cs100f19.sg
Computer Environment
Fall, 2019

Prerequisites:

There are no prerequisites for this course.

General Information:

Class Schedule:	A: Tue, Thu 11am~1.10pm
	B: Tue, Thu 2pm~4.10pm
Classroom:	LT 5B
Professor**:**	Vadim SUROV
Contact**:**	1940, vsurov@digipen.edu
Class Web Page**:**	A: https://distance.sg.digipen.edu/course/view.php?id=3488
	B: https://distance.sg.digipen.edu/course/view.php?id=3489
Office Hours**:**	Tue, Thu 9am~11am

Description:

This course provides a detailed examination of the fundamental elements on which computers are based. Topics include number systems and computation, electricity and basic circuits, logic circuits, memory, computer architecture, and operating systems. Operational code and assembly languages are discussed and then implemented on a hardware platform, such as a personal computer or an autonomous vehicle.

Course Objectives and Learning Outcomes:

Upon successful completion of the course, the student should be expected to be knowledgeable in the following areas:

1. How unsigned numbers are represented in binary.
2. Know how to convert numerical representations between different bases such as binary, octal and hexadecimal.
3. Know the different ways in which signed numbers can be represented in binary – signed magnitude, one's complement and two's complement.
4. Know the basic logic gates and appreciate how combinatorial logic circuits can be constructed using these gates. Also, the student should be able to translate between logic gates diagram, truth tables and Boolean expressions with little difficulty.
5. How binary arithmetic operations such as subtraction, division and multiplication can be implemented through application.
6. How real numbers are represented in floating point.
7. The basic components of the Von-Neumann architecture (such as ALU, Control Unit and Memory) and how they inter-operate, especially the fetch-decode-execute-writeback cycles.
8. How computer memory is implemented using flip-flop gates and how the memory is accessed with address, control and data signals.
9. Assembly programming on the DAsm simulator platform.

Textbook:

- The Hidden Language of Computer Hardware and Software, CODE, Microsoft Press, 2000, (ISBN 0-7356-1131-9).

Outline and Tentative Dates:

Please note that this is a tentative organization of the course and may be subject to change. Below is a list of topics that will be covered this semester. Depending on time, I may add additional topics or skip some of the ones listed.

Week	Topic	Textbook references
1	Introduction Encoding: Numbers Encoding: Binary Arithmetic	Chapter 1-3
2	Encoding: Number Base Conversion Basic Logic Gates	Chapter 7-9
3	Boolean Algebra, Truth tables and SOP (Sum of Products) Signed representation – signed magnitude and one's complement	Chapter 10
4	Eliminating borrowing when performing subtraction. Performing subtraction using the addition operation. Two's Complement Representation of the signed binary	Chapter 12-13
5	Floating point number representation of real numbers. IEEE 754 single precision and double Precision. Rounding errors due to floating point representation	Chapter 23
6	Continuation of the floating point number discussion – catastrophic cancellation and its implications. Mid-term review	
7	Trimester Break. No classes	
8	Memory – understand how different data types such as short, int, float, pointer etc are arranged in memory. Little and Big Endianess. RS-Flip Flops and Data-Flip Flops. How storage elements are implemented using the flip-flops gates. Address decoding	Chapter 14-16
9	Computer Architecture – how the system bus is constructed with address, control and data buses. Registers as a storage element that resides within the CPU in contrast with memory. Types of Instructions. The implementation of the fetch-decode-execute-writeback cycle in a datapath. CPU communication with I/O: special instructions, memory-mapping, polling and interrupts.	Chapter 17-21
10	Operating System – how an executable program is loaded into memory before execution. How a computer system boots up. An overview of the responsibilities of the OS.	Chapter 22
11	Assembly Programming – Introduction to the DAsm Virtual	

Machine. The computer architecture of the DAsm virtual machine. The instruction set of the DAsm virtual machine. The organization of the memory of the DAsm machine. Performing simple arithmetic using the DAsm assembly programming.

12 Assembly Programming cont – Translating C code into assembly programs. Loop structures in assembly programming. Accessing arrays in assembly programming. Pointers referencing and dereferencing in assembly programming. Function calls, argument passing and stacks.

13 Assembly Programming cont – A look into x86 architecture , a realistic assembly programming language for the Intel. machine. CISC and RISC machines.

14 Trimester review. No classes

15 Finals week

Grading Policy:

Grades will be derived from assignments, exams and class activity. The detailed weightings are as such:

Assignments	40%
Midterm Exam	20%
Final Exam	30%
Quizzes	10%
Attendance	-1% for each absence

Important: you must receive an average score of 60% on both the midterm and final exams combined to pass this course, regardless of your assignment/quiz/class activity scores.

Final letter grade algorithm:

Grade	%
A	93 – 100
A-	90 – 92.99
B+	87 – 89.99
B	83 – 86.99
B-	80 – 82.99
C+	77 – 79.99
C	73 – 76.99
C-	70 – 72.99
D	60 – 69.99
F	< 60

Last Day to Withdraw:

In order to withdraw from a course it is not sufficient simply to stop attending class or to inform the instructor. In accordance with the policy, contact your advisor or the Registrar to begin the withdrawal process.

The last day for withdrawal from this course is **October, 30.**

Academic Integrity Policy:

Quizzes, exams and assignments are NOT group projects. They must represent a student's own individual work. It is reasonable for students to consult or discuss general solutions to an assignment. However, it is unreasonable for students to collaborate on detailed solutions, to copy code, or to give away code. Please keep in mind that discussing solutions to exams, quizzes, homework, etc. with students that have not yet taken the exam or have not yet submitted the homework is also prohibited.

Cheating, or academic dishonesty in any form will not be tolerated in this course. Cheating, copying, plagiarizing, or any other form of academic dishonesty (including doing someone else's individual assignments) will result in, at the extreme minimum, a zero on the assignment in question, and could result in a failing grade in the course or even expulsion from DigiPen.

Academic dishonesty or cheating occurs when a student represents someone else's work as his/her own, or assists another student in doing so. This can happen on exams, quizzes, homework, or projects. Academic dishonesty may also occur when a student uses any prohibited reference or equipment in the completion of a task. Examples include using a calculator, or notes, or books, or the internet when such sources are prohibited for that task. Plagiarism is a common form of academic dishonesty. This takes the form of copying and pasting excerpts from the web and representing them as original work. The type and severity of any occurrence, as well as the legitimacy of any claim of academic dishonesty will be judged by the instructor and the disciplinary committee. All students are asked to help in promoting a culture of academic integrity by discouraging cheating in all forms.

Ultimately, you are only wasting your time (and money) because if you cannot master the fundamentals covered in this course, you have little hope of succeeding in other courses or as a programmer in the Real World. Please consult your student handbook for additional information and details on DigiPen Singapore's academic integrity policy.

Classroom Policies

During class, all electronic devices must be turned **OFF**. This includes cell and smart phones, game consoles, digital cameras, laptop computers or any other devices. If you absolutely must have a cell phone on for an emergency situation, you must first clear it with me **BEFORE** class begins. In addition to showing up for class on time, other student responsibilities include proper behavior during class, learning the material, completing assignments correctly, submitting assignments properly and on time, studying for the exams, and participating in class by asking or answering questions during the lectures. <u>All students are required</u> to bring a pencil (or other writing instruments) and papers to class, to take notes, quizzes and perform other tasks. Finally, classrooms are to be kept clean and belongings to be kept in the lockers. No foods in all classrooms, drinks are allowed but must have a cap or lid.

External Preparation

It is expected that the students in this class spend (2 x module credits) hours on average per week for outside classroom activities through the semester, including, but not limited to, homework, reading assignments, project implementation, group discussions, preparation of

examinations, etc.

Disabled Student Services

Students who have special needs or medical conditions and require formal accommodations in order to fully participate or effectively demonstrate learning in this class should contact the Student Life & Advising Office (studentlife.sg@digipen.edu) at the beginning of each semester. A Student Life & Advising Officer will meet with the student privately to discuss how the accommodations will be implemented.