CIS341
Computer Organization & Programming Systems

Syracuse University, Spring 2025

1 Overview

About the course

Core course for computer science; 3 credits

Prerequisite: CIS351 Data Structures

Course description: Digital logic, data type and representation, instruction set architecture, assembly language, program construction, processors, memory hierarchy, traps and interrupts, privilege and security, I/O

Time & location

Lecture (M001): TuTh 11:00am – 12:20pm @ Life Science Building 105

Lab (M003): Fr 09:30AM - 10:25AM @ SCITC 3-116

Lab (M004): Fr 10:35AM - 11:30AM @ SCITC 3-116

Lab (M005): Fr 11:40AM - 12:35PM @ SCITC 3-116

Instructor

Prof. Farzana Rahman

E-mail: (frahma02@syr.edu) Phone: 3154432047
Office hours:
Tue. & Thu 12:45 am–1:45 pm(in-person), and
Wed. 6:30 - 7:30 PM over zoom, by appointment as needed.
Office: CST 3-177B

Teaching Assistants:

Ziyang Jiao

E-mail: (zjiao04@syr.edu)
Office: TBA Office hours: TBA

2 Objectives

The course is designed to help you understand *how computers are built* and *how computers are programmed*. Although it may seem like computers are magical mystery machines to *users*, they are, in fact, very far from it. As computer scientists and engineers, we must understand what really happens when a program runs on a machine and think about more efficient ways to do so. In detail, we set forth the following learning objectives, as activities you should be able to do after completing the course:

1. Explain common bit-level representations of numeric values and the consequent mathematical properties of arithmetic and bit-level operations on them.

2. Translate a C function into an assembly code including the implementation of expressions, control, and procedures by recalling the corresponding instruction set architecture.
3. Explain the organization of the classical von Neumann machine and its major functional units, and estimate the performance improvements of common performance optimization techniques in modern processors.
4. Modify a C function to maximize performance while retaining its functional correctness by assessing the effect of each expression on the processor and its memory subsystem.
5. Estimate the performance of cache memory, and explain the workings of a system with virtual memory management.
6. Examine the sources of conflict that can arise when multiple threads of execution share resources, and demonstrate the ability to use synchronization constructs to mediate those conflicts.
7. Explain the programmer's interaction with the underlying system through the different APIs and abstractions, including system support for process and thread control, virtual memory, and system I/O.

3 Textbook

Randal E. Bryant and David R. O'Hallaron, *Computer Systems: A Programmer's Perspective*, Third Edition, Pearson, 2015. (ISBN: 9780134092669)

Orange Instant Access (OIA) provides you an online copy of the book for $29.18. You are automatically enrolled and your required course material will be accessible via Blackboard — all you need to do is log in. No additional purchase is needed. You will have until Feb. 7, 2022 to decide if you would like to remain enrolled in OIA. If you would like to opt-out of participation in this program, you may do so through the "Orange Instant Access" link in Blackboard. If you opt out, you are still responsible for obtaining the materials elsewhere.

4 LMS, Course page, Communication, Attendance

Blackboard (https://blackboard.syr.edu/): This class will use Blackboard Learning Management to house the syllabus, course content, links to external course materials, assignments, quizzes, exams, feedback, and grades. Note when submitting materials that the University's Blackboard Learning Management System is on Eastern Time. It is recommended that students check their blackboard announcement and email routinely to ensure up-to-date communication.

Discussion board: This term we will be using Blackboard for class discussion. Rather than emailing questions to the teaching staff, I encourage you to post your questions on Blackboard discussion.

Attendance and Misc.: (1) You must abide by the University's rules and health related guidelines and (2) communicate with me if you run into a situation where you cannot keep up with the work and lectures.

5 Schedule

The following is a tentative schedule and is subject to change.

Week	Tue. lecture	Thu. lecture	Events
1	Overview	C Basics	
2	C Pointers and Arrays	C memory management	HW1
3	Integers	Floating point	HW2
4	`asm`: basics	`asm`: control 1	HW3
5	`asm`: control 2	`asm`: procedures 1	HW4
6	`asm`: procedure 2	`asm`: data	
7	`asm`: buffer overflow	TBA	HW5
8	EXAM1 Review	**EXAM1**	
9	Spring break		
10	Memory hierarchy	Cache memory	HW6
11	Cache friendliness	Virtual memory 1	HW7
12	Virtual memory 2	Memory allocation 1	HW8
13	Memory allocation 2	Digital logic 2	HW9
14	Sequential processor	Pipelining and Parallelism	HW10
15	EXAM2 review	**Exam2**	

6 Class Policies

This course has five components, and their contributions toward the total grade are as follows.

- Honor-Pledge: 2%
- In-class quizzes: 8%
- Homework: 50%
- Exam1 & Exam2: 40%

The exam1 and exam2 weight may be either 10% and 30%, or 20% and 20%, whichever is greater. Final letter grades will be assigned based on numerical thresholds, and the exact threshold values will be determined at the end of class. However, you can expect that the letter grade cutoffs as shown below: Let C be the cutoff between two letter grades.

No **Incomplete** grade will be provided without valid reason. Violations of academic integrity overrides the foregoing table and could result in a F grade. Finally, the instructor reserves the right to change this grading scale.

6.1 Exams

There will be two exams in this course. The exact coverage and scope for the exams will be announced prior to the exam date, but in general, they will be cumulative, covering contents from

Letter grades	Cutoff
Between B+ and A-	$80 \leq C < 90$
Between C+ and B-	$70 \leq C < 80$
Between D and C-	$60 \leq C < 70$
Between F and D	$50 \leq C < 60$

the beginning.

Most of the exam questions will be variations of (1) the practice and homework problems of the textbook (B&O), (2) the previous exams from the B&O authors' class `https://www.cs.cmu.edu/afs/cs/academic/class/15213-f21/www/exams.html`, and (3) the examples and exercises performed in lectures and labs.

Exams are closed-books and closed notes. However, if deemed necessary, we will provide you with an appendix with relevant materials for reference.

6.2 Homework

We will assign a number of homework problems during the semester. Some of the HW will be of written format and some will comprise of programming assignments. // The homework are designed to provide hands-on experience in understanding the learning objectives of the course. The `C` programming language plays a critical role in these homework. However, the level of proficiency required for the programming homework incrementally increase, and students without prior exposure to the language should be able to learn as the course progresses. // The programming homework are based on the course contents developed by the authors of the textbook (B&O). You may find useful information on their course webpage at `https://www.cs.cmu.edu/afs/cs/academic/class/15213-f21/www/`. There are plenty of resources online (e.g. StackOverflow) for debugging. Also, try to attend office hours, and labs if you need help.

All programming homework will be made available and submitted through our class Linux server (`lcs-vc-cis341.syr.edu`); please do not e-mail your turn-ins. **We will not accept work turned in via e-mail**. To log in to the server, use your Net ID and its password. The submissions will be cross-checked through a code-similarity analysis tool, comparing not only the student's submissions, but also the solution from the instructor's manual. Please do NOT cheat. Finally, for every project, the handout will have detail submission instructions. Following these instructions are mandatory for students so automated grading script can grade your program. Not following project submission instructions may lead to zero in that project. **Note: in this course, we do not grade programming projects manually.**
In general, all homework will be due on Friday 11:59pm.

6.3 Late Submission and Extension Policy

You can submit your HW anytime prior to or at the time of the deadline. However, you should not wait till the last moment. In case you are submitting them late, late penalty will be given using the following policy:

$\mathcal{P}(n)$ % **points** of the total points will be subtracted from your obtained score for n late days,

where $n \in Z^+$ (i.e., $n = 1, 2, \ldots$). $\mathcal{P}$ will be calculated as follows:

$$\mathcal{P}(n) = \begin{cases} 2^n \ \% & \text{if } 1 \leq n \leq 6 \\ 100 \ \% & \text{if } n > 6 \end{cases}$$

Suppose, a HW is worth of a total $\mathcal{T}$ points and your obtained score is $\mathcal{S}$. For late submission, your final score can be $\mathbf{max}(0, \mathcal{S} - \frac{\mathcal{P} \times \mathcal{T}}{100})$ for n late days.

Technically, first late day will begin right after the exact time of the deadline. However, to deal with any last moment technical issue on the submission site, you all will have an automatic **24-hour extension/grace period**. For example, assume that a submission is due at Friday 11:59 PM (in EST); if you manage to submit within the next 24 hours (i.e., Saturday 11:59 PM (EST)), your submission will NOT be considered as a late submission. After this 24-hours grace period, n will become 2 and your submission will be considered late; there will be no excuse, such as 1 min or 1 hr late.

ATTENTION: If you cannot submit HW within the 7-day period following the project deadline, you are allowed to submit that HW anytime of the semester with the **permission from the professor**. However, the maximum you can receive in the HW is 50%.

6.4 Missed Exams

For exams, there are no extensions or make-ups, except for a university-accepted reason. If a student misses exams without a university-accepted reason, a zero grade will be assigned. In case you miss exam1, you will have the option of replacing your missed exam1's score with exam2's score. Students are responsible for contacting the instructor as soon as possible if they are unable to take any exams due to university-accepted reasons.

6.5 Email Policy

- For any technical questions/errors/bugs, please use the Blackboard discussion feature. Additionally, you can always bring those questions to professor's and TAs' office hours.
- Emails should be used only for the following purposes:
  - For other course related issues (e.g., about grading, scheduling one-on-one meetings, or discussing sensitive information)
  - Asking logistical questions (i.e., date/time of exams, conflict with exam times, and etc.)
  - Notifying emergency situations
- You must use your official university email address.
- All emails should have the prefix **"CIS341"** (without the quotes) in the subject line. A best effort attempt will be made to respond to emails within 48 hours on weekdays during normal working hours.
- Few things you should keep in mind throughout the semester are:
  - You are required to check your SU email at least once a day for any class updates/announcements.
  - No emails will be answered during weekends. Please do not expect a response if you plan to email over the weekend.

- No meetings will be scheduled on the day when assignments/homework are due.
- No questions on the discussion board will be answered on the day when assignments/homework are due or over the weekend.
- For questions with long and complicated answers, like help on debugging a program, I may ask you to attend office hours.
- Finally, for any assignment/homework, it is recommended that you **Start Early, Plan Carefully!**, so you can get help on time.

6.6 Use of class meeting time

- On some days (announced ahead of time), due to professional obligations and inclement weather, in-person lecture will NOT be held. Instead I will either provide a recorded lecture or we will have the class remotely over Zoom.
- If the unexpected occurs and I need to be absent from a class with no time to notify you, someone from my area will notify you or put a note on the classroom door by class time.
- Class meeting times are used to teach, learn, and discuss technical topics.
- No complaints, grading concerns, "suggestions" on course policy, etc. will be discussed in class. These will only be considered outside of the classroom during office hours.

6.7 Use of Lab Time

Lab session on Friday will be used by the teaching team to help students work on homework problems through hands-on activities. The lab periods will serve as the help hours where the TAs can provide help to individual students for debugging and troubleshooting purposes. Hence, attending lab time is highly recommended.

6.8 Attendance and Participation

Attendance is encouraged and sometimes we will have in-class problem-solving activities. If you miss a lecture or lab, it is your own responsibility to obtain all course content and oral announcements presented in that lecture. It is also your responsibility to go through the covered material (including labs, lectures, in-class activities, and homework) on your own.

6.9 Homework Discussion and Code Reuse Policy

Code Reuse: Professional coders reuse coding solutions available on the internet after understanding and customizing to the specific context. Whenever they reuse the code, they cite it. You MUST do the followings, if you to plan use a snippet of code that you find on the internet: 1. Try to understand how code works and why it should be used. It is good to add detailed comments.
2. Use only necessary piece of code, revise it and make the code your own. DO NOT copy paste.
3. Include a reference and cite the source.
Failing to follow above process MAY lead to a form of plagiarism.
Acceptable and unacceptable use of Artificial Intelligence (AI) Tools: The use of generative AI tools (e.g. ChatGPT, Dall-e, etc.) is permitted to be ONLY for the following activities: 1) Brainstorming and refining your ideas; 2) Finding and learning information on a topic; and 3) Checking grammar and style.

The use of generative AI tools is not permitted in this course for the following activities:
-Completing graded work (e.g., homework, quiz, exam) in the course;
-Completing any individual work that have been assigned to you;
-Writing entire sentences, paragraphs, or papers to complete class assignments.
Any assignment that is found to have used generative AI tools in unauthorized ways will be treated as academic integrity violations.

6.10 Grade Posting

Your grade data are recorded in the Blackboard system. It is your responsibility to check them regularly, and inform us promptly when any discrepancies are found.

7 University Policies

University Attendance Policy

Attendance in classes is expected in all courses at Syracuse University. It is a federal requirement that faculty promptly notify the university of students who do not attend or cease to attend any class. Faculty will use Early-Semester Progress Reports and Mid-Semester Progress Reports in Orange SUccess to alert the Registrar and Financial Aid Office on non-attendance. For more information visit:
Faculty: `http://registrar.syr.edu/faculty-staff/non-attendance/`
Students: `http://registrar.syr.edu/students/non-attendance/`
If a student is unable to participate in-person or virtually for an extended period of time (48 hours or more), the student may request an absence notification from their home school/college Dean's Office or through Student Outreach and Retention (SOaR) office. Instructors will be notified via the "Absence Notification" flag in Orange SUccess.
Barnes Center at the Arch (Health, Counseling, etc.) staff will not provide medical excuse notes for students. When Barnes Center staff determine it is medically necessary to remove a student from classes, they will coordinate with SOaR case management staff to provide appropriate notification to faculty through Orange Success. For absences lasting less than 48 hours, students are encouraged to discuss academic arrangements directly with their faculty.
Additional information may be found at Student Outreach and Retention: Absence Notifications (`https://experience.syracuse.edu/soar/support-services/absence-notifications/`).

Diversity and Disability

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to contact me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Center for Disability Resources (CDR) in this process.
If you would like to discuss disability-accommodations or register with CDR, please visit Center for Disability Resources. Please call (315) 443-4498 or email (`https://disabilityservices.syr.edu/`) for more detailed information.
The CDR is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact CDR as soon as possible to begin

this process.

Discrimination or harassment

Federal and state law, and University policy prohibit discrimination and harassment based on sex or gender (including sexual harassment, sexual assault, domestic/dating violence, stalking, sexual exploitation, and retaliation). If a student has been harassed or assaulted, they can obtain confidential counseling support, 24-hours a day, 7 days a week, from the Sexual and Relationship Violence Response Team at the Counseling Center (315-443-8000, Barnes Center at The Arch, 150 Sims Drive, Syracuse, New York 13244). Incidents of sexual violence or harassment can be reported non-confidentially to the University's Title IX Officer (Sheila Johnson Willis, 315-443-0211, titleix@syr.edu, 005 Steele Hall). Reports to law enforcement can be made to the University's Department of Public Safety (315-443-2224, 005 Sims Hall), the Syracuse Police Department (511 South State Street, Syracuse, New York, 911 in case of emergency or 315-435-3016 to speak with the Abused Persons Unit), or the State Police (844-845-7269). I will seek to keep information you share with me private to the greatest extent possible, but as a professor I have mandatory reporting responsibilities to share information regarding sexual misconduct, harassment, and crimes I learn about with the University's Title IX Officer to help make our campus a safer place for all.

Use of Student Academic Work

Educational use of student work: I intend to use academic work that you complete this semester for educational purposes in this course during this semester. Your registration and continued enrollment constitute your permission.

Mental Health and Well-being

Mental health and overall well-being are significant predictors of academic success. As such it is essential that during your college experience you develop the skills and resources effectively to navigate stress, anxiety, depression, and other mental health concerns. Please familiarize yourself with the range of resources the Barnes Center provides (https://ese.syr.edu/bewell/) and seek out support for mental health concerns as needed. Counseling services are available 24/7, 365 days, at 315-443-8000.

Academic drop deadline

As part of our efforts to track satisfactory academic progress, the Academic Drop Deadline and the Financial Drop deadline will both occur on September 16, 2024, for the fall semester and February 3, 2025, for the spring semester. Students may still withdraw from courses after these deadlines; this would place a 'WD' grade on their transcripts. Students enrolled in "flex" classes (Flexibly formatted classes) have different deadlines and will need to check MySlice for the Academic and Financial Drop deadlines that pertains to their class.

Academic Integrity Policy

As a pre-eminent and inclusive student-focused research institution, Syracuse University considers academic integrity at the forefront of learning, serving as a core value and guiding pillar of education. Syracuse University's Academic Integrity Policy provides students with the necessary guidelines to complete academic work with integrity throughout their studies. Students are required

to uphold both course-specific and university-wide academic integrity expectations such as crediting your sources, doing your own work, communicating honestly, and supporting academic integrity. The full Syracuse University Academic Integrity Policy can be found by visiting class.syr/edu, selecting, "Academic Integrity," and "Expectations and Policy."

Upholding Academic Integrity includes the protection of faculty's intellectual property. Students should not upload, distribute, or share instructors' course materials, including presentations, assignments, exams, or other evaluative materials without permission. Using websites that charge fees or require uploading of course material (e.g., Chegg, Course Hero) to obtain exam solutions or assignments completed by others, which are then presented as your own violates academic integrity expectations in this course and may be classified as a Level 3 violation. All academic integrity expectations that apply to in-person assignments, quizzes, and exams also apply online.

Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered. Students may not drop or withdraw from courses in which they face a suspected violation. Any established violation in this course may result in course failure regardless of violation level.

Use of third party websites: Using websites that charge fees or require uploading of course material (e.g., Chegg, Course Hero) to obtain exam solutions or assignments completed by others and present the work as your own violates academic integrity expectations in this course and may be classified as a Level 3 violation, resulting in suspension or expulsion from Syracuse University.

Online quizzes and exams: All academic integrity expectations that apply to in-person quizzes and exams also apply to online quizzes and exams. In this course, all work submitted for quizzes and exams must be yours alone. Discussing quiz or exam questions with anyone during the quiz or exam period violates academic integrity expectations for this course.

Zero tolerance for artificial intelligence use: All generative-AI tools are prohibited in this course because their use inhibits achievement of the course learning objectives. This policy applies to all stages of project and writing processes including researching, brainstorming, outlining, organizing, and polishing. Do not use Generative-AI tools to create any content (i.e., images and video, audio, text, code, etc.). If you have any questions about a feature and whether it is considered Generative-AI, ask your instructor.

Use of MOSS softawre for plagiarism detection: Occasionally, your solutions to HW will be checked using an automatic system, MOSS (`http://cs.stanford.edu/~aiken/moss/`) for determining the similarity of programs. MOSS is a plagiarism detection tool which can identify similarity matching among written computer programs.

Additional University Policies

Syracuse University's Religious Observances Policy (`https://policies.syr.edu/policies/university-governance-ethics-integrity-and-legal-compliance/religious-observances-policy/`) recognizes the diversity of faiths represented in the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their traditions. Under the policy, students are given an opportunity to make up any exam- ination, study, or work requirements that may be missed due to a religious observance, provided they notify their instructors no later than the academic drop deadline. For observances occurring before the drop deadline, notification is required at least two academic days in advance. Students may enter their observances in MySlice under Student Services/Enrollment/My Religious Observances/Add a Notification Students should review SU's policies regarding: Orange SUccess (`http://orangesuccess.syr.edu/getting-started-2/`), and other Academic Rules (`http://coursecatalog.syr.edu/content.php?catoid=17&navoid=2249`).