School of Computer Science
www.cs.mcgill.ca

Course Outline

Course Name:	Computer Systems Lab COMP-308 Winter 2021
Instructor:	Joseph Vybihal

Contact Information:

Office:	ENGMC 323 (https://mcgill.zoom.us/j/86080652491)
Office Hours:	Fri 11:30 – 12:30 EST (or by appointment)
Discussions:	http://piazza.com/mcgill.ca/winter2021/comp308
Prof. Email:	joseph.vybihal@mcgill.ca

Course Objectives:

After meetings with corporations like EA Games and Artificial Mind & Motion it was decided that students from McGill Computer Science were missing hands on experience with real hardware and low-level assembly. COMP 308 was developed to address these two needs. The application area selected for students to experiment on is modern computer graphics cards.

This course serves to fill two purposes: (a) students who are interested in hardware, this course takes the theoretical and simulated assembler knowledge from COMP 273 and solidifies their understanding of hardware by writing real graphics card assembler programs. This requires intimate knowledge of the hardware and operating system. (b) Students who are in the Games Option, this will provide them the deep understanding of graphics cards that is looked for by gaming companies. The course will also explore CG and C, which are skills in demand by gaming companies.

Primary learning outcome: To have a clear understanding about how real hardware functions, specifically the relationship between the CPU and the graphics card. To be able to write drivers and software at the assembler level.

Secondary learning outcomes: To write C code that interfaces with hardware directly. To write in a special graphics card scripting language called CG. Serves as an introduction to a graphics course.

Course Description:

Digital circuitry and programming interface of peripheral circuit boards (cards), e.g., graphics cards, introduction to tools and libraries that interact with the card; performance issues.

Texts:

Primary Texts:	No textbook
Reference Texts:	Art of Intel x86 Assembly + PC Graphics Handbook

Evaluation:

Labs	50%	10 lab submissions (first 7 @ 5%, last 3-1 @ 8%)
Project	50%	On your own

All labs and projects are due on MyCourses at the indicated time and date. Late submissions will lose 5% of its grade per day late. Submissions beyond 2 days late will not be accepted. You may not submit work via e-mail without the permission of the instructor.

Students are responsible for all materials for the labs and project, whether or not it is covered in class.

No make-up tests or make-up work are allowed in this course.

If you are not satisfied with the grading of a submission you may request a review within 7 days of return. Indicate in writing or during a meeting with the instructor where and why you feel the marks are unjustified and give it back to your instructor for re-grading. Note that the entire submission will be re-graded and your grade can go up or down (or stay the same) accordingly.

Course Requirements:

CS Students:	COMP-273 (prerequisite)
ECSE Students:	ECSE-323 or COMP-273 (prerequisite)

This course assumes you are familiar with C, Windows and Linux.

Teaching Method: This course does not have any tests.

Each lecture will present to the student a topic they will need to master that week. The lecture is divided roughly into two segments of 40 minutes and 10 minutes. The 40-minute segment will present the theory for the week. The 10-minute segment will present the lab work the student will need to hand in before the next class. The labs will provide you code to modify for your experiments.

There is a final project that each student must do on their own and serves as their final exam. The project will combine into a single application all the topics covered in the course. The project does not provide any code. You will build the application either from scratch or using code from the labs. You are not permitted to use external libraries above those outlined in the project.

Additional Information: The course slides are not meant as a complete set of notes or a substitute for a textbook, but simply constitute the focus of the lecture. Important gaps are left in the slides that are filled in during class, thus **l**ecture attendance should be considered essential.

The material covered in the classroom will be used to supplement textbook readings.

Every chapter should be read twice. The first reading should be done prior to attending class and the second reading should be done after the class discussion of the chapter. The questions at the back of each chapter follow directly from the reading. Students should be able to answer these questions after a thorough reading of the material.

Academic Integrity: *Code of Student Conduct*

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/integrity for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples reseignements, veuillez consulter le site www.mcgill.ca/integrity).

Final Exam Policy: *Regulations*
Students should not make other commitments during the final exam period. Vacation plans do not constitute valid grounds for the deferral or the rescheduling of examinations. See the Centre Calendar for the regulations governing Examinations:
   http://www.mcgill.ca/conted-students/exams/regulations/
Students are required to present their I.D. Card (with photo) for entrance to their examination.

Classroom Rules: All electronic devices (cell phones and beepers) must be turned off during class time.

Assignments Pickup: All assignments are submitted to and picked-up from Web CT.

Email Policy: E-mail is one of the official means of communication between McGill University and its students. As with all official University communications, it is the student's responsibility to ensure that time-critical e-mail is accessed, read, and acted upon in a timely fashion. If a student chooses to forward University e-mail to another e-mail mailbox, it is that student's responsibility to ensure that the alternate account is viable.

Please note that to protect the privacy of the students, the University will only reply to the students on their McGill e-mail account.

Computing Resources: Trottier 3rd floor.

Students Rights and Responsibilities:

Regulations and policies governing students at McGill University can be downloaded from the website:
   http://www.mcgill.ca/deanofstudents/rights/

Students Services and Resources:

Various services and resources, such as email access, walksafe, library access, etc., are available to Continuing Education students:
   http://www.mcgill.ca/conted-students/services/

Minerva for Students: http://www.mcgill.ca/minerva-students/

Note:

In the event of extraordinary circumstances beyond the University's control, the evaluation scheme in a Course is subject to change, provided that there be timely communications to the students regarding the change.

Tentative Course Outline

WEEK	TOPIC	DETAILS	LAB	WORK
Operating Systems, Memory and Graphics Cards				
Jan 8	Introduction, Operating Systems and Graphics Cards	About the course, Computer modes: Real & Protected, Memory architecture: Mapped, Emulation (Windows OS), Intel Memory and CPU Architecture		
Low-level Programming				
Jan 15	INTEL Assembly 1	Windows command-line assembler, Intel assembly language instructions	Lab 1: DosBox & Debug	
Jan 22	INTEL Assembly 2	Assemblers, Addressing modes, Segment offsets	Lab 2: coding using Debug & ASM programming with TASM + TLINK (Hello World)	
Jan 29	Graphics Cards 1	Interrupts, addresses and video modes, SVGA Architecture (NVIDIA)	Lab 3: I/O routines	
Feb 5	Graphics Cards 2	Video banks, video modes, and interrupts	Lab 4: Video modes, card info & your graphic library	
Feb 12	General DOT	Drawing points, Video banks	Lab 5: Dot + simple scene	
Feb 19	General LINE and TRIANGLE	Drawing lines and triangles	Lab 6: Line code in a single bank and Triangles	
Feb 26	General FILL	About filling shapes	Lab 7: Fill	
STUDY BREAK				
C Programming and Hardware Interfaces				
Mar 12	C and Assembler	Writing assembler in C, and conio.h	Lab 8: Inline assembly + graphics, conio.h, debug C code.	
Mar 19	C and OpenGL	Graphics libraries	Lab 9: OpenGL **Project: C, OpenGL, CG**	
CG				
Mar 26	Introduction to CG	Interfacing OpenGL with CG	Lab 10: CG	
GOOD FRIDAY				
Apr 9	CG Programming	Graphics processing		
Apr 16	Extra Week		**Project Due**	