Baylor University Spring 2016 Syllabus
ELC 3338: Computer Organization

Keith Evan Schubert

1 Course and Instructor Information

Instructor: Keith Evan Schubert
Office location: Rogers - Room 300F
Telephone: (254)710-3348
Email: keith_schubert@baylor.edu
Office Hours: MW 8:30 AM - 10:30 AM
Class Days/Time: MW 12:20PM - 1:10PM
Classroom: Rogers 109
Lab Days/Time: M or W 2:30PM - 4:25PM
Labroom: Rogers 114
Textbook: Patterson and Hennesey, **Computer Organization and Design, 5th ed.**
Supplementary Textbook: none
Prerequisites: ELC 2337 and 3336, or CSI 3439

2 Schedule

Date	Topic	Read	Homework	Lab
1/11	8 Ideas, 5 Parts	1.1-1.4		1
1/13	Fabrication, Power	1.5, 1.7		1
1/18	MLK day	-		
1/20	Performance - time eq, Amdahl's law	1.6, 1.8-1.12		2
1/25	ISA, 0-3 addresses, Arithmetic/logic	2.1-2.4, 2.6	HW 1	2
1/27	Representation, RISC/CISC, load-store, addressing	2.4-2.5, 2.9-2.10		3
2/1	branches, jumps, links, conventions, and tables	2.7-2.8, A.6		3
2/3	Parallelism, compilation, procedures, examples	2.11-2.21		4
2/8	Review: binary, compliments, add, subtract, CLA	3.1-3.2	HW 2	4
2/10	Multiplication and Booth's algorithm	3.3		5
2/15	Division and Mod	3.4		5
2/17	Floating point numbers, IEEE 784	3.5		6
2/22	Floating point arithmetic and parallelism	3.5-3.11	HW 3	6
2/24	Midterm	1-3		help
2/29	Processor and datapath: MIPS	4.1		7
3/2	Conventions, datapath control	4.2-4.4		7
3/7	Spring Break			
3/9	Spring Break			
3/14	Pipelining: Overview, ILP, performance	4.5		8
3/16	Pipelining: structural, data hazards	4.6-4.7		8
3/21	Pipelining: control hazards	4.8		9
3/23	Pipelining: exceptions	4.9		9

3/28	Resurrection Break			
3/30	Pipelining: multiple issue, superscalar	4.10-4.16		10
4/4	Memory heirarchy	5.1	HW 4	10
4/6	Memory technology	5.2		11
4/11	Cache implementation	5.3		11
4/13	Memory control	5.8-5.9		12
4/18	Cache performance	5.4		12
4/20	Virtual machines and memory	5.6-5.7		13
4/25	Virtual memory translation and TLB	5.7		13
4/27	Coherenece, Snooping	5.10-5.17	HW 5	help
5/7	Saturday, May 7, 2:00 âĂŞ 4:00 pm Final Exam	1-5		

3 Objective:

To provide the basic knowledge of computer architecture and how the influences of VLSI technology, high level languages, and assembly language interacts in the design of hardware. Upon successful completion of this course, the student will have learned the techniques and theories of:

1. Performance metrics
2. Arithmetic and ALU
3. Control unit design
4. Pipelining
5. Cache and Virtual Memory
6. Bus, I/O, and reliability
7. Implementing computer designs

3.1 Catalog Description

Prerequisite(s): ELC 2337 and 3336; or CSI 3439. Introduction to the organization and design of general purpose digital computers. Topics include instruction sets, CPU structures, hardwired and microprogrammed controllers, memory, I/O systems, hardware description languages and simulations. (3-0)

4 Reading

You are to read it in advance for each class (except the first, which would not be possible). The reading assignments listed cover the material that will be discussed in class, but in a different way, and with a different emphasis. I would be wasting your time and insulting you if I did not add material, as I would be implying you are unwilling or incapable of reading and understanding. There are two main reasons for reading the material ahead of time.

1. Reading the text before class gives you the basic ideas, so the deeper truths and broader implications can be covered in class.

2. Even the best of textbooks will cause most people to get confused on some aspects. If you read the book before the class, your can ask questions and your confusion will get cleared up. Reading will make the course easier for you.

I know that reading before class is not frequently done, but I encourage you to do it. You are here to get a top quality education, but in order to get it you must do more than just show up.

5 Grading

All assignments will be submitted in the course Canvas site, by the time specified unless previously arranged with the instructor. The grading percentages and policies of each graded area are listed in their sections below.

The grading scheme is as follows.

Letter	Score Range
A	$[94-100]$
A-	$[90-94]$
B+	$[87-90)$
B	$[83-87)$
B-	$[80-83)$
C+	$[77-80)$
C	$[73-77)$
C-	$[70-73)$
D+	$[67-70)$
D	$[63-67)$
D-	$[60-63)$
F	$[00-60)$

All grades will be available on the course Canvas site.

I do not curve grades, but I do give opportunities to earn credit by doing extra work that helps you learn the material and grow as an engineer. Extra credit for tests takes the form of writing tutorials that I will post on the website for other students to benefit. You must write the tutorial on an area you lost points on. You must write the tutorial yourself, do not copy it from the web. I get really annoyed when students copy tutorials from others. I always find it, don't try. Writing a tutorial teaches you to do the work. All who have done them have remarked how much they learned. Don't cheat yourself of a valuable learning experience, while risking expulsion for cheating. For the final, one and only one tutorial may be submitted in advance.

You may earn extra credit for homework by attending school seminars, attending relevant conferences, and participating in school outreach activities, like the open house.

Labs that are submitted on time can be fixed and re-graded, so no extra credit is needed.

6 Homework (15%)

Homework has been implemented as quizzes in the course Canvas. You may take them in whenever you feel like and in a piecemeal fashion, just be careful of the closing date (see the Canvas calendar or main page, note it is due by 11:55 PM). You will get immediate feedback on the correctness of each answer when you submit the homework, which should help you to learn as you go. In a few cases, extended answers, such as proofs, are required, which will require me to grade them and thus cannot be verified immediately.

These proofs must be organized, and show all the steps and the math must use LaTeX[1] formatting. For extended answer problems, how you get the answer is as important (if not more important) than what the answer is.

Homework is due by 11:55 PM on the due date. Late homework will be not accepted, the Canvas will promptly close the quizzes. Your clock might differ, so please try to be in safely under the deadline. You can save your work without submitting, which allows you to divide up when you do your problems, but if in the end you don't click submit it won't be graded and you will get a zero. Please carefully watch the due date and time, as Canvas will automatically stop the quiz when time runs out. After I set it, I do not control it, it is automatic. If you don't submit the quiz in time you will get a zero. Please do not risk this by waiting till the last second.

Students are encouraged to discuss class material, *but the work must be done individually*. The homework and all other graded work should reflect the effort of the individual who receives credit for it. Cheating will not be tolerated. The student may never copy other student's work, nor allow others to copy one's own work. If two assignments look excessively similar, and are not narrow enough to justify the similarity, automatically a grade of zero results, with the likely referral to appropriate university bodies. Again, students are allowed and encouraged to discuss the material related to assignments, but when it comes to actually doing the assignment work it is to be done individually.

7 HDL Project (30%)

The building of a computer is an essential aspect in really understanding the material, and as such we will be building a MIPS computer in an HDL. Key parts of the project will be discussed and worked on in class but you must work on aspects as homework to finish. You will need to test your components by building testbenches and generating timing diagrams. You will work in groups of 2. When your group is finished you will write a report documenting what you accomplished in LaTeX using the template LabN.tex provided. All project files must be uploaded to the class Canvas by the end of day on the day marked on the schedule. On the due date of the project you will be assigned a report of someone (random by Canvas) to review and provide them comments to improve. The one who wrote the report may then modify their lab write up to improve it. I will then grade it. Note you must submit your project on time, or it will not make it into the review and grading process. I can't change this later. Stay on top of your project!

The first lab will be done by everyone, and then the partners will split the remaining write-ups - each partner writing one or the other of the remaining pairs of labs.

8 Midterm (25%)

The midterm is closed book, but I allow 2 pages of 8.5×11 front and back of notes in the midterm. You should bring paper to write on and a pen or pencil. You cannot use a calculator. No electronic device of any type is permitted in the midterm, use of one in any way will result in a 0 for the exam. Cell phones should be off and stored.

9 Final (30%)

The final is closed book, but I allow 4 pages of 8.5×11 front and back of notes in the final. You should bring paper to write on and a pen or pencil. You cannot use a calculator. No

[1] LaTeXis a free document formatter, available on all platforms, that does a great job with both math and computer code, and thus will actually make your life easier. It comes with standard Linux and Unix installs, but for those who use other platforms, I have put links on my webpage (look for the Tex link on my main page) to where you can download it for your home computer.

electronic device of any type is permitted in the final, use of one in any way will result in a 0 for the exam. Cell phones should be off and stored. The final is

Saturday, May 7, 2:00 âĂŞ 4:00 pm

10 Getting Help

Everything always seems easier in class. The goal of this course is to learn the material, not to frustrate or confuse you. You will not know what is hard or confusing until you try though. When you hit that problem that you can't figure out, don't get frustrated, get help. You are highly encouraged to take advantage of office hours. Office hours are the premiere assistance methodology of this class. You are also encouraged to discuss problems and methods with each other. Study groups can be very helpful. Do not cheat yourself though by getting solutions and not understanding! All work must be your own. You can discuss and help, but may not copy someone else's work, or allow your work to be copied. That is plagiarism and is treated very severely.

The class website also has my notes, some basic computer practice drills that check themselves if you need to refresh these topics, student tutorials, and links to other resources. You are encouraged to avail yourself of the help these provides.

11 University Policies

11.1 Academic Integrity

Plagiarism or any form of cheating involves a breach of student-teacher trust. This means that any work submitted under your name is expected to be your own, neither composed by anyone else as a whole or in part, nor handed over to another person for complete or partial revision. Be sure to document all ideas that are not your own. Instances of plagiarism or any other act of academic dishonesty will be reported to the Honor Council and may result in failure of the course. Not understanding plagiarism is not an excuse. As a Baylor student, I expect you to be intimately familiar with the Honor Code `http://www.baylor.edu/honorcode/`. For more information see the Baylor University Honor Code on the Academic Integrity Web page or contact the Office of Academic Integrity at 710-8882 or Academic_Integrity@baylor.edu.

11.2 Turnitin

Students agree that by taking this course, all required papers, exams, class projects or other assignments submitted for credit may be submitted to turnitin.com or similar third parties to review and evaluate for originality and intellectual integrity. A description of the services, terms and conditions of use, and privacy policy of turnitin.com is available on its web site: `http://www.turnitin.com`. Students understand all work submitted to turnitin.com will be added to its database of papers. Students further understand that if the results of such a review support an allegation of academic dishonesty, the course work in question as well as any supporting materials may be submitted to the Honor Council for investigation and further action.

11.3 Academic Success

We as faculty members have high academic expectations of you. However, every student who has been admitted to Baylor can be successful. I am a vigilant professor and will notice if you are struggling in my course. If your academic performance in this class is substandard, I will submit an Academic Warning to the Success Center during the sixth week

of the semester. I will work to help you get the help you need to learn more fully, and I can assist you in finding the resources you need beyond my course. Familiarize yourself with the culture of success we have at Baylor by stopping by the Paul L. Foster Success Center in Sid Richardson or by going to: http://www.baylor.edu/successcenter/. Even if you don't need help, you can get involved by tutoring other students in the future or by telling a hall mate how and where to get help.

11.4 Office hours

One of the best ways to take full advantage of learning in my course is by coming to my office hours. I am anxious to guide you in your academic pursuits. Take advantage of the hours listed above or email me for an appointment.

11.5 Classroom Protocol

I expect you to be mature about your education and courteous to others. This means several things, such as,

1. being an active participant in class;
2. showing up on time each day ready for class
3. if you can't make it, you should make provisions to get notes and such so you learn;
4. being respectful of others;
5. not using cell phones or web surfing - if you don't want to be here, then don't sign up for class;
6. leaving class quietly to take an important call or go to an essential meeting, so as not to disturb others.

12 ADA

Any student who needs academic accommodations related to a documented disability should inform me immediately at the beginning of the semester. You are responsible for obtaining appropriate documentation and information regarding accommodations from the Baylor University Office of Access and Learning Accommodation (OALA) and providing it to me early in the semester.

Contact Information:
254-710-3605
Paul L. Foster Success Center
1st floor on the East Wing of Sid Richardson - Room 190

13 Graduate Writing Consultants

If you are a graduate student, Graduate Writing Consultants are available to help you with your writing. Please email gwc@baylor.edu. Attach the paper or chapter you would like the consultant to review and indicate any specific issues you want to discuss (i.e., organizational problems, transitions, clarity, etc.). The Center Coordinator will then contact you to arrange a one-hour appointment. You can also visit the Graduate Writing Center website.

14 Other Information

The student is responsible for all material covered in the readings, class, labs, and also for all announcements made therein. **The topics and dates in this syllabus are tentative**, for instance I might need to cut a topic or move things around should we face unpleasant weather or other unforeseeable conditions. All changes will be discussed with the class.

My personal website, r2labs.org, which has my notes and helps for students is not required for the course, it is solely there for your help. The university will not provide technical support for resources available on r2labs.org. The university is not responsible for the content of r2labs.org and does not endorse any products which may be advertised through r2labs.org.