

ECE 382N-14 High-Speed Computer Arithmetic

Unique #17795

Fall, 2024

Hours: Monday & Wednesday
5:00 PM to 6:30 PM

Location: ECJ 1.214

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Office Hours: Monday and Wednesday 3:00 PM to 4:30 PM, Tuesday 11:00 AM to 2:00 PM or by appointment.

Prerequisites: Graduate standing in ECE or CS.

This course covers the design and implementation of binary arithmetic as applied to general purpose and special purpose computers. The focus is on developing high-speed algorithms for the basic arithmetic operations and understanding their implementation using VLSI technology at the gate level.

Text: Earl Swartzlander, ed., *Computer Arithmetic*, Available from University Duplicating. This collection of reprints includes most of the required reading, although students may need to find a few articles from the literature.

Grading: • 3 Examinations @ 20% each,
• Project @ 40%

Plus and Minus grades are not used.

Numerical Grade	Letter Grade
$G \geq 90\%$	A
$90\% > G \geq 80\%$	B
$80\% > G \geq 70\%$	C
$70\% > G \geq 60\%$	D
$60\% > G$	F

Student Project: A properly documented project on a subject of interest to the student (with approval of the topic by the instructor) is a significant portion of the course grade. A written report is due on December 4, 2024. The projects may be done by individuals or by small groups of 2 to 4 students. Each project will be the subject of a *BRIEF* presentation of the project results to the class during the last two class sessions.

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Policies:

- Attendance at all classes is expected, but not counted in grading.
- There is no Final Examination, but there are 3 “regular” examinations.
- There are no make-up examinations. Excused absence from an examination must be approved in advance. Absence is excused only in extreme circumstances (serious illness, death in the immediate family, etc.). Requests for excused absences should be made in writing and must be supported by appropriate documentation. Unexcused absence from an examination will result in a grade of zero for that examination.
- There is no re-grading of examinations, unless you feel that there is an error. In this case, you should submit a written request. Verbal requests will not be considered.
- The fourth class day is the last day of the official add/drop period. Drops after this time must be approved by the Dean’s office.
- University policies on scholastic dishonesty will be strictly enforced. Students who violate University rules on scholastic dishonesty (including, but not limited to, cheating, plagiarism, collusion, or falsifying academic records) are subject to disciplinary penalties, including failure in the course or dismissal from the University.
- By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holiday. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holiday, you will be given an opportunity to complete the missed work within a reasonable time after the absence.
- Disabilities: The university is committed to creating an accessible and inclusive learning environment consistent with university policy and federal and state law. Please let me know if you experience any barriers to learning so I can work with you to ensure you have equal opportunity to participate fully in this course. If you are a student with a disability, or think you may have a disability, and need accommodations please contact Disability and Access (D&A). Please refer to D&A’s website for contact and more information: <http://diversity.utexas.edu/disability/>. If you are already registered with D&A, please deliver your Accommodation Letter to me as early as possible in the semester so we can discuss your approved accommodations and needs in this course.
- Web-based, password-protected class rosters are associated with all academic courses taught at the University. Students who do not want their names to be included in these electronic class rosters must restrict their directory information in the Office of the Registrar, Main Building, Room 1.

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Emergency Preparedness

Every member of the university community must take appropriate and deliberate action when an emergency strikes a building, a portion of the campus, or entire campus community. Emergency preparedness means we are all ready to act for our own safety and the safety of others during a crisis. It takes an effort by all of us to create and sustain an effective emergency preparedness system.

If you have an emergency either on or off campus, you should call 911 to report the situation.

Please make note of the phone number for the Behavior Concerns Advice Line (BCAL: 512-232-5050). This is the number to call if you have concerns regarding the attitude or actions of other students, staff, or faculty. It is advised that you carry this number with you when you are on campus

Students requiring assistance in evacuation should inform me in writing of their needs during the first week of class. This information will then be provided to the Fire Prevention Services office.

If you would like more information regarding emergency preparedness, visit <http://www.utexas.edu/safety/preparedness/>.

Emergency Communications

Emergencies may range from inclement weather, to building evacuations, to campus closures. The university has a variety of tools to communicate with the public in the event of these and other possible emergencies. Depending on the type of emergency, the University may use some or all of the following tools to communicate with faculty, staff and students:

Siren System

The siren system is tested at 11:50 AM on the first Wednesday of every month, and delivers a siren warning and public address announcement in the event of certain outdoor emergencies.

Emergency Web Site

You may want to bookmark the [emergency Web site](#) because it is updated with information during actual emergencies or campus closures.

Local Press and Social Media

University Communications staff sends emergency information to the press and update social media with public safety messages. The university depends a great deal on the press and social media to keep students, faculty, and staff informed during campus emergencies.

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Pager System

Our campus first responders, resident advisors, and some building managers are part of the AWACS paging system. The pagers send text messages about emergencies on campus and alert city responders (APD, AFD, EMS, Office of Emergency Management, etc.) to campus crisis situations.

Fire Panel Systems

Residence halls are equipped with fire panel systems that have a public address capability. Resident advisors are trained to use these systems in emergencies in order to make announcements to the entire building regarding evacuation, shelter in place, etc.

Text Alerts

The university collects cell phone numbers from members of the campus community for emergency text messages.

University Group E-mail

During emergencies, UT Safety Alert sends an “urgent” group e-mail to every student, faculty and staff member. The e-mail directs individuals to the emergency Web site for additional information and instruction.

Voicemail to Office Telephones

This tool leaves a voice message on every faculty and staff member’s office phone on campus.

Public Safety Patrol Car Announcements

UTPD patrol cars are equipped with PA systems, which officers can use to provide instructions to pedestrians during emergencies.

University Emergency Information Line — 512-232-9999

Students, faculty, and staff can call this main number for information about campus closures.

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Course Schedule

The following course schedule is approximate. It indicates the topics, their order and probable dates, but it is subject to change.

DATE	TOPIC	READING ASSIGNMENT
August 26	Course Overview	
August 28	Number Systems	
September 2	No Class (Labor Day)	
September 4	Ripple Carry and Carry Completion Adders	Gilchrist, Pomerene and Wong
September 9	Carry Lookahead Adders	Weinberger and Smith and MacSorley (pp. 15-18)
September 11	Carry Select and Conditional Sum Adders	Lehman and Burla and Sklansky
September 16	Carry Skip Adders	Bedrij
September 18	Parallel Prefix Adders	Brent-Kung
September 23	Parallel Prefix Adders	Kogge-Stone
September 25	Multiple Word Addition	Svoboda and Swartzlander (Parallel Counters)
September 30	Adder Comparison	
October 2	<i>Examination 1</i>	
October 7	Booth and Modified Booth Multipliers and Array Multipliers	Booth, Baugh and Wooley, and Blankenship
October 9	Fast Multipliers	Wallace and Dadda (pp. 118-125)
October 14	Serial-Parallel Multipliers	Swartzlander (Quasi Serial Multiplier)
October 16	Multiplier Comparison	
October 21	Logarithmic Arithmetic	Combet, <i>et al.</i> and Swartzlander and Alexopoulos
October 23	<i>Examination 2</i>	
October 28	Restoring Division and Non-Restoring Division	Shaw (pp. 10-12) and MacSorley (pp. 27-38)

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DATE	TOPIC	READING ASSIGNMENT
October 30	SRT Division	Robertson, Atkins
November 4	Newton-Raphson and Goldschmidt Division	Anderson, <i>et al.</i> (pp. 343-347)
November 6	IEEE Standard Floating-Point Arithmetic	IEEE Std. 754
November 11	Floating-Point Fused Multiply Add	
November 13	Residue Arithmetic	
November 18	Review	
November 20	<i>Examination 3</i>	
November 25-29	Thanksgiving Break	
December 2	Advanced Topics	
December 4	Project Summaries	
December 9	Project Summaries	