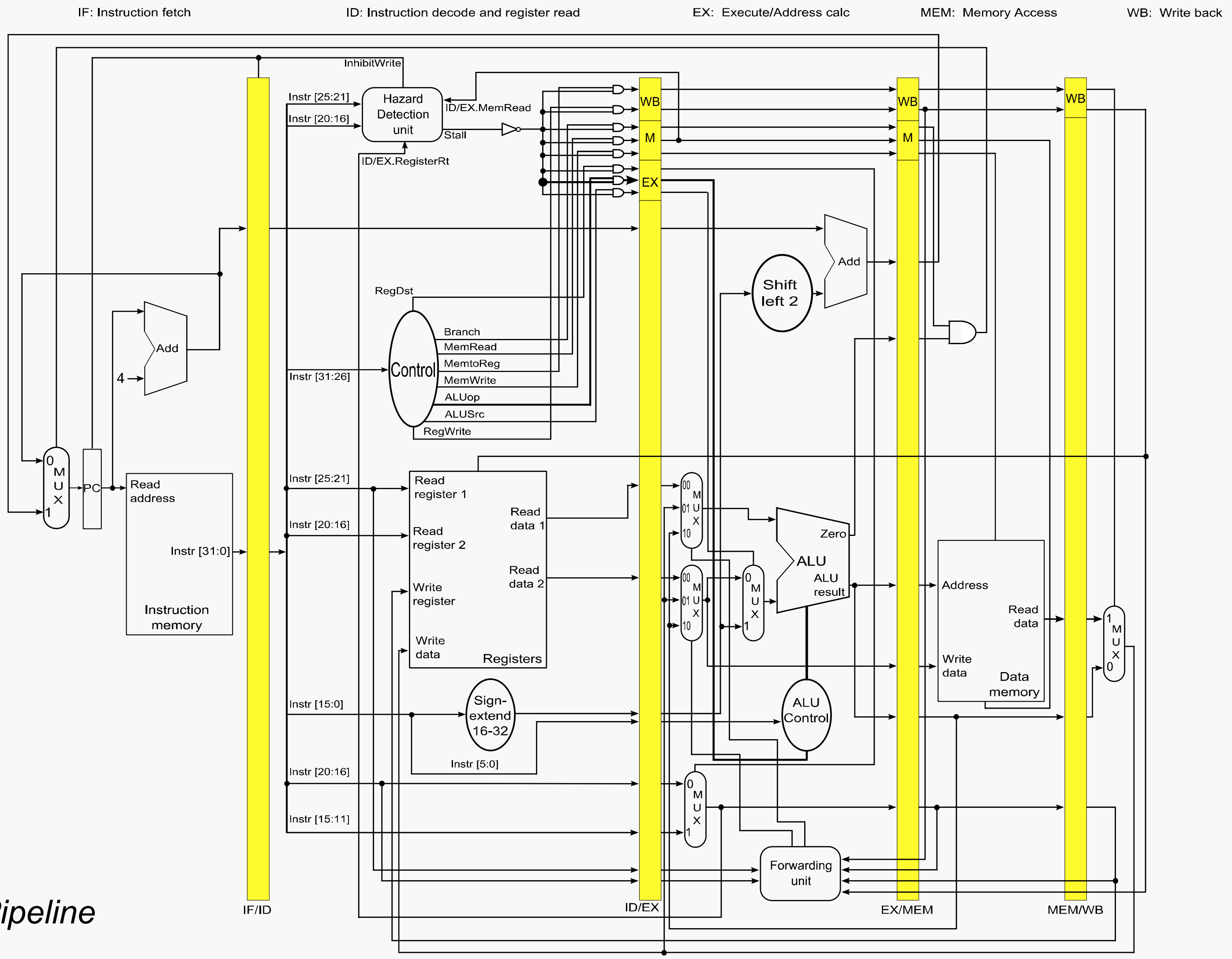
Computer Science 2506: Computer Organization II



MIPS32 Pipeline

Instructors

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Course Description

Detailed coverage of a RISC architecture, including instruction formats and construction, addressing modes, instruction execution, arithmetic/logic units, control unit design, memory hierarchy operation and performance, pipelining, input/output, and the relationships between high level programming languages and machine language, with practice in the development of medium-sized system software solutions in C.

The course will focus on the MIPS32 architecture.

Course Objectives

Having successfully completed this course, the student will be able to:

- Design and analyze instruction sets and their impact on processor design,
- Identify and analyze the design and function of the basic instruction execution elements of a modern processor,
- Apply finite state automata to computer design,
- Describe the basic elements of computer architecture and their impact on the performance of a modern processor,
- Explain the design and function of each element in a memory hierarchy,
- Identify and explain the different methods of I/O in a computer system,
- Explain the relationship between the computer hardware, the operating system that runs on it, and the applications that are compiled to it,
- Write moderately complex system programs in C,
- Compare computer architectures and organizations based on quantifiable performance metrics.

Course TAs

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Office Hours on course website

Prerequisites

CS 2114	**Software Design and Data Structures**
CS 2505	**Computer Organization I**
or	
ECE 2504	**Intro Computer Engineering**
ECE 2574	**Data Structure and Algorithms**
	These prerequisites must have been completed with a grade of C or higher (C- is not acceptable) or AP credit.

Math 2534	**Discrete Mathematics**
or	
Math 3034	**Intro to Proofs**

I will not grant any exceptions to the stated prerequisites, including the minimum grade requirements.

Required Textbook

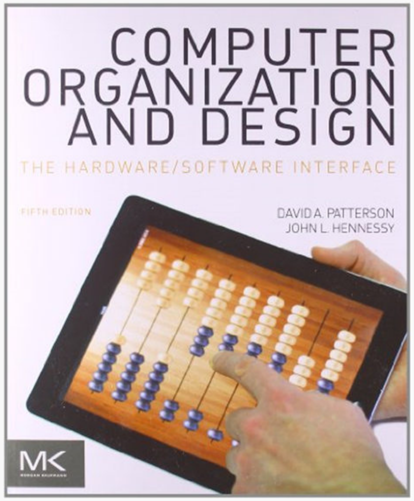
Required:

Computer Organization and Design: the Hardware/Software Interface, 5th Edition

David A Patterson and John L Hennessy

Morgan-Kaufmann ©2013

ISBN 978-0-12-407726-3


COMPUTER ORGANIZATION AND DESIGN
THE HARDWARE/SOFTWARE INTERFACE
FIFTH EDITION
DAVID A. PATTERSON
JOHN L. HENNESSY
MK

The 4th Edition will also be fine, but some of the reading assignments will not correspond to the organization of topics in that version.

Recommended Textbooks

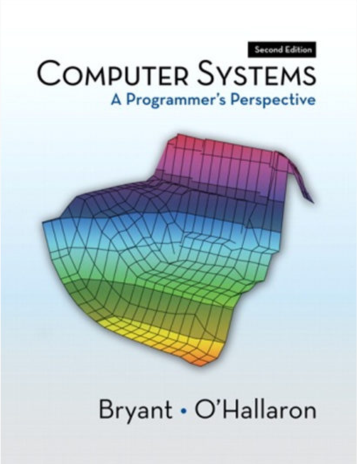
Computer Systems: a Programmer's Perspective, 2nd Edition

Randal E Bryant & David R O'Hallaron

Addison Wesley ©2011

ISBN 978-0-13-610804-7

This contains considerable information related to the buffer bomb project.



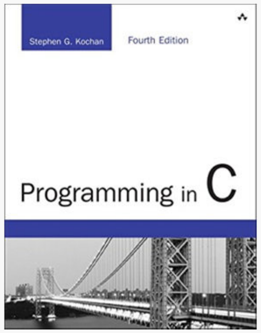
Recommended C Resources

Programming in C, 4th Edition

Stephen G Kochan

Developer's Library ©2014

978-0-321-77641-9

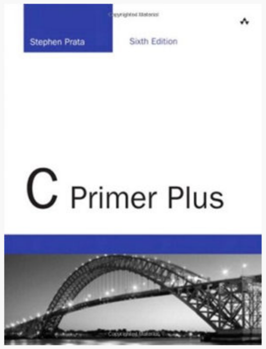


C Primer Plus, 6th Edition

Stephen Prata

Developer's Library ©2014

978-0-321-92842-9



C Programming a Modern Approach, 2nd Edition

K. N. King

WW Norton ©2008

978-0-393-97950-3

Recommended References

CS 2506 Course Notes, Fall 2014 Edition, W D McQuain, ©2005-14
(available ONLY at the course website)

Available via the Safari Database in the VT Library:

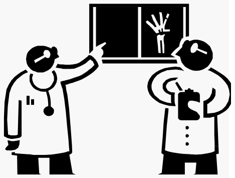
The Art of Debugging with GDB, DDD, and Eclipse
N Matloff & P J Salzman, No Starch Press ©2008 ISBN 978-1-593-27174-9

Write Great Code, Volume 1
R Hyde, No Starch Press ©2004 ISBN 978-1-593-27003-2

Write Great Code, Volume 2
R Hyde, No Starch Press ©2006 ISBN 978-1-593-27065-0

Evaluation

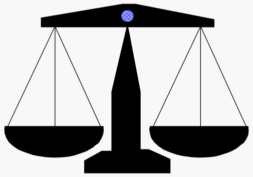
Final grades will be based on the average achieved over the following :



Item	Weight	Dates
Assignments MIPS C	 24% 36%	See course website
Tests	10% each	Tentatively, Sept 25 and Nov 13
Final Exam*	20%	19:00 – 21:00 Tuesday December 16

Grade Scale

The usual 10-point scale will apply (subject to any curve). A final average of 90% will guarantee an A-, 80% will guarantee a B-, and so forth.



Curve

A grade curve may or may not be employed in this course.The application of a curve is dependent upon class performance on tests, projects and homework. The decision to utilize a curve rests entirely with the course instructors.

* Exam score will replace the lower test score, if it is higher.

Minimum Requirements Rules

In order to receive a grade of C or higher for the course, you are required to meet some minimum requirements:

Buffer bomb	You must trigger at least the first three phases (0-2)

Understand something clearly: if you fail to meet the stated requirements, you will receive a grade of C- or lower for the course, regardless of your overall average.

The Meaning of Pairs Work

You will probably be allowed to work together on some assignments. If you are allowed to work in pairs, or groups, it is important you understand what we expect.

Acceptable pairs work requires:

- Each partner contributes to the analysis of the assignment, and to the derivation of a solution. This does not mean the contributions will always be equal, but both partners must be actively involved. When the solution is complete, each partner should understand the entire solution.
- The partners do not "divide" different parts of a multi-part assignment, with each working independently on his/her parts and having little or no involvement in the other parts.
- No partner "runs away" with the problem and solves it independently, not giving the other partner(s) the opportunity to contribute.

If you are allowed to work in pairs, you will choose your partner. Choose wisely.

Development Systems

Test Environments

- When relevant, a test environment, will be specified for homework assignments.
- The C-language assignments will be compiled with gcc 4.4 (as installed on the rlogin cluster) and tested on CentOS 6.5 (as installed on the rlogin cluster).
- Solutions will only be tested under the specified environment.
- It is the YOUR responsibility to ensure that YOUR solutions execute correctly in the appropriate environment; solutions that do not will receive substantial deductions.

Therefore, you are required to develop your solutions using CentOS 6.5 and gcc 4.4.

Late Work

Due dates

Each programming project and homework assignment will have a due date and time and will include instructions for submission.

Homework

Usually, no late submissions will be allowed for homework assignments.

Programming Assignments

Except in the very rare case that an extension is granted, late submissions will incur a penalty per diem late penalty that will be included in the project specification. This is typically 10%.

Extensions

Any request for an extension must be made, preferably by email, at least 24 hours prior to the due date.

Late submissions will not be given any credit if submitted after graded assignments or solutions have been released.

Statute of Limitations

Any questions about the grading of an assignment must be raised with your instructor within two weeks after the graded assignment has been made available to you.

Sources of Help for This Course

General Issues

- CS 2506 classmates
- CS 2506 Forum board (forum.cs.vt.edu)
- CS 2506 TAs
- CS 2506 Instructor

Programming Language Help

- P&H text and other resources from the course website
- C language references
- CS 2506 Forum board

Lecture Instruction

Lectures will consist of presentations, applications, problems and solutions interspersed with classroom discussion.

Damage Control

Backups

Students are responsible for making backup copies of all their work in this (and all) courses.

Loss of work due to hard drive failure is **NOT** an acceptable excuse. Backup copies of files on the same hard drive are not backup copies. Backup copies of files on second hard drives are also risky. Backup copies should be maintained on two separate distinct storage mediums, (e.g., hard drives and Zip disks).

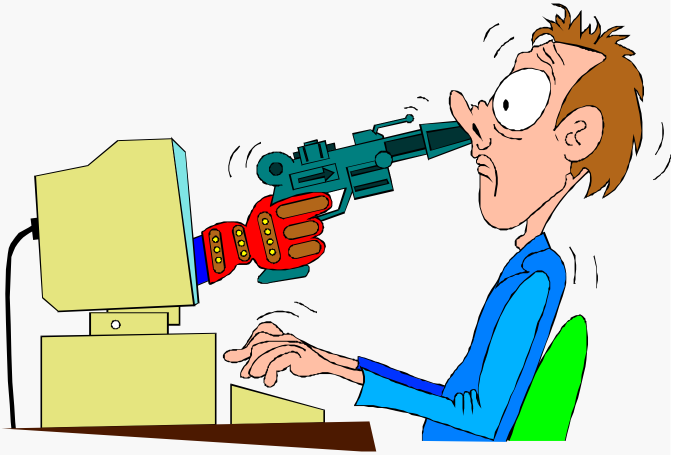
Backup copies should be maintained until after the end of the term and students have received their course grade. (The Army lives by triplicate for a reason.)

Remember: Computer systems are mechanical devices.

Systems fail. Drives die. Bad sectors appear.

Network connections break.

Plan for it. It is inevitable!



Use of Electronic Devices in Class

There are certainly legitimate uses of laptops and tablets during lectures.

But, most students who use laptops or tablets during class are essentially unaware of the details of the material that is being presented, and are therefore effectively absent.

The use of most other devices, such as cell phones and media players, is almost certainly a pure distraction to the student.

Therefore:

- You may not access your cell phones or media players during lectures.
- You may not use Google Glass during lectures.

You may use an audio recorder during class.

Honor Code

An exhaustive list of Honor Code violations would be impossible to present here, but among other things, each of the following is a flagrant violation of the Virginia Tech Honor Code, and violations will be dealt with severely (Honor Court):

- Working with another student to derive a common program or solution to a problem. Unless explicitly stated otherwise, there are no group assignments in this course.
- Discussing the details required to solve an assignment. You may not share solutions, or collaborate in the creation of a solution.
- Copying source code (programs) in whole or in part from someone else.
- Copying files from another student's disk or lab account even though they might be unprotected.
- Editing (computer generated) output to achieve apparently correct results.

It is acceptable to discuss an assignment with classmates in a general way, i.e., to discuss the nature of the assignment. In other words, you may discuss with your classmates what your solution is required to accomplish but not how to achieve that goal using C, MIPS32 assembly, or other relevant tools. In no way should the individual statements of a program or the steps leading to the solution of the problem be discussed with or shown to anyone except those people cited in the following statement.

Honor Code

Feel free to discuss the homework assignments and your program source code with the teaching assistants assigned to CS 2506, the instructor, or the free tutors provided by UPE. The discussion of your program source code must be limited to these people. Note that this specifically excludes discussions of your program source code with other students (even if they are not enrolled in CS 2506), or with tutors except for those named above. Privately hired tutors are not an exception to this requirement, nor are athletic or other tutors provided by the University.

Copies of all submitted work are retained indefinitely by the Department. Submitted programs are subjected to automated analysis for detection of cheating.

If you have any question as to how the Honor Code applies to this class, remember that:

- Any work done in this class must be done on an individual basis.
- Credit will be given only for work done entirely on an individual basis.
- Do not make any assumptions as to who can provide help on a programming assignment.
- All submitted work is archived. All submitted programs will be subjected to automated cheating analysis via the MOSS system.

Evidence indicating the violation of the policies stated above will be submitted to the Honor Court.

It is much easier to explain a poor grade to parents or a potential employer than to explain an Honor Court conviction.

One Additional Note

In recent terms we have observed a new behavior regarding cheating.

Some of the projects we use each semester may have been used in previous offerings of the course.

A small number of students have submitted solutions that were based (in whole or in part) on solutions submitted by other students in previous offerings. Be advised:

- That is cheating.
- When we do the cheating analysis for a project, we include submissions from previous offerings as well as the current term. (We save everything.)
- If we detect this form of cheating, the students from the previous terms will also be charged with violating the Honor Code.
- The University does make provisions for cases in which a charged student has already graduated. You do not what to discover how this works, so safeguard your code for the long term!

Posting Code Online

At some point you will very likely want to make samples of the code you write available to potential employers. There is absolutely nothing wrong with that!

But if you do that, you need to be sure you're not making it easy for other students to access your code.

GitHub is an interesting service, but the free accounts are insecure.

As of now, a secure GitHub account costs as little as $7 per month.