UNIVERSITY of WASHINGTON

CSS 422 Hardware and Computer Organization

Course Overview

Professor: Yang Peng

Course Objectives

- This is an introductory course into
  - The fundamentals of digital hardware (digital logic and digital circuit design)
  - The architecture of modern microprocessors
  - Assembly language programming
  - The computer memory system and transition to operating systems

Course Information

- Prerequisites: CSS 342
- Meeting time: TTH 8PM – 10PM, UW1-020
- Textbooks
  - Hardware and Computer Organization: The Software Perspective, Arnold S. Berger (available online)
  - Essentials of Computer Organization & Architecture, Null
- Class website: https://canvas.uw.edu/courses/1232689
- Office Hours:
  - **Monday 10:30 AM – 12:30 PM, UW1-260T**
  - Appointments via emails

Grading

Course Work		%
Midterm exam		25
Final exam		25
Project		25
Participation	Lab, Exercise	5
Homework		20
Total		100

Achievements	**Estimated** Grade
97(or 98) – 100	4.0
90 – 96 (or 97)	3.5 - 3.9
80 - 89	2.5 - 3.4
70 - 79	1.5 - 2.4
60 - 69	0.7 - 1.4

This is just for your reference.
The final decimal grade will be curved!
It may be tuned up or down! Don't be surprised!

Exams

- **Midterm exam**
  - Covers all the contents by the time of exam
- **Final exam**
  - Covers the contents after the midterm
- The exams are to test your understanding of the concepts
- You should expect **challenging questions** that apply basic concepts to comprehensive problems

- No cheating
- If I see any suspicious actions during exam, then you will be asked to leave the exam room, and you will be reported as cheating. (See "Academic Integrity" for details)

Project

- **Group of 2 or 3 students – NO INDIVIDUAL PROJECT**
- The project is the capstone element of the course, designed for you to
  - Solidify your command of assembly language coding methods
  - Work as a team
  - Manage version control issues
- **Begins the 2nd week** and is due at the last week

- Once a group decides to change the team members, the group has to tell me in person
- The grade is given only based on the final product
  - **Individuals who have significantly less contribution will have some points taken off!**
  - **Individuals who have more contribution will not have extra points!**

Participation

- Lab + Exercise
  - Lab
    - Use your own laptop
    - Install needed software
    - Done at home in this quarter
  - Exercise
    - **15** exercises in total (almost every class)
    - 3 attempts: correct answers will be given at the last attempt
    - **Due at 11:59pm the next day (some exercises may have extended deadlines)**
    - You will learn how much these exercises will help your grade
    - If sick or any emergency, then notify me at least 24 hours before
    - Late exercises will not be graded

Homework

- **5 assignments in total**
- Assignments are posted in the Assignment section on Canvas
- You are required to submit them online! No hard copy!
- **Read and follow the description carefully!** Not following any description will result in losing points. (Pay attention to "attach image, attach file, screenshot, etc.")
- **Late submission is not accepted! No grade!**
- You need to **check your submission on Canvas after submission!**
  - Don't trust Canvas that much!
  - Don't trust Google doc that much!
- Homework is an individual work. **Copy is NOT allowed!**
- You are supposed to SOLVE the problems, not GOOGLE the solution

Software

- Simulator for Assembly Language Programming
  - Easy68k

    http://easy68k.com

- References
  - 68000 Programmer's Reference Manual

    https://www.nxp.com/files/archives/doc/ref_manual/M68000PRM.pdf
  - 68000 Family Assembly Language, Alan **Clements**

    http://www.amazon.com/68000-Family-Assembly-Language-Programming/dp/0534932754

- Digital Logic and Circuit:
  - Logisim

    http://www.cburch.com/logisim/index.html

Academic Integrity

- If you are ever in doubt, consult the University Policies (Policy on Academic and Behavioral Conduct) in your Student Handbook

- I will catch students cheating and will follow the university guidelines and will send a letter

How to Succeed

- Do not skip a class! **Important information will be announced in class!**
- Start your homework and project **Early! Early! Early!**
- Be prepared, don't fall behind!
- Form a study group if needed!
- Discussion
- Work harder

- **Warning:**
  - ***You are in this program since you passed CALCULUS class. I expect that you can all do calculation without calculus.***
  - ***THIS CLASS ABSOLUTELY, POSITIVELY WILL REQUIRE A SUBSTANTIAL TIME COMMITMENT ON YOUR PART***

Topics

- 3 major topic areas

- Part 1: Assembly language programming
  - Introduction to microprocessors
  - Programming model of a microprocessor (68000)
  - Addressing modes
  - Writing in assembly language
  - Assembling, linking, loading, and debugging

Topics – cont'd

- Part 2: Special topics in computer architecture
  - Memory hierarchy
  - Caches and virtual memory
  - Pipeline and performance
  - RISC vs. CISC
  - I/O processes

Topics – cont'd

- Part 3: Hardware architecture
  - Concepts of gates, flip-flops, and registers
  - Algorithmic State Machines
  - Data path and control flow (heart of a processor)