

MATH 230

Computer Organization & Architecture

Spring 2015

Instructor: Bruce Smith
Office: 390d
E-mail: bsmith@swccd.edu
Office Phone: 421-6700, x5291

Meeting Time: Lect: Mon, Wed 10:00a-11:15a, rm 394
Lab: Fri 10:00a-12:15p, rm 394
Office Hours: MT: 8:00a - 8:50a, M: 12:00p - 12:50p,
and by appointment

Course Description

This course teaches the internal organization and operation of digital computers with a new emphasis on advances in parallelism. This course uses assembly language programming to emphasize the CPU datapath, starting from C down to assembly and machine language, on thru hardware implementation and modeling of assembly language functions; hence, the subjects covered include C, assembly language programming, memory management, the translation of higher level programs into machine language, computer organization, caches, performance measurement, parallelism, CPU design, warehouse scale computing, and related topics.

Course Prerequisite

A grade of "C" or higher in Math 130 (Introduction to Computer Programming), or equivalent.

Textbooks

Required:

- *Computer Organization and Design: The Hardware/Software Interface (revised 4th Edition)*, by David A. Patterson and John L. Hennessy, Publisher: Morgan Kaufmann, ISBN 978-0123747501.
- *C Primer Plus (5th Edition)*, by Stephen Prata, Publisher: Sams, ISBN 978-0672326967

Optional:

- *Programming in C, 2nd Edition*, by Kernighan and Ritchie, Publisher: Prentice-Hall, ISBN 978-0131103627. This book will be on reserve in the SWC library.

Additional References:

- *Digital Principles and Applications, 3rd Ed.*, by Malvino, Leach.
- *The Essentials of Computer Organization and Architecture, 2nd Ed*, by Null and Lobur, Publisher: Jones and Bartlett, ISBN 978-1449620639
- *Digital Design, 3rd Ed*, by M. Morris Mano, Publisher: Prentice Hall, ISBN 0-13-062121-8

Support Software Used in Lab Computers. See this document as a PDF to get links.

- CodeBlocks and Minimalist GNU, or MinGW, for programming in C. Simply install CodeBlocks and MinGW gets installed.
- Logisim is an educational tool for designing and simulating digital logic circuits.
- MARS, the MIPS Assembler and Runtime Simulator, is an IDE for programming in MIPS assembly language

Use of a USB Flash Drive with 4G or more memory is strongly recommended. Programming in C/C++ can be done on any computer if you have your compiler handy. If you want to keep a compiler with you, try Pocket C++ (uses Notepad++).

This document, and other course-related material can be found at the instructor's website: www2.swccd.edu/~bsmith/m230/

Exams and quizzes may require a scientific calculator.

Exams and Grades

The exams are scheduled as follows:

- MidTerm Exam: March 6th (Fri) *tentative - may change*
- Final Exam: cumulative, on May 22 (Fri), 10:30am - 12:30pm

Your grade for the course will be based on the following components:

Quizzes (40%), Projects (20%), Midterm (20%), and Final Exam (20%).

Lowest quiz score may be dropped for those with fewer than 4 absences.

Minimum grade threshold scores: A = 90%, B = 80%, C = 70%, D = 60%, below 60% = F
No grade of "Incomplete" (I) will be given.

Student Learning Outcomes

By the end of the course, students should be able to perform the following:

- produce and use mathematical expressions to describe the functions of simple combinational and sequential circuits.
- interpret and convert numerical data from one base format to another.
- identify and describe the internal representation of non-numeric data.
- identify and explain how to execute an instruction in a classical von Neumann machine.
- define and demonstrate the conversion of fundamental high-level programming constructs to both the assembly and machine language level.
- organize programming constructs to demonstrate how to handle subroutine calls at the assembly level.
- identify and describe the role of cache and virtual memory.
- explain how to use interrupts to implement I/O control and data transfers.
- explain, compare, and assess alternative implementations of datapaths.
- explain and demonstrate basic instruction level parallelism using pipelining and the major hazards that may occur.

Notes on the Calendar

There will be no classes on February 13 (Lincoln's Birthday), February 16 (Washington's Birthday), March 31 (Cesar Chavez's Day), April 3 (Good Friday), March 30 - April 5 (Spring Break), May 25 (Memorial Day)

Other Important Dates

Jan 24: Last day to:

1) get a refund in the Bookstore without proof of drop.

Feb 4: Last day to:

1) add classes; 2) withdraw from full-semester classes and qualify for a full refund; 3) get a refund for Student Activities stickers.

Feb 8: Last day to withdraw from a class without receiving a "W" grade.

April 17th: Last day to withdraw from full-semester courses and receive a "W" grade.

May 21: No classes/Flex Day

May 22 - 29: Finals Week

Make-ups

No make-up exams or quizzes will be given without prior consent of the instructor. Students participating in an officially sanctioned, scheduled, college extracurricular activity will be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation.

Attendance

Each student is expected to attend every class meeting. In the case of absence, it is the student's responsibility to inform the instructor.

Mandatory First Day of Class: Instructors must drop any student who fails to attend the first class meeting if the class is at maximum enrollment and other students are waiting to enroll, unless the student notifies the instructor in advance.

Dropping for Absences: Per SWCCD Policy 5075, instructors may drop a student from a class if the student's total hours of absences exceeds twice the number of lecture hour equivalent units (LHE) for the class. For example, if this is a 4-unit (4 LHE) class, when you have more than eight hours of absences, you will be dropped and receive a "W" or an "F" depending the date dropped.

Dropping for Tardiness: A tardy is defined as arriving after the start time up to 10 minutes late. If you are more than 10 minutes late, this will count as an absence. Two (2) tardies will count as one (1) absence. This tardy policy also applies to students leaving before the end of class or returning late from a break. The tardy policy will begin after the end of the add period.

Dropping students for being tardy will be in accordance with SWCCD Policy 5075 stated above. Arriving late or leaving early is a problem for both the students and the instructor. Students are expected to be in class for the entire class period.

Late Adds: After the add period concludes, a student may add classes only: 1) If the instructor certifies that the student has been in attendance during the add period. 2) Submits a Late Add

Form to the School Dean. 3) Receives the approval of the School Dean. 4) Submits approved form to Admissions and Records.

If an add code is given at the start of the semester, it must be used within 24 hours of receipt, at which point the code can be assigned to someone else.

Students with Disabilities

Southwestern College recommends that students with disabilities or specific learning needs contact their professors during the first two weeks of class to discuss academic accommodations. If a student believes they may have a disability and would like more information, they are encouraged to contact Disability Support Services (DSS) at (619) 482-6512 (voice), (619) 207-4480 (video phone), or email at DSS@swccd.edu. Alternate forms of this syllabus and other course materials are available upon request.

Academic Success Center Referral

Services are located in the ASC (420), the Writing Center (420D), the Reading Center (420), Math Center (426), the Library/LRC Interdisciplinary Tutoring Lab, MESA, specialized on-campus School tutoring labs, the Higher Education Center, and the San Ysidro Education Center. Online learning materials and Online Writing Lab (OWL) are available online at swccd.edu/~asc.

Classroom Policies

No food or drinks allowed in the classroom (water bottles OK). Please switch all cell phones either off or to silent mode. No children or other visitors unless prior permission is obtained.

Misconduct

Faculty may require a student who disrupts the classroom to meet with the Dean of MSE prior to the next class meeting. Also, instructors may exclude a student for misconduct on the day of the disruption, and an additional day if needed. Further disciplinary action may be pursued by the instructor or college administration.

Misconduct includes the following:

- Academic cheating and plagiarism: Academic dishonesty of any type by a student provides grounds for disciplinary action by the instructor or college. In written work, no material may be copied from another without proper quotation marks, footnotes, or appropriate documentation. Students (both the giver and the receiver) involved in cheating and/or plagiarism will receive a zero (failing) grade on the assignment (this assignment cannot be dropped) and, at the discretion of the instructor, earn a failing grade in the class. Academic dishonesty of any type such as cheating and plagiarism can result in one or all of the following: a failing grade on the assignment, a failing grade in the class, and/or formal disciplinary action by the college.
- Disruption of instructional activities or administrative procedures.
- Continued disruptive behavior, continued willful disobedience
- Habitual profanity or vulgarity, and/or the open and persistent abuse of college personnel.
- Use, sale, or possession on campus, or campus premises under the influence of alcoholic beverages, narcotics, other hallucinogenic drugs or substances, or any poison classified as such by schedule "D" in section 4160 of the Business and Professions Code.

- Alteration or misuse of college documents, including acts of forgery and furnishing false information.
- Acts or threats of damage to or theft of property belonging to or located on college-controlled property or facilities.
- Act or threat of physical abuse of any person. Assault or battery upon any student, college personnel, authorized college guest, or any other person.
- Violation of college regulations or state laws.
- Additionally, please review course catalog (swccd.edu/Catalog/), or Southwestern Community College District Procedure No. 5550 for more information.

Disciplinary Action Procedures

- When a student conduct violation has occurred, the first attempt to resolve the misconduct will be an informal consultation between the student and the instructor (or college staff member).
- If the situation is unresolved, the Dean will meet with the instructor and the student(s) involved.
- If the situation remains unresolved, the instructor will complete a “Report of Student Misconduct” and file the report with the Dean of Student Services.
- In situations involving safety or if the College Police have become involved, steps 1 and 2 need not be adhered to.

M230 Lecture/Lab Calendar

quiz dates to be given in class; dates herein are tentative and may change

MON		WED		FRI - LECT/LAB/QUIZ
Jan 19th		21st	1	23rd
No Class Holiday: MLK		Course Introduction, Debugging Lab		
26th	2	28th	3	30th
Number Representation I, CP5:pp 1-22		Number Representation II		
Feb 2nd	4	4th	5	6th
Number Representation III		C programming I, IDE lab work		
9th	6	11th	7	13th
C pointers, CP5: pp 23-86		C Pointers and Arrays CP5: pp 347-386		No Class Holiday: Lincoln
16th		18th	8	20th
No Class Holiday: Washington		C: Arrays, Strings and dynamic memory CP5: pp 89-122		
23rd	9	25th	10	27th
C: Functions CP5:		MIPS: Introduction P & H: 2.1-2.3		
Mar 2nd	11	4th	12	6th
MIPS: Load/Store P&H: 2.6, 2.9 (pg 95-96 only)		MIPS: Branches and Procedures P&H: 2.7, A.6 (On CD)		
9th	13	11th	14	13th
MIPS: Procedures/Logical Ops P&H: 3.3, 2.5 P&H: 3.4 (pg 176, top 177, 181) P&H: 3.5 (pg 183, bottom 188, 189)		MIPS: Instruction Format P & H: 2.4, 2.9, Green Card		
16th	15	18th	16	20th
MIPS: Instruction Format II, P& H: 3.6, 3.8		I/O Basics (Polling & Interrupts)		

MON	WED	FRI - LECT/LAB/QUIZ
23rd 17 Floating Point I P&H: 3.10 (On CD)	25th 18 Floating Point II P&H: 3.10 (On CD)	27th
30th No Class Holiday: Spring Break	Apr 1st No Class Holiday: Spring Break	3rd No Class Holiday: Good Friday No Class Holiday: Spring Break
6th 19 Floating Point III - denorms, etc. P&H: 3.10 (On CD)	8th 20 Truth Functions and Boolean Logic	10th
13th 21 Laws of Boolean algebra and circuit simplification	15th 22 More simplification of boolean circuits	17th
20th 23 ALU design I	22nd 24 ALU design II	24th
27th 25 CPU Design: Single-cycle datapath I	29th 26 CPU Design: Single-cycle II	May 1st
4th 27 CPU Design: Control I	6th 28 CPU Design: Control II	8th
11th 29 CPU Design: Pipelining I	13th 30 CPU Design: Pipelining II	15th
18th 31 Caches I	20th 32 Caches II	22nd Final Exam: M230 (Fri) 10:30am-12:30pm
25th Finals Week	27th Finals Week	29th Finals Week

Final Exam: May 22, Fri, 10:30am - 12:30pm