Computer Systems

CS3443 – Fall 2021
Online Syllabus

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General Course Information

Time & Location: Online
Instructor Information:
  Instructor: Dr. Shital Joshi
  Email: Shital.Joshi@okstate.edu
  Office: 229 MSCS; Stillwater, OK 74078-1053 USA
  Phone: 1-405-744-5273
  Virtual Office Hours: Tue/Wed 11:30 AM – 12:30 PM (CT) and by appointments
Course Credit: 3.0
Prerequisites: CS 2133 with a grade of “C” or better
Software: SPIM MIPS Simulator

Course Overview
Learn in detail functional and register level description of computer systems, computer structures, addressing techniques, macros, linkage, input-output operations. Introduction to file processing operations and auxiliary storage devices. Material is supplemented by programming assignments, which are implemented in assembly language.

Course Objective

Upon the successful completion of the course, the students should be able to:

- Demonstrate programming proficiency using various addressing modes and data transfer instruction of the target computers.
- Program using the capabilities of the stack, program counter and registers and understand how these are used to execute a machine code program.
- Understand various conventional computational organizations and their strengths and weaknesses.
- Understand the concept of memory hierarchy.
- Understand how I/O devices interface with the processor, memory.
- Understand interrupts and how they can be handled.
- Analyze and evaluate computer performance.
- Analyze MIPS microprocessor design and MIPS instruction set architecture.
- Describe how a CPU performs instructions during fetch-decode-execute cycle and how memory supports its actions taking MIPS as a reference architecture.
- Understand how pipelining can improve CPU performance for MIPS architecture.
Canvas Classroom for the Course

The course uses Canvas which can be accessed at https://canvas.okstate.edu. Students can sign in using their O-Key username and password provided by OSU. After sign-in, students can see the Canvas Dashboard, which provides a list of links for the courses in which they are enrolled. This course will be listed as CS 3443 Computer Systems Online Fall 2021. Click on that link to go to the course homepage. Near the left side of that page is a menu of links, with Home (the homepage) at the top.

The three primary sections of the Home page are:

- **Home** (at the top) provides you all the lecture videos and additional materials/handsout for the course. You can find your syllabus in this section.
- **Announcements** (near the top) provides you with important and time-sensitive updates and comments on class matters. Should something happen to prevent the instructor from being available during his office hours on any given date, he will make an effort to post a notice in this section of the Canvas classroom.
- **Assignments** (below Announcements) contains all the documents related to assignments and from this section you will be able to submit your assignments.
- **Discussions link** (in the left-side menu) takes you to the list of course discussion forums. Here, you will find a forum labeled Student Lounge for nifty news and casual conversation, a general Q&A forum where questions/discussion concerning assignments or other aspects of the course can be posted, as well as Assignment Forums, in which specific, topical discussion prompts will be posted by the instructor. Please keep your comments clean and civil.

Since this is an online course, it is students’ responsibility to keep track of all announcements, course contents and due dates.

Grading Policy

The final grade will be assigned based on the point total as:

- 90% -- 100%  A
- 80% -- 89.99%  B
- 70% -- 79.99%  C
- 60% -- 69.99%  D
- Less than 59.99%  F
Assignments

The course assignment is categorized as home assignments and participation in discussions. There are 6 home assignments throughout the semester, which include written assignment, programming assignments (MIPS Programming) and numerical problems. Students will have a total of 7 days (including holidays) to submit the assignments. All assignments must be submitted through Canvas. Any submission made through email will not be entertained. All your assignments will be checked in Turnitin for any plagiarism.

Since this is an online course, discussion forms an integral part of the grade. Each student is expected to make three posts on a weekly basis. These posts will be based on the subject matter discussed in the current week videos. The students’ post should demonstrate their understanding of the material. Each student should demonstrate that they have observed the video lecture of the present week and have understood the topic well.

For the 1st post (each Monday -- Thursday of the current week), each student needs to post at least one question based on the current week video lectures. Each student needs to post his/her question within 4 days from the day link is made available. When posting question(s), students need to specify what they understood, followed by their confusions/doubts on that topic. This will help other students to answer their question better. Just posting the question will not earn full credit. In the 2nd post (each Friday -- Saturday of the current week), each student needs to submit his/her answer to somebody’s else question, made on the 1st post. In the 3rd post (each Sunday of the current week), each student needs to post his/her final understanding on the question he/she has posted on the 1st post. If any student is not satisfied by any answers posted by fellow students or do not get any respond, then students are encouraged to contact me/TA or do their own research and write appropriate response. Students are free to post any many questions as they want and answer to multiple posts. However, I will look for the quality of the post, rather than the quantity. Students’ response will be graded based upon their analysis and the critical thinking. Focus will be given to the response that indicates the ability to handle the conceptual ideas rather than the response containing just a fact.

Once the grade is posted for the assignments, discussions and exam (excluding final exam), students have 7 days (including holidays) for any grade dispute. For this, students need to send an email to the TA (cc instructor). If no email is received within this time frame, then it will be assumed that there is no issue with the grades and no changes will be made after that.
Grading Information

The final grade will be calculated based on individual grades received on home assignments, discussion participation, mid-term exam and the final exam. The weighting for each of these are:

- Home Assignments: 50%
- Participation in Discussions: 20%
- Mid Term Exam: 15%
- Final Exam: 15%

Due dates and Late Work Policy

Each assignment is due by 11:59 PM (CT) on the date specified on the assignment handout posted on the Canvas classroom site. Late penalty is 10% per class day. Assignments turned after a week late from the due date will not be accepted. For discussion posts, late work policy is different. Failure to post response to the discussions within the specified date/time will lead to 0 for that particular post.

Collaboration Policies

Each assignment is to be submitted individually. However, students can discuss concepts, ideas and techniques among their peers/TA/instructor. After discussion, students need to write up their own solution. Copying another person’s work, in part or in whole, is not allowed. Sharing solution, in part or in whole, is considered cheating as well. If any student is unsure whether collaboration is acceptable, speak with the instructor in advance. Students are responsible to take care of their solutions and prevents it from leaking.

Exam Logistics

Exams must be administered by a proctor or proctoring service approved by OSU. The exams must be taken within the days specified:

- Mid Term Exam: 10/14/2021 (Thu) -- 10/15/2021 (Fri)
- Final Exam: 12/08/2021 (Wed) -- 12/09/2021 (Thu)

We will use Examity for our course and the proctoring service will be Level 3 Live Proctoring. Students need to pay for the exam. Students can get additional information at: https://itle.okstate.edu/online-test-proctoring.html
Getting Help in this Course

Any questions concerning the content of the course and assignments should be directed to the instructor (or the TA, cc to the instructor as well) using official email. Students are advised to use email and not the messaging service available in the Canvas. The typical response time will be within 24 hours. For prompt response, please include the course number in the square bracket, followed by the brief message subject; for example:

[CS 3443: Online] MIPS Error: Exception occurred at PC = 0x00000000

Students are advised to make use of the office hours, which will be conducted using the Canvas Conference. Upon request, students can meet the instructor and the TA on a one-to-one basis as well using the zoom.

Technical Support

You can reach OSU Arts & Sciences Outreach Office at:

Email: casoutreach@okstate.edu
Phone: 1-405-744-5647

Syllabus Attachment

Other useful information, such as important dates throughout the semester, can be found on the https://academicaffairs.okstate.edu/student-support/index.html under Current Syllabus Attachment.
Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>08/16 - 08/22</td>
<td>Introduction and Performance: Technology trends; Basic Organization of Von Neumann machine; Measuring CPU performance; Amdahl’s law and averaging performance metrics</td>
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<tr>
<td>2</td>
<td>08/23 - 08/29</td>
<td>Number Representations: Signed and Unsigned number representation; Fixed- and floating-point systems Individual programming assignment 01 (Based on Week01)</td>
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<tr>
<td>3</td>
<td>08/30 - 09/05</td>
<td>MIPS Introduction: Components of an instruction set; understanding instruction set from implementation perspective; introduction to RISC and CISC architecture and example instruction set. Individual programming assignment 02 (Based on Week02) Lab01_Exploring QtSpim</td>
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<tr>
<td>4</td>
<td>09/06 - 09/12</td>
<td>MIPS Continuation: MIPS CPU; Representing instructions for arithmetic operations; Lab02_Understanding Memory in QtSpim Lab03_Understanding Memory Alignment in QtSpim</td>
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<tr>
<td>5</td>
<td>09/13 - 09/19</td>
<td>MIPS Continuation: logical operations; handling 32-bit immediate and addresses; Character and string processing in MIPS Lab04_Understanding Arithmetic Operations in QtSpim Lab05_Control Structures in QtSpim(Part 1)</td>
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<tr>
<td>6</td>
<td>09/20 - 09/26</td>
<td>MIPS Continuation: Control instructions in MIPS Individual programming assignment 03 (Based on Week03 – Week05) Lab06_Control Structures in QtSpim(Part 2)</td>
</tr>
<tr>
<td>7</td>
<td>09/27 - 10/03</td>
<td>MIPS Continuation: Supporting procedures; Stacks in MIPS and handling recursion. Individual assignment 04 (Based on Week06 – Week07)</td>
</tr>
<tr>
<td>8</td>
<td>10/04 - 10/10</td>
<td>Addressing mode in MIPS; Encoding of MIPS instructions; Pseudo Instructions in MIPS; various steps in transforming a C program in a disk to a running program</td>
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<tr>
<td>Week</td>
<td>Date</td>
<td>Topics</td>
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<tr>
<td>9</td>
<td>10/11</td>
<td>Mid Term Exam 10/14 (Thu) -- 10/15 (Fri)</td>
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<td>10/17</td>
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<tr>
<td>10</td>
<td>10/18</td>
<td>Datapath Design: Logic design (combinational logic and sequential logic); building a datapath; simple implementation scheme of datapath and control unit for MIPS architecture</td>
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<td>10/24</td>
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<tr>
<td>11</td>
<td>10/25</td>
<td>Pipelining: Overview of pipelining; non-pipelined vs pipelines performance; data dependencies; pipeline hazards</td>
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<td>10/31</td>
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<tr>
<td>12</td>
<td>11/01</td>
<td>Memory Hierarchy: Introduction to memory systems; basics of Cache; Cache organization</td>
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<td>11/07</td>
<td>Individual assignment 05 (Based on Week10 &amp; Week11)</td>
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<tr>
<td>13</td>
<td>11/08</td>
<td>Cache organization continuation, measuring and improving Cache performance, Introduction to Virtual memory</td>
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<td>11/14</td>
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<tr>
<td>14</td>
<td>11/15</td>
<td>Virtual memory continuation, Paging and Page table, Address translation and TLBs</td>
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<td>11/21</td>
<td>Individual assignment 06 (Based on Week12 -- Week14)</td>
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<td>15</td>
<td>11/22</td>
<td>Students’ Fall Break</td>
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<td>11/28</td>
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<td>16</td>
<td>11/29</td>
<td>I/O Devices: Common I/O device types and characteristics; I/O mapping; interrupts; data transfer between I/O devices and memory, Multiprocessors: Cache consistency; cache coherence problem</td>
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<td>12/03</td>
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<tr>
<td>17</td>
<td></td>
<td>Final Exam 12/08 (Wed) -- 12/09 (Thu)</td>
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- This is just a tentative course schedule. It may evolve throughout the semester.
- Any changes in the schedule will be announced via announcement. So, students are encouraged and expected to closely keep track of announcement section.
- No submission is required for the lab work. These are very useful to complete the assignments on MIPS.