CSc 252 - Computer Organization - Spring 18
12:30-1:45 pm, TuTh, ILC 141

Description of Course
Basic machine organization; elementary hardware concepts; interrupts. Machine operations and instructions; assembly language concepts and programming.

Course Prerequisites or Co-requisites
Prerequisite: 210
Students are expected to have familiarity with either C or Java (preferably both).

Instructor and Contact Information
Instructor: Russell Lewis
Russell Lewis
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Office Hours
(Exact office hours subject to change, consult the class webpage for up-to-date information.)

Websites
Class Homepage: https://lecturer-russ.appspot.com/classes/cs252/spring18/
Piazza: https://piazza.com/arizona/spring2018/csc252/
D2L: https://d2l.arizona.edu/d2l/home/646991
Recordings on Panopto: Access through “Content” tab on D2L
Course Format and Teaching Methods
We will be using an online textbook through zyBooks. Sections from the textbook will be assigned each week; you will need to read them before class on the first lecture day. (We will be checking, and giving you a grade for completion. We will also have quizzes most weeks. Most questions will be copied directly from the exercises you performed - or something very close.)

In class, we will be mixing lecture with regular class activities. Most days, you will have a series of activities that you will work on in groups; I plan to alternate group work with lecturing. We will be checking to see if you complete these activities; while you don’t have to get them perfect, you are required to work diligently and arrive at the best answer you can.

Course Objectives and Expected Learning Outcomes
By the end of the semester, the student will:

- Be capable of writing short (less than 300 line) programs in MIPS assembly. Key elements include:
  - Understanding common instructions
  - Use of appropriate registers
  - Constructing loops and if/else statements
  - Traversing simple data structures such as arrays and strings
  - Declaration of storage, variables, and constants
  - Declaring functions; calling functions; passing parameters and return values; performing stack management as both caller and callee

- Understand the inner workings of a simple CPU, including:
  - Implementing simple logic statements in gates
  - Combinational and stateful logic
  - Adders and basic ALU implementation
  - Basic issues of logic optimization: path length/gate count minimization
  - Overall CPU design, implementing a few basic RISC instructions
  - Pipelining: reason for use, basic techniques, common issues
  - Cache implementation, memory hierarchies, and their implications for performance

Absence and Class Participation Policy
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at [http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop](http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop)

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: [http://policy.arizona.edu/human-resources/religious-accommodation-policy](http://policy.arizona.edu/human-resources/religious-accommodation-policy).

Absences preapproved by the UA Dean of Students (or dean’s designee) will be honored. See [https://deanofstudents.arizona.edu/absences](https://deanofstudents.arizona.edu/absences)

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

Makeup Policy for Students Who Register Late
Students who register for class late will be allowed to make up missed assignments; all missed assignments will be due at the same time as the third homework/project. Students will not be allowed to register for the class more than two weeks after it begins, save in truly exceptional circumstances.

Course Communications
The primary path for outside-lecture communications will be Piazza. If a student has an issue
which cannot reasonably be resolved through Piazza (inappropriate to discuss publicly, private issue, etc.), then the student may email the staff alias, or the instructor.

**Required Texts or Readings**

[Required] Online textbook through learn.zybooks.com. Details will be provided during the first week of class. The textbook will be the online version of:

Patterson and Hennessy, Computer Organization and Design, 5th Ed. Morgan Kaufmann.

**Required or Special Materials (if any)**

None

**Required Extracurricular Activities (if any)**

None

**Assignments and Examinations: Schedule/Due Dates**

**Projects**

This class will have programming projects, due most weeks. The following schedule gives approximate due dates for each one. The schedule below is approximate; as I assign the projects, it may occasionally be necessary to adjust due dates. Likewise, the topics mentioned are my current plans, and are subject to change. It is possible that I might assign fewer projects than listed below; however, I will not assign more.

Projects will be due at 5pm.

- Simulation Project 1  
  due on or about Wed, 24 Jan  
  Basics of Binary Arithmetic
- Assembly Project 1  
  due on or about Wed, 31 Jan  
  Introduction to MIPS
- Simulation Project 2  
  due on or about Wed, 7 Feb  
  Logic Networks
- Assembly Project 2  
  due on or about Wed, 14 Feb  
  Loops, Arrays, and Strings

  --- No Project Due 21 Feb (while I’m at SIGCSE) ---

- Simulation Project 3  
  due on or about Wed, 28 Feb  
  An ALU

  --- Spring Break ---

- Assembly Project 3  
  due on or about Wed, 14 Mar  
  Functions
- Assembly Project 4  
  due on or about Wed, 21 Mar  
  TBD
- Simulation Project 4  
  due on or about Wed, 28 Mar  
  Single-Cycle CPU
- Assembly Project 5  
  due on or about Wed, 4 Apr  
  TBD
- Simulation Project 4  
  due on or about Wed, 11 Apr  
  Pipelined CPU
- Assembly Project 6  
  due on or about Wed, 18 Apr  
  TBD
- Assembly Project 7  
  due on or about Wed, 25 Apr  
  TBD
- Assembly Project 8  
  due on or about Wed, 2 May  
  TBD

**Late Days**

Each student will be allocated 3 "Late Days," which may be used through the semester. No individual assignment may be more than 24 hours late. Projects turned in more than 24 hours late - or additional late assignments after the first three - will not be accepted. The last assignment will not be eligible for any late days; additionally, I reserve the right to forbid late days on other assignments.

Additionally, this course does not allow re-submission of work after the due date (or Late Day) has passed.
Late Days may be used for either Assembly Projects or Simulation Projects. They cannot be used for any other grade item.

Tests
This class will have 6 short tests. Each will be given during lecture, and take less than the full class period (25 minutes); after the test is complete, we will do some more lecture.

Tests will be given on the following days:

| Test 1 | Thu, 25 Jan |
| Test 2 | Thu, 8 Feb |
|        | --- 3 week spread between tests, due to SIGCSE--- |
| Test 3 | Thu, 1 Mar |
|        | --- 3 week spread between tests, due to Spring Break --- |
| Test 4 | Thu, 22 Mar |
| Test 5 | Thu, 5 Apr |
| Test 6 | Thu, 19 Apr |

Homeworks
Each Test will have a corresponding Homework, which is due at the beginning of class on the Test day. The Homework will be turned in on paper; we will inspect them to make sure that the students completed the assigned problems, but will not grade them for correctness.

Homeworks are intended as test preparation; as such, students are encouraged to work in groups. However, every student must turn in their own paper copy of the homework; shared papers will not be accepted.

zyBook Readings and Quizzes
Most weeks, a few sections from the zyBook textbook will be assigned. The website automatically checks completion of these sections; the sections must all be completed by the beginning of the first lecture that week. We will collect completion information from the website, and will give points based on that information.

In addition, we will have a 5-minute quiz, at the beginning of class, on all weeks with zyBooks assignments. The questions on this quiz will be copied from the activities in the textbook (or very close); thus, if the student read (and remembers) the material from the textbook, they should be trivial to complete.

Final
The final exam will be at:

Wed, 9 May, 1-3 pm

Final Examination or Project
A final exam will be given (see times listed above); the times are set by the University. The Final will be given in the normal classroom.

University Policies and Schedule

Grading Scale and Policies
Grading Scale
I will use a simple grade cutoff scheme. This means that if you earn the number of points listed
for a given grade, you are guaranteed that grade. At the end of the semester, I reserve the right to lower these cutoffs, meaning that it might be easier to earn a good grade (but it is unusual for me to do so). However, I guarantee that I will not raise these cutoffs (making it harder to earn a good grade).

- 90% A
- 80% B
- 70% C
- 60% D

**Point Distribution**

Points will be distributed as follows:

- 3% zyBooks Readings
- 2% In-class quizzes (based on zyBooks readings)
- 5% In-class Activities
- 30% Assembly Projects
- 10% Simulation Projects
- 5% Homeworks (paper - exam prep)
- 30% Tests (in class)
- 15% Final Exam

Within each category, points are distributed evenly; that is, every Test is worth the same as every other (except the Final), every Assembly Project is worth the same as every other, and every Simulation Project is worth the same as every other. Thus, the exact value of each item will depend on the number of each item that is assigned.

We will drop the following items from the grade calculation:

- One Test (not including the Final)
- One Assembly Project
- Two zyBooks quizzes
- 10% of available ICA points (that is, achieving 90% of the ICA points will give you full score)

We will not drop any items from the following categories:

- The Final
- zyBooks readings
- Simulation Projects
- Homeworks

**Grading Schedule**

Projects will be graded, typically, within 6 days of the due date. If exceptions have to be made occasionally, staff will inform the students about the delay and the reason for it.

Tests will be graded within 10 days.

**University Policies**

University policy regarding grades and grading systems is available at [http://catalog.arizona.edu/policy/grades-and-grading-system](http://catalog.arizona.edu/policy/grades-and-grading-system)

**Requests for incomplete (I) or withdrawal (W)** must be made in accordance with University policies, which are available at [http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete](http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete) and [http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal](http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal), respectively.

**Dispute of Grade Policy**

If you have an issue with how a quiz, project, or exam was graded, you must submit a request for a regrade (through email) to within 7 days of when the item was returned to you.

**Honors Credit**
Unfortunately, I are not able to offer Honors Credit for this course this semester.

**Scheduled Topics/Activities**

For a list of assignment and test dates, please see the “Assignments and Examinations: Schedule/Due Dates” section above.

The lectures will cover the following material. Note that this schedule is approximate, and may need to be modified slightly during the semester.

Students are responsible for all material covered in lecture (as well as the required reading), even if the actual lectures deviate from this overview.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11 Jan</td>
<td>Introduction, binary integers</td>
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<tr>
<td>2</td>
<td>16 Jan, 18 Jan</td>
<td>Binary addition</td>
</tr>
<tr>
<td>3</td>
<td>23 Jan - 25 Jan</td>
<td>MIPS: Introduction; if()</td>
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<tr>
<td>4</td>
<td>30 Jan - 1 Feb</td>
<td>Logic gates and adders</td>
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<tr>
<td>5</td>
<td>6 Feb - 8 Feb</td>
<td>MIPS: loops and arrays</td>
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<td>6</td>
<td>13 Feb - 15 Feb</td>
<td>ALUs</td>
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<tr>
<td>7</td>
<td>20 Feb - 22 Feb</td>
<td>--- Russ: at SIGCSE Thurs --- MIPS: functions (basics)</td>
</tr>
<tr>
<td>8</td>
<td>27 Feb - 1 Mar</td>
<td>Carry lookahead adders; multipliers</td>
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</tbody>
</table>

--- Spring Break ---

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<thead>
<tr>
<th>Week 9</th>
<th>Date</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>13 Mar - 15 Mar</td>
<td>Simple CPU overview</td>
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<tr>
<td>10</td>
<td>20 Mar - 22 Mar</td>
<td>Instruction formats, simple CPU details</td>
</tr>
<tr>
<td>11</td>
<td>27 Mar - 29 Mar</td>
<td>Pipelining, part 1</td>
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<tr>
<td>12</td>
<td>3 Apr - 5 Apr</td>
<td>MIPS: recursion</td>
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<tr>
<td>13</td>
<td>10 Apr - 12 Apr</td>
<td>Pipelining, part 2</td>
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<tr>
<td>14</td>
<td>17 Apr - 19 Apr</td>
<td>Hazards and forwarding</td>
</tr>
<tr>
<td>15</td>
<td>24 Apr - 26 Apr</td>
<td>Floating point</td>
</tr>
<tr>
<td>16</td>
<td>1 May</td>
<td>Caches</td>
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</tbody>
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**Department of Computer Science Code of Conduct**

The Department of Computer Science is committed to providing and maintaining a supportive educational environment for all. We strive to be welcoming and inclusive, respect privacy and confidentiality, behave respectfully and courteously, and practice intellectual honesty. Disruptive behaviors (such as physical or emotional harassment, dismissive attitudes, and abuse of department resources) will not be tolerated. The complete Code of Conduct is available on our department web site. We expect that you will adhere to this code, as well as the UA Student Code of Conduct, while you are a member of this class.

**Classroom Behavior Policy**

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

The use of personal electronics such as laptops, iPads, and other such mobile devices is distracting to the other students and the instructor. Their use can degrade the learning environment. Therefore, students are not permitted to use these devices during the class period, except as part of assigned group activities.
Threatening Behavior Policy
The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations
At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

If our class meets at a campus location: Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://www.library.arizona.edu/help/tutorials/plagiarism/index.html.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor’s express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students
UA Academic policies and procedures are available at http://catalog.arizona.edu/policies

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

Confidentiality of Student Records

Subject to Change Statement
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.