ASTR 2600 Computational Techniques

Spring 2013 Syllabus

Instructor: Adam Ginsburg (adam.ginsburg@colorado.edu)
Class e-mail address: ASTR2600@gmail.com (feel free to add on gchat / Google Talk)

Office (lab) hours: None declared yet! We'll take a survey to find out what works best.

All other times: Adam's office is Duane D217

Student Assistant: Cameron Wedge (cameron.wedge@colorado.edu)

Meeting location: Sommers-Bausch Observatory classroom

Meeting time: 3pm-4:15pm Mondays & Wednesdays

Required Text: *Computer Programming for Scientists Using IDL* Parts 0-3 by Dewey Anderson. The current version is different from the text used last semester. The text will appear in the bookstore in 2 "volumes". Currently the first volume containing Part 0 & Part 1 is available in the bookstore; Part 2 & 3 should also be available.

Purpose: This is a course intended to teach you the basics of computer programming using the IDL language and introduce you to the Unix operating system. We will be using Sunray terminals on the cosmos computer in the Cosmos Lab at the Sommers-Bausch Observatory.

Assignments: Programming exercises and homeworks will be done on the Cosmos Lab computers. This is not a lab class so expect to do the assignments outside of class time. Cameron and I will be available to help you in the lab during our scheduled office hours. If you need access to the building after hours, we will have Keith Gleason (SBO manager) get your CU ID card approved for entry.

Assignments will be turned in by copying the appropriate files onto a github repository. The first homework will cover setup of github and we will have a tutorial on using git.

Most assignments are in the book.

Books: The IDL text is required and there will be reading assignments given each class. You are expected to do the reading *before* the next class. There may be clicker questions in class based on the assigned reading.

Grading:

Assignments will be given each week. As a rule they will consist of 3 parts: an exercise, a "Whuduzitdo?" (What does it do?) and a "Graded Homework". I plan to assign them on Mondays. The exercises and Whuduzitdo's will be due *before the next class* (Wednesday). The homework will be due the following Monday (by end of the day). However, the deadlines are subject to change - in the past, students have preferred to have office hours on a Friday to work on the assignments.

The exercise part is mostly "type this in and see what happens" to show you IDL. (Don't just treat it as a typing exercise. Pay attention to what you're typing and what it's doing.) The Whuduzitdo section shows you IDL statements or programs and *you* have to say what it does, i.e. you pretend to be the computer. This usually means answering a question like "What does it print?" or "What's the value of this variable?". Sometimes it explains an objective of the IDL and you have to say why it doesn't meet that objective and how you would fix it. This is important practice for debugging (finding your mistakes in) programs.

The exercise and the Whuduzitdo will each be given a grade of 0, 1 or 2 points.

2 points if you do the entire thing

1 point if it seems a poor or partial effort in some fashion *or is turned in late.*

0 points if you don't do it, or do so little of it that I can't justify giving you 1 point

The total grade for all exercises & Whuduzitdo's combined will count as 15% of your grade.

There will also be tutorials, i.e. in-class work, that may resemble Whuduzitdos or Exercises, but in some cases are just designed to teach you how to use a UNIX tool. These will be graded primarily on participation credit and will count, along with participation, for 10% of your grade.

No assignment will be accepted more than 2 weeks late.

Notice that the correctness of answers to the Whuduzitdo's don't count toward the grade. The objective is to get you to *try* and figure it out, no worrying about whether you got it right. It's a learning exercise, not a test of your knowledge.

Homeworks will be graded on a 0-100% scale. There is a late penalty of 3 points per day.

Weekends and holidays do not count in the late penalty assessment, e.g., a homework due at midnight on Tuesday night will take a 3 point hit if you turn it in on Wednesday, a 12 point hit if you turn it on Friday and a 15 point hit if you turn it on Saturday, Sunday or Monday.

I will waive your largest homework late penalty for the semester (but assignments later than 2 weeks still will not be accepted).

There *may* be one exam that would consist almost entirely of things like you find in the Whuduzitdo's. It would count the same as a single homework. Alternatively, we may do a final project that would be similar to homeworks, but would count as two homeworks.

Letter grades are assigned in 10-point bands, i.e., A's are 90-100, B's 80-89, etc.

Advice: You can usually tell if your homework is working. *Don't* turn in homework assignments that don't work. I don't give much credit for something that doesn't work. Take the 3-point late penalty and get help the next day. That's why the late penalty is as small as it is. But BEWARE: Don't habitually turn in late assignments. The late penalties will build up faster than you think. It's a shame to find your A-level work earning you a grade of C (or worse). Many of the assignments build on earlier assignments so don't plan on "skipping" an assignment to turn it later: you probably will not be able to complete any assignment without first completing all prior assignments, *including* exercises and tutorials.

Clickers (and attendance): Clickers may be used in class. These may be survey questions or "What does it do?" questions. 10% of your grade will be based on clicker responses and participation in lecture. Most of this grade will be participation, though a small portion will be correctness when there is a right answer. Attendance is required to get the clicker credit. Excused absences will not count against your grade.

Class Component	Grade Percentage
Exercises and Whuduzitdo?s	15%
Tutorials / In-class lab work	10%
Clickers and Attendance	10%
Homework	65%

Rough course outline:

How computers work (Chapter 0) will be mixed in to the class.

Weeks 1-5: Introduction

- Unix
- Interactive IDL: Chapters 1 - 9
  - Data types, equations, built-in procedures & functions, graphics
- Assignments dealing with: calculations, reading/writing files, displaying data (plotting), images

Weeks 6-10: Programming in IDL

- writing IDL scripts & programs Chapters 10, 11
- flow control constructs, IF, FOR, WHILE Ch 12
- writing your own procedures & functions Ch 13
- Software design Ch 14
- data structures Ch 15

- Animation Ch 16
- Assignments dealing with dynamical simulations, differential equations, N-body simulation

Weeks 11-15: More-advanced techniques

- Random numbers, interpolation, curve-fitting
- Object-oriented programming and "classes"
- Recursion: factorial, binary tree, Measuring stars in telescope images
- An introduction to Python, ipython, and genuinely modern programming techniques

To activate your cosmos account: Get on a computer on campus (not from home) and use a web browser and go to

https://sac.colorado.edu/

There you can use the drop down menu to select "cosmos", enter your CU login name and IdentiKey Password and activate your account. You should then be able to login to the cosmos computers in the Cosmos Lab.

Standard Caveat: All aspects of this syllabus are subject to change.

HONOR CODE

As a CU student, you are required to be familiar with CU's honor code and to not violate it.

This class will require some special care because the programming environment often has a collaborative feel. Indeed, much of my programming expertise comes from seeing how others program and incorporating the good ideas I've seen. But the work-world is not the school-world and what is encouraged there is often forbidden here.

Under no circumstances should any computer files be electronically shared without explicit permission from me (e.g., someone brings in a neat data file we all want to analyze).

Talking with others about the *exercises* is encouraged even while you are doing them.

Don't just ask other people the answer to the Whuduzitdo's. Try and figure it out. It's a learning experience. That's why *correctness* of your answer doesn't count toward the grade.

Homeworks should be entirely your own work. You may not work in groups and you may not share code.

The Boulder Provost's Disability Task Force recommended syllabus statement:

(1) If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.

If you have a temporary medical condition or injury, see Temporary Medical Conditions: Injuries, Surgeries, and Illnesses guidelines under Quick Links at Disability Services website and discuss your needs with your professor.

(2) It is the responsibility of every instructor to clearly explain his or her procedures about absences due to religious observances in the course syllabus so that all students are fully informed, in writing, near the beginning of each semester's classes. Campus policy regarding religious observances states that faculty must make reasonable accommodation for them and in so doing, be careful not to inhibit or penalize those students who are exercising their rights to religious observance. Faculty should be aware that a given religious holiday may be observed with very different levels of attentiveness by different members of the same religious group and thus may require careful consideration to the particulars of each individual case. See http://www.colorado.edu/policies/fac_relig.html

If you have questions about providing students with religious accommodations, please contact the Office of Discrimination and Harassment at 303-492-2797.

A comprehensive calendar of the religious holidays most commonly observed by CU-Boulder students is at http://www.interfaithcalendar.org/

Recommended syllabus statement:

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, up to three missed classes will be excused for religions obligations. The 3-points-per-day "late fee" will not be assessed for excused absences, but the 2-week deadline will still be enforced. See full details at http://www.colorado.edu/policies/fac_relig.html

(3) Faculty and students should be aware of the campus "Classroom Behavior" policy at http://www.colorado.edu/policies/classbehavior.html as well as faculty rights and responsibilities listed at http://www.colorado.edu/FacultyStaff/faculty-booklet.html#Part_1 These documents describe examples of unacceptable classroom behavior and provide information on how to handle such circumstances should they arise. Faculty are encouraged to address the issue of classroom behavior in the syllabus.

Recommended syllabus statement:

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

(4) The Office of Discrimination and Harassment recommends the following syllabus statement:

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh

(5) The Boulder campus has a student Honor Code and individual faculty members are expected to familiarize themselves with its tenets and follow the approved procedures should violations be perceived. The Honor Council recommended syllabus statement:

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academics/honorcode/