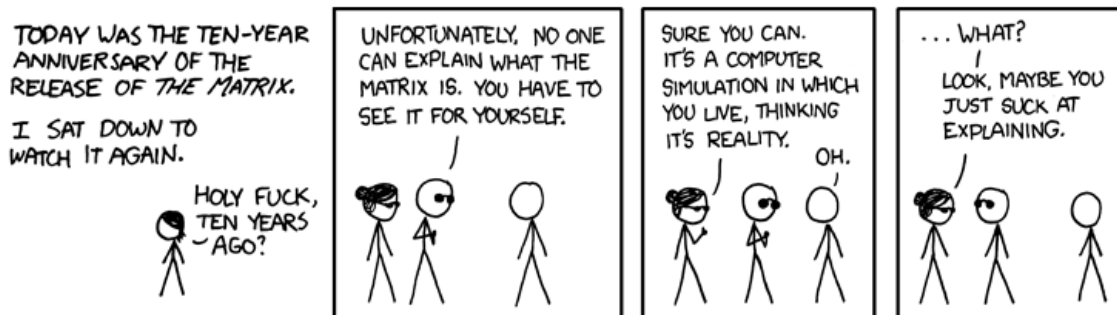


The Matrix in Computer Science (Course Missive)



The Matrix Revisited (excerpt)<http://xkcd.com/566/>

Introduction

Course Description: The aim of this course is to provide students interested in computer science an introduction to vectors and matrices and their use in modeling and data analysis. The course will be driven by applications from areas chosen from among: combinatorial optimization, computer vision, cryptography, game theory, graphics, information retrieval and web search, machine learning, and scientific visualization. For example, students will learn Google's PageRank method for ranking web pages. This course satisfies the linear algebra requirement for the Computer Science Sc.B and the Applied-Math/Computer Science Sc.B., and fulfills an "intermediate math-oriented" requirement for the Computer Science A.B.

Prerequisites: No formal prerequisites but students are expected to be comfortable with programming and with mathematics (writing a proof).

- *Programming background:* You should be fine if you have the equivalent of an AP in Computer Science or if you have taken one of CS 40, CS 150, CS 170, CS 190. The course is taught using Python but prior experience with Python is not necessary; the first two labs are intended to provide instruction and practice in the features of Python most relevant to the course.
- *Mathematics background:* You should be familiar with the ideas of sets and functions. We will review these ideas. and with some basic proof techniques. It is helpful if you have basic knowledge of proof techniques. CS 220 definitely suffices, but you can also get by with a strong high-school math background and a little extra work. For example, though we don't use calculus in this class, if you succeeded in AP Calculus, that's a good indication you will be ready for this class.

Goals: The learning goals are: (1) develop a facility with the methods and concepts of basic linear algebra, especially those relevant to applications in computer science, (2) understand the rudiments of basic computations in linear algebra, and be able to use these in applications, and (3) be able to prove elementary results in linear algebra.

Meeting Time and Place Lecture Monday, Wednesday, Friday 3:00-4:20, CIT 368. The "lecture" will also include quizzes and some problem-solving sessions. In addition, based on your preferences and availability, you will be assigned to one two-hour lab session. You must attend this lab session weekly.

Mandatory office hours You are expected to visit the professor's office at least once during the semester. Office hours are arranged by email or in class. Group office hours will be scheduled in class.

Time requirements In addition to the lectures and labs, you are expected to spend roughly five hours a week doing homeworks, reviewing the material, and studying for quizzes.

Grad students The graduate school requires graduate students taking an undergraduate course to do extra work to get credit for the course. Approximately once a week, we will assign extra homework problems intended for graduate students. In order to register, grad students need to get permission from the professor, and then request an override from the Registrar's Office.

Staff

The course has a professor, two head TAs (HTAs), and two undergraduate TAs (UTAs). If you have course questions during the semester, you should email

`cs053tas@cs.brown.edu`

which goes to the whole staff, including the professor. One of us will get back to you. Don't expect us to be on top of email during all hours, however!

The professor is Philip Klein (`klein@brown.edu`). Professor Klein's office is CIT 111111111. Professor Klein's office hours are by appointment—just email him or talk to him after lecture to set up a time. In fact, students in this class will be required to visit the professor at some point in the semester.

The other staff are:

Ari Beller, head undergraduate TA
Galadriel Brady, head undergraduate TA
Ebube Chuba, undergraduate TA
Rebecca Townsend, undergraduate TA

The TAs will hold TA hours in a room to be decided later. We will maintain the schedule on the course web site. These hours are designed to help you with homework assignments, in addition to any general questions you have about the course (things you didn't understand in lecture, etc). If you can't make it to anyone's hours one week but really need help with an assignment, email the staff and someone will try to schedule an appointment. Please keep in mind, however, that the staff have their own lives.

Communications: The course web site and email

The course web site is <http://www.cs.brown.edu/courses/cs053/>, which you can reach alternatively using <http://csmatrix.org>. There you can find TA hours, tentative course calendar and other resources, including information on homework and lab assignments, and announcements.

Most announcements will be sent by email to the Brown University email addresses of the students registered for the course. Be sure you are registered so you can receive these messages. If for some reason you cannot register, please contact the professor.

Textbook

The textbook for this course is *Coding the Matrix: Linear Algebra through Computer Science Applications*, Edition One. A limited number of copies are available at the Brown University Bookstore for \$30. Amazon has it for slightly more.

Assignments and Grading

Your final grade in the course will be determined as follows:

Type of assignment	Percentage
In-class quizzes	25
Weekly lab section	25
Homework/Problem sets	25
Final exam	25

Grades are determined by overall performance according to these measures. You are not competing with your classmates.

Labs are all worth the same amount. Quizzes and problem sets might differ in their value; some quizzes will be worth more than others, and the same goes for problem sets.

Your matrix directory

You will need to have an account on the Computer Science Department's computer system. While logged in to one of the CS Department computers, you should run a script we will provide, called `cs053_coursedir`. This script will create a folder called `matrix` in which you will put all your code and the course support code. The `cs053_coursedir` script will set the permissions on your `matrix` folder so that nobody other than the course staff can read it. After that, you are responsible for making sure the permissions are correct. You are encouraged to ask a TA or a Sunlab consultant for help if you have doubts.

Auto-grading

We have a system for auto-grading many of the homework problems and lab tasks. This gives you immediate feedback, and sends us your work.

To support auto-grading, you need to add to your `matrix` directory a text file called `profile.txt`. It should have two lines. The first line should consist of the keyword `USERNAME` followed by your Banner ID. The second line should consist of the keyword `PASSWORD` followed by a password that is to be used *only for this class*. Don't use a password that you have used for any other purpose. You will communicate your Banner ID and password to us using a Google Docs form.

Corresponding to each chapter of the textbook and to each lab is a template file, which you will download from <http://grading.codingthematrix.com> into your `matrix` directory. There are also template files for specific problems, such as your vector implementation and your matrix implementation. Also, for some assignments we will provide template files. Your solutions will go in the template file. You will use a script, `cs053_submit`, to submit your solutions to the grading server. The argument to the script is the name of the template file, e.g.

```
~/course/matrix $ cs053_submit python_lab.py
```

The script will allow you to submit the answers to whichever problems you specify. Your performance on these problems will be recorded and you will be told which problems you got right.

However, you must *not* use the grading server as a substitute for testing your code. For many problems, we provide test examples for you to use in testing and debugging. However, you will not be able to rely wholly on our test examples; you will also need to come up with your own.

Though you must provide your solutions via a file, you are strongly encouraged to use Python interactively to test and debug your solutions. You will be taught how to import definitions from your file into a Python workspace.

Lectures and quizzes

“Lectures” are an important part of the course. You will be doing work during lecture, including work with other students. On most class days, there will be a **quiz**. Some quizzes will be more serious than others; some will involve simple application of methods recently taught, some will require you to write down definitions you have been taught. Some quizzes will be more like **mini-midterms**.

We welcome class participation and questions.

Most of the mathematical content (concepts, definitions, theorems) in lecture will be in the textbook. In addition, the pdfs of the slides will be provided on the course website. This means you will not have to take notes in lecture, though you are encouraged to do so if it helps you stay focused in class.

Labs

The labs are a central part of the course. Almost every week, you will attend a two-hour lab, in which you will carry out a computation, usually requiring you to write some code and sometimes do some problem-solving on paper. The lab assignments can be found in the course textbook. The labs are intended to give you a chance to demonstrate your understanding of the course material and your ability to apply it. You are expected to show up for lab

1. with a good understanding of the lecture material,
2. with paper and pencil/pen to work out some math,
3. having read through and thought about the lab assignment.

Students who fail to meet these expectations are in danger of receiving a low lab grade. Lab is not the ideal time to ask all your general questions about the course. However, you can ask TAs questions when the TAs are not needed for helping others with lab assignments.

If you do meet the above expectations, you should be capable of successfully completing the lab. During lab, you are encouraged to collaborate with other students. (In fact, for some labs we might require you to work in pairs.) You are also encouraged to seek as much help as you need from the TAs, who will be hovering around you for the duration of the lab. The TAs are supposed to do what they can to bring about the lab success of every well-prepared student.

Each lab section will have two TAs leading the lab. You will give us your lab time preferences during the first lecture, and we will email you with your assigned lab time soon after that. If you miss the first lecture or cannot make your assigned lab time, email the staff. You will be expected to come to the same lab time every week. If there is a week when you need to attend another session, email the staff with your request **at least two days beforehand** so that we can verify that there is room in the other session and so that both sets of lab TAs know. We will write back to let you know if it is okay.

Homework

The purpose of homework assignments is to reinforce the material, sometimes teach you more material, and test your understanding of the material. The problems may include computations, proofs, and programming problems. Some collaboration is allowed on these assignments, but see the collaboration policy for more information on this.

Homework will be assigned for each lecture and due immediately before the start of the following lecture. Homework will consist of two kinds of problems, auto-graded and human-graded. The auto-graded problems are to be submitted via the computer, and the human-graded problems are to be submitted on paper and dropped in the CS053 hand-in bin, located on the second floor of the CIT. For proofs and other problems involving mathematical notation, please either write clearly by hand or use a math typesetting tool such as L^AT_EX. *If your solution consists of several sheets of paper, you must staple your pages together.* Put your Banner ID (not your name) at the top of the first page.

All homework due on a day must be turned in by 2:59 pm on that day.

For auto-graded problems, you will of course get immediate feedback. For human-graded problems, we will return your graded homework by the time of the next lecture. You are responsible for picking up your graded homework from the hand-back cabinet on the second floor of the CIT.

After that lecture, you can submit solutions to additional problems to get partial credit for late work. Additional points earned for late work are discounted by a factor of .75 in determining your grade. In order to earn credit for late human-graded problems, *you must include your originally submitted graded homework* if any. Please write RESUBMIT at the top of your new solution sheets, and **staple** them to the originally graded homework, .

Each assignment may also be resubmitted by the beginning of the two lectures later for partial credit. (On each problem you turn in late, your score on that problem is multiplied by .75 in determining your grade.)

Doing homework on material very soon after the material is presented in lecture is a way of reinforcing your understanding of the material, exposing any gaps or misconceptions you might have, and making sure that

everybody is up-to-date. This course moves quite quickly and the material is cumulative, so getting behind can be disastrous.

We will assign problems via email and via the course web site. To receive email, you must be registered for the class or at least have the class in your shopping cart.

Final Exam

The final exam is scheduled for December 16, 9:00-12:00.

Collaboration Policy

The CS department has rules about collaboration, and there are also some that are specific to this course. These policies are designed to make sure that every student is graded individually and fairly; according to the amount that s/he has learned. Please be aware that it is not hard for us to tell if you break any of these rules! If you have any questions about the following policies, make sure you ask us so that you do not inadvertently break any rules.

Labs

Collaboration is encouraged in labs—both with your fellow students and with the lab TAs.

Homework

You are allowed to talk as much as you want with any course TA and with the professor about any homework assignment. A TA is not responsible, however, for writing your code for you or giving you a solution. You are also allowed to talk to other students about the problems and come up with solutions together. However, we want to make sure that you actually understand these solutions. Therefore, any written record from a collaborative session must be discarded at the end, and you are required to write up your solutions on your own, without any notes and without any coaching. In other words, you need to be able to reconstruct *on your own* any work that you do with a classmate.

You are allowed to use online resources or alternative textbooks, but if you happen to find solutions or partial solutions to the specific problems we have assigned, you must not use information from those solutions; if you do find such solutions, please report it to the staff.

Quizzes and exams

No collaboration is allowed during a quiz or exam. Even if a quiz involves using a computer, you are not allowed to consult any resources other than the programs and data provided to you through the course.

Other matters

Schedule

The schedule of topics will be available on the course calendar, visible on the course web page. However, be aware that the schedule of topics is subject to change (and is likely to change). Note also that lectures, labs, and problem sets will continue during Reading Period.

Inclusion

Our intent is that this course provide a welcoming environment for all students. All members of the CS community, including students, faculty and staff, are expected to treat one another with kindness and respect. If we in the course staff slip up in this regard, feel free to contact Philip Klein (professor) or, if that does not feel comfortable, Ugur Cetintemel (Department Chair), Tom Doepfner (Vice Chair) or Laura Dobler (diversity and

inclusion staff member). You can also speak confidentially to *student advocates for diversity and inclusion*, who hold regular office hours.

To access student support services and resources, and to learn more about diversity and inclusion in CS, including information about office hours for student advocates, please visit <http://cs.brown.edu/about/diversity/resources>

Accessibility and accommodations

Brown University is committed to full inclusion of all students. Please inform the professor early in the term if you have a disability or other conditions that might require accommodations or modification of any of these course procedures. You may speak with the professor after class or during office hours. For more information, please contact *Student and Employee Accessibility Services* at 401-863-9588 or SEAS@brown.edu. Students in need of short-term academic advice or support can contact one of the deans in the Dean of the College office.

In case of sickness, etc.

If you are sick, please email the professor when you are able. Don't endanger your health by working through your sickness. We will provide extensions if needed. If your sickness is contagious, please make an effort not to spread it. Don't come to class or to hours or to the computer labs. We will give you a chance to make up the work.

If you need to miss class due to illness or family emergency or religious holiday, contact the professor and we will arrange something.

Keeping up

This class moves quickly and relentlessly. The workload is not large, but it is consistent. You need to commit to spending an hour or two after each lecture to do the homework, review the material, and prepare for the next lecture's quiz. If you cannot make that commitment, this might not be the class for you.

The course material is cumulative, by which we mean that you need to understand earlier material in order to understand later material. If you find yourself getting behind in terms of your understanding and you are willing to do the work to catch up, you are encouraged to contact course staff right away. We want you to succeed in this course. Catching problems early can help.