CSE2312 Computer Organization and Assembly Language Programming
Summer 2023
(subject to change prior to the first day of class, revised 5/17 and 6/4)

Instructor Information

Instructor:
Jason Losh, Ph.D.

Office Number:
ERB 649

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Faculty Profile:
https://mentis.uta.edu/explore/profile/jason-losh

Office Hours:
Office hours will be held before and after each class in ERB 129, since this time and place is most convenient to students. Appointments are also available as needed.

Teaching Assistants:
Todd Rosenkranz, todd.rosenkrantz@uta.edu

Course Information

Section Information:
002

Time and Place of Class Meetings:
MW 3:30-5:20pm in ERB 129
This is a 100% face-to-face course. This is not an online course.

Description of Course Content:
Computer organization from the viewpoint of software, including: the memory hierarchy, instruction set architectures, memory addressing, input-output, integer and floating-point representation and arithmetic. The relationship of higher-level programming languages to the operating system and to instruction set architecture are explored. Some programming in an assembly language. Prerequisite: CSE 1320.

Student Learning Outcomes:
Upon successful completion of this course, students will have knowledge of:

- Range, and size of integer and boolean variable types
- Basis for 2's compliment encoding of signed integers, ALU signed/unsigned agnostic design
- ALU operating including flag operation
- ALU register interface in the CPU
- Arithmetic, logical and shift operations in the ALU
- Load/store interface between registers and memory
- Memory addressing modes (direct, indirect, indirect indexed, …)
- Flow control instructions and loops in the ALU, relation to for/while loops in C

- Configuring Rpi for SSH
- AAPCS register and calling conventions
- Writing mixed C / assembly programs
- Using the GNU compiler, assembler, linker, and debugger
- Detailed knowledge of ARM arithmetic, logical, load/store, and program flow instructions
- Effects of packing on performance and memory size
- Full decrementing stack design and the stack pointer
- IEEE-754 floating point number range, dynamic range issues, and memory storage
- Pipelined vs non-pipelined processors
- Cycle-exact calculation of pipeline timing
- Interrupts
- Memory virtualization and paging (heap fragmentation, security implications)
- Virtual machines
- Cache memory

Class Web Page:
Additional files will be provided as needed on the course web site at http://ranger.uta.edu/~jlosh/.

Communication:
All class-wide communication by the instructor, including distribution of homework sets, will occur via the class listserv. If you are enrolled prior to the first day of class, you will be added to the listserv automatically. If you add on or after the first day of class, please sign up for the CSE2312-L listserv by sending an e-mail from your UTA e-mail account to listserv@listserv.uta.edu from your UTA e-mail account (no subject line needed) and the command SUBSCRIBE CSE2312-L as the message body. You will then receive an e-mail from the listserv server to which you must acknowledge to join the listserv with "OK" in an e-mail.

Textbooks and Other Course Materials:
Raspberry Pi Operating System Assembly Language, 4th ed., Bruce Smith, CreateSpace Independent Publishing Platform, ISBN 978-0648098737. Cost is around $20.00.

All students are required to have a Raspberry Pi 3b/3b+/4b (with appropriate accessories to power it and make it work) for the following courses: CSE 1106, 2312, 4342, and 4352. We coordinate between the instructors of these courses to ensure that a single purchase can be re-used for all of these courses to minimize your costs. The cost is between $120 and $180.

Most students buy a kit with the single board computer board, case, power supply, fan, hdmi to micro-hdmi cable, micro SD card with the 32-bit OS pre-installed, and accessories to save a lot of time. Many students in the past have purchased a kit from Canakit, but this is not an endorsement. Please plan to order a RPi kit as soon as possible, as many University students buy a similar board for their courses. Any of the memory sizes for the RPi 4b kits will work for these courses.

In addition, students will need the following components at home to work with the Raspberry Pi directly:
USB keyboard and mouse (will be provided for the labs in the labs)
Monitor accepting HDMI or DVI and a proper HDMI to DVI cable

Alternatively, instead of using an monitor, SFTP and SSH access from a PC is possible with an Ethernet cable after configuration.

Current computer recommendations are available at https://www.uta.edu/academics/schools-colleges/engineering/students/student-computer.

Major Assignments and Examinations:
Quiz 1 (Monday, June 12)
Quiz 2 (Monday, June 26)
Quiz 3 (Wednesday, July 5)
Test 1 (Monday, July 10)
Quiz 4 (Wednesday, July 19)
Quiz 5 (Monday, July 31)
Quiz 6 (Wednesday, August 9)
Test 2 (Thursday, August 10 @ 3:30pm)

Technology Requirements:
The students will need a Raspberry Pi setup as described above to solve homeworks and complete the lab assignments.

Grading Information

Grading:
- Grade scale: A (90-100), B (80-89), C (70-79), D (60-69), and F (0-59)
- Grade calculation: Test 1 (30%), Test 2 (30%), Quiz Average (40%)
- The instructor reserves the right to make reasonable changes in performance evaluation as needed.
- The instructor also reserves the right to make substantial changes in the structure of the course if the modality of the course must be changed.
- Any request for re-grading must be submitted to the teaching assistant within one week of the completion of grading. If, after requesting a re-grade from the teaching assistant and getting a response, you may refer the case to the instructor if you think further action is needed.

Expectations for Out-of-Class Study:

As a general rule of thumb, for every credit hour earned, a student should spend 3 hours per week studying outside of class. Hence, for this 3-credit course, a minimum expectation of 9 hours of study is expected in addition to the time spent in class.

Tests:
- To ensure that all students are treated equally and given the same time to prepare for the exam, no makeup will be provided for any test missed.
- If you know you are going to miss a test, you can request an advance test given 1 week prior to the normally scheduled time for the exam, with the understanding that any curve applied to the test taken at the official test time will not apply to the advance test, since the content of that test will be unique.
- Tests are on-campus.
- Failure to submit your exam by the end time announced in class will result in a grade of zero.
- A single piece of paper (front and back) with handwritten notes is allowed.
- A calculator without data storage (except a single value) is allowed.
- Tests are based on lecture material, homework problems, example test questions and topics, review session topics, and practical knowledge learned during the compilation and assembly of the computer programs.

Quizzes:
- No makeup will be provided for any quiz missed.
- The lowest quiz grade will be dropped.
- Quizzes are on-campus
- Failure to submit your quiz by the end time announced in class will result in a grade of zero.
- A single piece of paper (front and back) with handwritten notes is allowed
- A calculator without data storage (except a single value) is allowed.

Homework:

- Homework is assigned to help you master the student educational outcomes required for the course. It is important to work the homework so that you will perform well on the quizzes, exams, and in subsequent courses.
- Due to the presence of web sites that provide solutions to homework sets, homework will be assigned but not collected. A solution will be provided by the grader around the suggested due date for the homework.

Course Schedule

The anticipated lecture order is as follows:

- Syllabus (0.5 hrs)
- Integer Numbers and reason for 2's complement encoding (1.5 hrs)
- ALU and Flags (1.5 hrs)
- Bitness of Processor, ALU Register Interface (1.5 hrs)
- Boolean operations and logical/arithmetic shifts (1 hr)
- ALU Opcodes (1.5 hrs)
- Configuring the Raspberry Pi (static IP, SSH) (0.5 hrs)
- First look at C procedure calling convention (AAPCS) (0.5 hrs)
- First mixed C/assembly ALU programs (4 hrs)
- Flow control Opcodes (1.5 hrs)
- MOV/MVN/LDR for constant encoding (0.5 hr)
- Load/store interface, addressing modes, endianness (2 hrs)
- Using the GDB debugger (0.5 hrs)
- Pointers in C, dereferencing, and association with memory opcodes (1 hr)
- Procedure calling and register saving convention (1 hr)
- C/assembly mix code for arrays of characters and integers (4 hrs)
- String to/from integer conversion (1 hr)
- Calling subfunctions, register saving convention, PUSH/POP (1 hr)
- Floating-point numbers, encoding, and loss of accuracy (2 hr)
- Floating point examples (1.5 hrs)
- Structures, C alignment, and speed/size tradeoffs (2 hrs)
- Instructions and Fetch Logic, Basic Program Flow (1 hrs)
- Pipeline and cycle-accurate timing analysis (1.5 hrs)
- Virtualization of memory, page tables/faults, memory fragmentation, security (1.5 hr)
- Virtual machines (1 hr)
- Stack, heap, and memory management (1 hr)
- Interrupts (1 hr)
- Cache (1.5 hrs)

The instructor reserves the right to make changes in the schedule as needed as the class progresses.

The official dates for registration, census, and dropping are available at www.uta.edu/acadcal.

Academic Integrity

This information is copied from http://www.uta.edu/conduct/academic-integrity/index.php.

The University of Texas at Arlington strives to uphold and support standards of personal honesty and integrity for all students consistent with the goals of a community of scholars and students seeking knowledge and responsibility. Furthermore, it is the policy of the University to enforce these standards through fair and objective procedures governing instances of alleged dishonesty, cheating, and other academic/non-academic misconduct.

Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, and collusion on an examination or an assignment being offered for credit. Each student is accountable for work submitted for credit, including group projects.

- Cheating
  - Copying another's test or assignment (added note: remember this includes homework!)
  - Communication with another during an exam or assignment (i.e. written, oral or otherwise)
  - Giving or seeking aid from another when not permitted by the instructor
  - Possessing or using unauthorized materials during the test
  - Buying, using, stealing, transporting, or soliciting a test, draft of a test, or answer key
- Plagiarism
  - Using someone else's work in your assignment without appropriate acknowledgment
  - Making slight variations in the language and then failing to give credit to the source
- Collusion
  - Without authorization, collaborating with another when preparing an assignment

Institution Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page (http://www.uta.edu/provost/administrative-forms/course-syllabus/index.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Additional Information

Face Covering Policy:
While face coverings are not mandatory, all students and instructional staff are welcome to wear face coverings while they are on campus or in the classroom.

Attendance:
At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report must the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

In this course, attendance in-class, on campus is expected.

Emergency Exit Procedures:
Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Academic Success Center
The Academic Success Center (ASC) includes a variety of resources and services to help you maximize your learning and succeed as a student at the University of Texas at Arlington. ASC services include supplemental instruction, peer-led team learning, tutoring, mentoring and TRIO SSS. Academic Success Center services are provided at no additional cost to UTA students. For additional information visit: Academic Success Center. To request disability accommodations for tutoring, please complete this form.

Emergency Phone Numbers

In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381.