Course Description
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 Objectives
Upon the successful completion of the course, the students will 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.

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

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Component</th>
</tr>
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<tbody>
<tr>
<td>20%</td>
<td>Weekly Discussion</td>
</tr>
<tr>
<td>50%</td>
<td>Individual Home Assignments</td>
</tr>
<tr>
<td>15%</td>
<td>Mid Term Exam</td>
</tr>
<tr>
<td>15%</td>
<td>Final Exam</td>
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</table>

Note: One best score out of 2 exams will be used for the total of 30%, only if the student scores 70% or more in both the exams.

Grading Scale
Grades will follow the standard scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A%</td>
<td>90 – 100%</td>
</tr>
<tr>
<td>B%</td>
<td>80 – 89.99%</td>
</tr>
<tr>
<td>C%</td>
<td>70 – 79.99%</td>
</tr>
<tr>
<td>D%</td>
<td>60 – 69.99%</td>
</tr>
<tr>
<td>F%</td>
<td>&lt; 60%</td>
</tr>
</tbody>
</table>

Note: The total grades shown in Canvas may not reflect the proportions above. So, please do your own calculation using the weights.
Materials

Textbook

Programming Language SPIM MIPS Simulator: QtSpim

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 CS3443-Fall2023-Online. 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 six primary sections of the Home page are:

- Home (at the top) provides you all the lecture videos and additional materials/hands-out for the course. You can find your syllabus in this section.
- Announcements (below Home) provides you with important and time-sensitive updates.
- Assignments (below Announcements) contains all the documents related to assignments and from this section you will be able to submit your assignments.
- Discussions (below Assignments) takes you to the list of course discussion that students need to complete every week. Please keep your comments clean and civil.
- Zoom-CAS (below Discussions) is where office hours will be held.
- Grades (below Zoom-CAS) shows student’s grades for the course.

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

Assignments

The course assignment is categorized as home assignments and participation in discussions. There are 6 home assignments throughout the semester, which include written assignments: 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 the 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 else’s 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 response from the fellow student, then students are encouraged to contact me or do own research and write appropriate response within the specified duration. All the three posts need to be made every week to be eligible for a maximum of 15 points weekly for the discussion. Students can post as many questions as they want and answer multiple times. However, I will look for the quality of the post, rather than the quantity.

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 the instructor. If no email is received within the time, then it will be assumed that there is no issue with the grading and no changes will be made after that.

Due Dates and Late Work Policy

Each assignment is due by 11:59 PM (CT) on the date specified on the assignment handout. Late penalty is 10% per day, up to the end date (i.e. 7 days from the due date). Assignments turned after a week late from the due date will not be accepted. Late
Collaboration Policies

Academic integrity is taken very seriously. You are permitted (and indeed encouraged) to discuss the course material with fellow students in general terms on the Canvas discussion board, but the materials you submit on Canvas must be your own original work. 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. Any violation found will result in an automatic zero, and depending on the egregiousness of the offence may result in earning an ‘F’ for the course and facing academic disciplinary measures. You have the right to appeal the charge. Go to [http://academicintegrity.okstate.edu/](http://academicintegrity.okstate.edu/) for a video on OSU’s academic integrity policy and additional information. 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: 10/19/2023 (12:00 AM, Thu) – 10/20/2023 (11:59 PM, Fri)
- Final Exam: 12/11/2023 (12:00 AM, Mon) – 12/12/2023 (11:59 PM, Tue)

We will use Examity for our course and the proctoring service will be Level 3 (i.e. Live Proctoring). You can get additional information [here](http://academicintegrity.okstate.edu/) under Proctoring Options. Please go through the following resources to get familiarize with Examity: [Live Proctoring Video](http://academicintegrity.okstate.edu/) and [Examity Student Guide for Live Proctoring (in pdf)](http://academicintegrity.okstate.edu/).

Students need to pay for this exam service. You can get additional information [here](http://academicintegrity.okstate.edu/) under Cost of Examity and Billing.

Getting Help in this Course

If any students need any additional help, then they are encouraged to email the instructor and/or TA at their respective email addresses. The typical respond 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 supposed to use official email address for any correspondence. The instructor/TA will very rarely check the Canvas inbox. So, please use email for reaching to the instructor/TA.

Students are highly encouraged to attend the instructor’s and TA’s office hours, that will be held through zoom. The link for the office hours will be provided in the announcement. If any student needs additional assistance, then a separate zoom link can be created in discussion with the student.

The OSU community is here for you and wants to provide all the tools and resources to best support your mental health. If you or someone close to you is having a difficult time, our mental health resources [https://wellness.okstate.edu/student-wellness/resources.html](https://wellness.okstate.edu/student-wellness/resources.html) are available to help. Whether it’s mental or physical health, we have student wellness resources [https://wellness.okstate.edu/student-wellness/index.html](https://wellness.okstate.edu/student-wellness/index.html) to ease the stress of college life.

Reach out to your advisor or instructor if you need support or help in your courses and utilize the many academic resources [https://go.okstate.edu/undergraduate-academics/academic-support.html](https://go.okstate.edu/undergraduate-academics/academic-support.html) available on campus. Our faculty’s goal is to assist you, whatever the circumstances might be.

Syllabus Attachment

Other useful information, such as important dates throughout the semester, can be found on the OSU Syllabus Attachment under Current Syllabus Attachment for the current semester.

Technical Support

You can reach OSU Arts & Sciences Outreach Office at:
Email: casoutreach@okstate.edu
Phone: 1-405-744-5647
<table>
<thead>
<tr>
<th>Class (Duration)</th>
<th>Topic (Assignments/Labs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong> (08/21 – 08/27)</td>
<td>Introduction and Performance: Technology trends; Basic Organization of Von Neumann machine; Measuring CPU performance; Amdahl's law and averaging performance metrics</td>
</tr>
</tbody>
</table>
| **Week 2** (08/28 – 09/03) | Number Representations: Signed and Unsigned number representation; Fixed- and floating-point systems  
Individually programming assignment 01 (Based on Week 01) |
| **Week 3** (09/04 – 09/10) | MIPS Introduction: Components of an instruction set; understanding instruction set from implementation perspective; introduction to RISC and CISC architecture and example instruction set  
Individually programming assignment 02 (Based on Week 02)  
Lab01_Exploring QtSpim |
| **Week 4** (09/11 – 09/17) | MIPS Continuation: MIPS CPU; Representing instructions for arithmetic operations  
Lab02_Understanding Memory in QtSpim  
Lab03_Understanding Memory Alignment in QtSpim |
| **Week 5** (09/18 – 09/24) | 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) |
| **Week 6** (09/25 – 10/01) | MIPS Continuation: Control instructions in MIPS  
Individually programming assignment 03 (Based on Week 03 – Week 05)  
Lab06_Control Structures in QtSpim (Part 2) |
| **Week 7** (10/02 – 10/08) | MIPS Continuation: Supporting procedures; Stacks in MIPS and handling recursion  
Individually assignment 04 (Based on Week 06 – Week 07) |
| **Week 8** (10/09 – 10/15) | 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 |
| **Week 9** | 10/19/2023 (Thu) and 10/20/2023 (Fri)  
Mid Term Exam |
| **Week 10** (10/23 – 10/29) | Datapath Design: Logic design (combinational logic and sequential logic); building a datapath; simple implementation scheme of datapath and control unit for MIPS architecture |
| **Week 11** (10/30 – 11/05) | Pipelining: Overview of pipelining; non-pipelined vs pipelines performance; data dependencies; pipeline hazards |
| **Week 12** (11/06 – 11/12) | Memory Hierarchy: Introduction to memory systems; basics of Cache; Cache organization  
Individually assignment 05 (Based on Week 10 - Week 11) |
| **Week 13** (11/13 – 11/19) | Cache organization continuation, measuring and improving Cache performance, Introduction to Virtual memory |
| **Week 14** | 11/20 (Mon) – 11/24 (Fri)  
University Holiday (Students’ Fall Break & Thanksgiving) |
<table>
<thead>
<tr>
<th>Week 15</th>
<th>Virtual memory continuation, Paging and Page table, Address translation and TLBs</th>
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</thead>
<tbody>
<tr>
<td>(11/27 – 12/03)</td>
<td><strong>Individual assignment 06 (Based on Week12 - Week15)</strong></td>
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</tbody>
</table>

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<tr>
<th>Week 16</th>
<th>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</th>
</tr>
</thead>
<tbody>
<tr>
<td>(12/04 – 12/08)</td>
<td></td>
</tr>
</tbody>
</table>

| 12/11/2023 (Mon) – 12/12/2023 (Tue) | Final Exam |

This is just a tentative course schedule. It may evolve throughout the semester.

Any changes in the schedule will be announced via announcement.

Each week students have to participate in the discussion as per the instructions.

*No submission is required for the lab work. However, these are very useful to complete the assignments on MIPS.*