CIS 3207: Introduction to Systems Programming & Operating Systems
Fall, 2025

Professor: **Dr. Gene Kwatny**
Office: SERC 324
Phone: 215-204-1679
EMAIL: gkwatny@temple.edu
Professor Kwatny's Web Site (includes biography): https://sites.temple.edu/gkwatny/

Office Hours: Great opportunity for 1 on 1 discussion
Tuesday, Thursday 2:30 PM – 3:30 PM
(other times available by request)
Check Canvas for up-to-date office hour schedule [appointments are encouraged]

Course Assistants:

3207.001 Louise Dupont (louise.dupont@temple.edu)
Office Hours

3207.002 Benjamin Incollingo (Benjamin.Incollingo@temple.edu)
Office Hours

3207.004 Caleb Hageman (caleb.hageman@temple.edu)
Office Hours

Course Meeting Times: 3207 Sections 1, 2 and 4:

LECTURE: Tuesday & Thursday	12:30 PM - 1:50 PM	Beury 160	[Prof. Kwatny]
Laboratory Section 1: Wednesday	9:00 AM - 10:50 AM	BioSci 137	[Loiuse Dupont]
Laboratory Section 2: Wednesday	9:00 AM – 10:50 AM	Tuttleman 9	[Benjamin Collingo]
Laboratory Section 4: Wednesday	1:00 PM - 2:50 PM	BioSci 137	[Caleb Hageman]

Course Topics

- Operating system principles and computer architecture
- Processes and threads
- Concurrency
- CPU Scheduling and dispatching
- Memory management and virtual memory
- Device management
- File systems

Learning Objectives

- Operating systems general knowledge
  - Students will be able to explain the objectives and functions of modern operating systems.
  - Students will be able to analyze and express the tradeoffs inherent in operating system design.
  - Students will be able to explain the benefits of building abstract layers in hierarchical fashion.
  - Students will be able to describe the value of and demonstrate the use of APIs and middleware.
  - Students will be able to contrast kernel and user mode in an operating system
  - Students will be able to analyze interrupt processing and demonstrate how it functions.
- Concurrency
  - Students will be able to express the need for concurrency

    - Students will be able to describe and demonstrate how concurrency can be achieved within the framework of an operating system
        - Students will be able to demonstrate knowledge of the different states that a task may pass through and the data structures needed to support the management of multiple tasks
    - Students will be able to demonstrate the potential run-time problems arising from the concurrent operation of many separate tasks
    - Students will be able to apply techniques for achieving synchronization in an operating system
        - Students will be able to analyze and express the reasons for using interrupts, dispatching, and context switching to support concurrency in an operating system.
- Task Scheduling and Dispatching
    - Students will be able to apply and analyze several algorithms for preemptive and non-preemptive scheduling of tasks in operating system
    - Students will be able to discuss the similarities and difference between processes and threads and apply them in the implementation of systems
- Memory management
    - Students will be able to explain the rationale for hierarchical memory
    - Students will be able to understand, analyze, and demonstrate principles of virtual memory, particularly for caching and paging
- Device management
    - Students will understand device control implementation and link relevant operating system mechanisms such as buffering and direct memory access and when to use them.
    - Students will understand OS device management layers and the architecture (device controller, device driver, device abstraction)
- File systems
    - Students will be able to analyze design choices and tradeoffs in file systems
    - Students will be able understand storage management
    - Students will be able to understand and physical and logical directory structures

Course Prerequisites:
CIS 1166 Math Concepts in Computing I or MATH 2196 Basic Concepts in Math; CIS 2107 Computer Systems and Low-level Programming; CIS 2168 Data Structures (minimum grade of C- in each of the required prerequisite courses). **The course will require substantial programming assignments; students should have experience programming in C**.

Required Course Materials:
The course requires the use of two textbooks

- "OPERATING SYSTEMS - Three Easy Pieces", Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, free online: http://pages.cs.wisc.edu/~remzi/OSTEP/
  The digital version of individual chapters of this book are available for free. Optionally, you may purchase a PDF containing all chapters for $10.00, a softcover for $21.00, or a hardcopy for $36.00.
- "Computer Systems - a Programmer's Perspective",3e, Bryant & O'Hallaron, 2016, Pearson
  This is the same textbook used in CIS 2107. You may already have a copy or purchase a used copy.

Textbook Content
Reading and lecture material from "Operating Systems Three Easy Pieces": Chapters 1 - 8, 12 - 16, 18 – 22, 25 – 28, 30 - 32, 35 – 37, 39, 40.
Reading and lecture material from Bryant & O'Hallaron ('Computer Systems') Chapters 1, 6.1 - 6.3, 8, 11, 12 [you may find Chapter 9 helpful in understanding virtual memory]
Approximate Reading Schedule: (see Canvas)

All lecture materials and supplemental documents and texts are available through Canvas.

Additional course material will be drawn from selected research publications. You may also find the following optional reference texts useful to you in tackling the programming assignments for this course:

- "The Linux Programming Interface: A Linux and UNIX System Programming Handbook" by Michael Kerrisk
- "UNIX Network Programming, Vol. 1: Networking APIs: Sockets and XTI" by W. Richard Stevens
- "Advanced Programming in the UNIX Environment", 3rd edition, by W. Richard Stevens and Stephen Rago
- "Operating Systems Internals" by Stallings,
- "Interprocess Communications in Linux" by Gray
- [Some of these texts are available in Canvas in the section '***Additional Textbook References***']

Grading Policy:

Course grade will be determined by :

Final Exam (30%) [the final exam will be comprehensive, covering all course material]
Midterm Exam (25%) [covers all material up to the date of the midterm exam]
Quizzes (20%) [There will be an in-class quiz once per week. Unless announced otherwise, quizzes are to be completed individually, in person; you may not work together on a quiz. The grade for a missed quiz is 0. The lowest 3 quiz grades will be dropped. **There are No Makeup Quizzes**]
Laboratory Projects (25%) [We will have 4 to 5 multi-week projects with weekly deliverables]

NOTE ABOUT GRADING IN CANVAS: I use Canvas to **list** graded items. I **do not** use Canvas to compute grades. Each exam will be scored and translated to a letter grade. Projects will be graded individually and "the grades for the group of projects" will be combined to form a letter grade. Quizzes will be graded individually, and the group of quiz grades (dropping lowest 3) will be combined to form a letter grade. For the course grade, I apply the above percentages to each category for a final grade at the end of the semester. **Ignore the weightings and any grade assessments performed by Canvas**.

Dates of Importance:

- Tuesday, August 26: First Class
- Wednesday, August 27: First lab
- Monday, September 8: Last day to add or drop a Full Term 16-week course (tuition refund)
- Friday, October 17: Fall Wellness Day
- Monday, November 24 – Wednesday November 26: Fall break (no classes)
- Thursday, November 27 – Sunday November 30: Thanksgiving Holiday (no classes)
- Wednesday December 3: Last Lab Session
- Thursday, December 4: Last Lecture Session
- Monday, December 8: Full Term 16-week Courses end
- Monday, December 8: Last Day to Withdraw
- Study Day: Tuesday, December 9
- **Final Exam: 3207 Sections 1, 2 and 4 - Thursday, December 11, 10:30 AM – 12:30 PM, Beury 160**

  Students who miss the final exam and do not discuss alternative arrangements with me **before** the exam, will receive a grade of F.

Programming Assignment Policies

All submitted programs must compile; programs that do not compile earn a grade of zero. Coding style and documentation are important and will be reflected in your programming assignment grade. You must

provide useful comments in your code, eliminate unnecessary commented code, partition your code into reasonably sized functions/methods, and use appropriate variable/function naming conventions. We recommend that you use Google's C and C++ coding style guide.

You are **not allowed** to look at other solutions for the programming assignments (or previous iterations of the homework), including those of other students in this or previous classes, or complete/partial solutions that may be available online. We will use a plagiarism detection tool, such as MOSS, on programming assignments.

We will be using GitHub to manage project code and materials. You will be required to learn to use Git and Github, perform code commits and use branching and source control as required. The GitHub repository you will create and maintain for this course is to be 'private', but shared with your TA and the instructor (This will be done automatically through your assignments). Do NOT use personal or public GitHub accounts. We will review progress in projects by following your GitHub commits. You must make regular commits to GitHub as you progress in project development.

Lab Assignments are generally multi-week and you will be given deliverables required each week as the project proceeds. Project code and results are to be submitted to Canvas. Projects are graded based on the last CANVAS assignment submission **prior to the project deadline**.

The CIS laboratory computer systems in SERC laboratories 204, 206, BioSci 137, and Tuttleman 9 are available for use this semester.

We will be using the C language for program development to complete the projects. You will need a C compiler, linker and editing environment for this work. Your lab instructor will give you help in choosing software for local (your own computer) use. CIS-linux2.temple.edu is a CIS server that you can use for editing, compiling and demos. There are a number of cloud-based development environments that you can also use and one we can recommend for programming assignments:

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Collaboration Policy

We encourage you to discuss the problem sets and programming assignments with your fellow classmates. We welcome discussions of possible interpretations of questions, solution approaches, and points of confusion. You are also welcome to use existing public libraries in your programming assignments (such as public classes for queues, trees, etc.) You may also look at operating systems code for public domain software such as Linux. Such activities qualify under approved collaboration practices and you are welcome to take advantage of them.

Unless explicitly stated otherwise on the assignment, you must write all code that you submit for programming assignments and all work on quizzes, homework sets, and exams must be your own. You are NOT allowed to LOOK AT other solutions, including those of other students or partial solutions for similar projects that may be available online through github or other platforms. For example, you may not look at the work done by a student in past years' courses, and you may not look at similar course projects at other universities. If you are unsure about whether a particular source of external information is permitted, contact the instructor before looking at it.

Some in-lab parts of laboratory projects may require/allow you to work in teams. In those cases, team members should contribute equally and will be graded individually. The write-ups and out-of-class portions of labs must be completed independently.

Intellectual dishonesty can end your academic career, and it is your responsibility to stay on the right side of the line. It is generally OK to verbally discuss the concepts needed to do project assignments. These

discussions should focus on overall approach and understanding, not the detailed answer to the specific problem. The following guidelines can help you to keep on the right side of the line:

- First, other than to the TA and instructor, it is never OK to look at the written work of another person or show another person your written work until after all grading on an assignment is completed. This includes looking at paper print-outs, sketching solutions on a white board or napkin, or looking at a screen to help debugging. It should go without saying that copying other people's code or solution sets is strictly prohibited.

- Second, everyone in the class is expected to take appropriate measures for protecting one's work. For example, you should protect your files and printouts from unauthorized access.

Students who violate university rules on academic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Because such dishonesty harms the individual, all students, and the integrity of the University, University policies on scholastic dishonesty will be strictly enforced.

If you are not sure about the use of a resource or the appropriateness of a collaboration, ask.

Use of Generative AI in CIS 3207

You may use generative AI tools (e.g., ChatGPT, Gemini, Claude) **only when such use supports the course learning objectives**. Refer to the following discussion or permitted and prohibited use.

Permitted Use

Generative AI may be used to:

- Clarify concepts introduced in class
- Explore the use of algorithms, functions, or ideas
- Review example code related to course content

Prohibited Use

Using AI to complete your assignments for you — without your own effort or understanding — is **not permitted** and violates academic integrity.

Documentation Requirement

If you use generative AI in any way on a project or assignment:

- You must clearly identify any code or content generated with the use of AI
- You must explain how you used the AI and what you learned from it
- This explanation must be submitted as a separate document with your project
- You will also discuss it during your demo with the TA

Failure to Comply

Omitting this required documentation will result in a grade of **zero (0)** for the project. A charge of **Academic Dishonesty** may also be filed.

You are responsible for ensuring your use of AI complies with university policies on academic honesty and does not include misinformation or violate intellectual property rights.

Late Project Assignment Submission Policy

This is a fast-paced course with frequent programming assignments. We have many projects to complete this semester. If you delay in completing a project, you will end up behind in each subsequent project. The course and assignments are designed so that you have sufficient time to complete the associated

coursework. If you cannot submit an assignment by the submission deadline, **late assignments will be accepted, with penalty, as follows:**

- 1 second up to 1 day late, maximum grade of 90% of project value
- 1 to 2 days late, maximum grade of 80% of project value
- 2 to 3 days late, maximum grade of 70% of project value
- 3 to 4 days late, maximum grade of 60% of project value
- 4 to 5 days late, maximum grade of 50% of project value
- after the 5th day, the submission will not be accepted and a grade of 0 will be assigned.*
  You are given 3 FREE LATE Days for the semester.

*Exceptions to this late policy can be made for illness and other life situations requiring flexibility. If you are experiencing health or personal circumstances that impact your ability to meet the deadlines, please let me know as soon as possible so that we can help you to stay on track and be successful in the course.

Attendance

Attendance for all class sessions is strongly encouraged. Attending classes is critical for you to be successful in this course and to participate in all group interactions. You are expected to be an active participant in the course and take responsibility for putting yourself in the best situation to advance your learning throughout the entire semester. If you miss class, you may miss important announcements, clarification, or discussion about assignments that may not be repeated on the course website.

Attendance for lectures will be taken through Canvas (Qwickly)
Quizzes and Exams are required to be taken in person.

Important points:

- If you do miss class, you are responsible for catching up on material that you missed and meeting course deadlines. Read the assigned text, ask a classmate for notes, and review lecture slides, which will be posted within 48 hours of each lecture. We are happy to answer questions about the lecture after you have reviewed the material that you missed.
- Religious holy days sometimes conflict with class and examination schedules. If you notify the instructional staff 14 days in advance of a planned absence due to observance of a religious holiday, you will have an opportunity to make up missed work (including exams) within a reasonable timeframe, either before or after the absence.

Course Communication Policy

ASK HOMEWORK AND CONTENT UNDERSTANDING QUESTIONS ON DISCORD: When you have a question related to the course content and assignments, you should post your question on Discord, where the instructional staff that is assigned to monitor questions can answer. We do our best to respond to questions within 48 hours. It is your responsibility to plan accordingly to study/do your assignments in time to ask questions. Questions about course content and assignments that are sent only to the instructor by email are not guaranteed to be unanswered. A link to the Discord server is shared on the Canvas course home page.

ASK QUESTIONS ABOUT GRADES AND REQUEST APPOINTMENTS BY EMAIL OR INPERSON: Your email should be sent to both the instructor and the TA. Our TA is very knowledgeable and is skilled in answering student questions; you should attend the TA's office hours or schedule an individual meeting with the TA before meeting with the instructor. Email Dr. Kwatny directly for an appointment.
Certainly, discuss course content questions with Dr. Kwatny.

CHECK YOUR EMAIL AND CANVAS FOR COURSE ANNOUNCEMENTS: Canvas notifications are delivered via email. As such, students are responsible for checking e-mail on a frequent and regular basis for class announcements.

Attending Office Hours with Dr. Kwatny or the TAs are a great way to have direct communication about course issues, content questions, assignments, etc.

Expectations For Class Conduct

It is important to foster a respectful and productive learning environment that includes all students in our diverse community of learners. Our differences, some of which are outlined in the University's nondiscrimination statement, will add richness to this learning experience. Therefore, all opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. Treat your classmates and instructor with respect in all communication, class activities, and meetings. You are encouraged to comment, question, or critique an idea but you are not to attack an individual.

Please consider that sarcasm, humor and slang can be misconstrued in online interactions and generate unintended disruptions. Profanity should be avoided as should the use of all capital letters when composing responses in discussion threads, which can be construed as “shouting” online. Remember to be careful with your own and others’ privacy. In general, have your behavior mirror how you would like to be treated by others.

Student Responsibilities

Students are responsible for reading all assigned text materials, handouts, and referenced sources. Students are responsible for participating in classroom discussions and discussions carried out though Canvas and Discord.

Much of the source code work in the course will require you to have familiarity with (or become familiar with) the C language and development environments for compiling and building C or C++ programs primarily in Linux. Reference material for the C Language is available via the course Canvas site.

This course requires the use of Canvas, including access to materials and for assignment submission. Some videos posted via Canvas will require the use of speakers on your computer. We may utilize web-conferencing tools to deliver synchronous material (in particular, Zoom). In order to participate in synchronous sessions, you should have a computer, a webcam, headphones, and microphone. Interactive **Polling will be used for some in class questions and you will need web access via phone or computer to participate**.

Student and Faculty Academic Rights and Responsibilities

Freedom to teach and freedom to learn are inseparable facets of academic freedom. The University has a policy on Student and Faculty and Academic Rights and Responsibilities (Policy #03.70.02) which can be accessed through the following http://policies.temple.edu/PDF/99.pdf.

Academic Honesty

According to the University Student Code of Conduct, students must not commit, attempt to commit, aid, encourage, facilitate, or solicit the commission of academic dishonesty and impropriety including plagiarism, academic cheating, and selling lecture notes or other information provided by an instructor without the instructor’s authorization. Violations may result in failing the assignment and/or failing the course, and/or other sanctions as enumerated in the University Code of Conduct (Links to an external site.).

Students are responsible for taking all quizzes and exams in the course. All work turned in for grading or review by the instructors of the course **must be the students own work**. The objectives of the course can only be met by you doing all of the work and presenting only your work for grading. **Presenting work that is not your own will result in disciplinary action and no credit.**

Recording and Distribution of Recordings of Class Sessions

Some sessions in the course may be recorded and access to those recordings will provided in the Canvas course.

Any digital documents or recordings created or permitted in this class can only be used for the student's personal educational use. Students are not permitted to copy, publish, or redistribute text, audio or video recordings of any portion of the class session to individuals who are not students in the course or academic program without the express permission of Professor Kwatny and of any students who are recorded. Distribution without permission may be a violation of educational privacy law, known as FERPA as well as certain copyright laws. Any recordings made by the instructor or university of this course are the property of Temple University

Accommodations For Students With Disabilities

Any student who has a need for accommodation based on the impact of a documented disability, including special accommodations for access to technology resources and electronic instructional materials required for the course, should contact me privately to discuss the specific situation by the end of the second week of classes or as soon as practical. If you have not done so already, please contact Disability Resources and Services (DRS) at 215-204-1280,4th Floor Gittis Student Center South to learn more about the resources available to you. I will work with you and DRS to coordinate reasonable accommodations for all students with documented disabilities.

Incomplete Grade Policy

Incomplete grades will be granted only in rare circumstances and require the approval of the instructor. A student will be eligible for a grade of "Incomplete" only if he/she: 1) has completed at least 51% of the work at a passing level, 2) is unable to complete the work for a serious reason beyond his or her control, and 3) files a signed agreement with the instructor outlining the work to be completed and the time frame in which that work will be completed. The student is responsible for initiating this process and all incomplete forms must be sent to the Associate Dean for Academic Affairs prior to the start of study days in that semester.

Please refer to the following for further details: Temple University's Incomplete Policy (Links to an external site.) (Policy #02.10.13).

Withdraw from the Course

If a student wishes to withdraw from a course, it is the student's responsibility to meet the deadline for the last day to withdraw from the current semester

See Temple University's Academic Calendar (Links to an external site.) for withdrawing deadlines and consult the University policy on withdrawals (Links to an external site.) (Policy # 02.10.14).

Statement on Academic Rights & Responsibilities

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