/policy/pol-04-25-05 with additional
      references at https://oied.ncsu.edu/divweb/policies/

   Code of Student Conduct https://policies.ncsu.edu/policy/pol-11-35-01