Reflections

Here, as the course unfolds, you will find review questions and comments on the material covered.

Review questions for *The Basis*

What is coordinate representation?

How can you express conversion between a vector and its coordinate representation using matrices?

What is linear dependence?

How would you prove a set of vectors are linearly independent?

What is the Grow algorithm?

What is the Shrink algorithm?

How do the concepts of linear dependence and spanning apply to subsets of edges of graphs?

Why is the output of the growing algorithm a set of linearly independent vectors?

Why is the output of the shrinking algorithm a set of linearly independent vectors?

What is a basis?

What is unique representation?

What is change of basis?

What is the Exchange Lemma?

Review questions for *The Matrix*

What is a linear combination?

What is a linear function?

What is the transpose of a matrix?

What is the sparsity of a matrix and why is it important in computation?

What is the linear-combination definition of matrix-vector multiplication?

What is the linear-combinations definition of vector-matrix multiplication?

What is the dot-product definition of matrix-vector multiplication?

What is the dot-product definition of vector-matrix multiplication?

What is an identity matrix?

What is an upper-triangular matrix?

What is a diagonal matrix?

What is a linear function?

What are two ways that a linear function $f: F^n \longrightarrow F^m$ can be represented by a matrix?

What are the kernel and image of a linear function?

What are the null space, column space, and row space of a matrix?

What is the matrix-vector definition of matrix-matrix multiplication?

What is the vector-matrix definition of matrix-matrix multiplication?

What is the dot-product definition of matrix-matrix multiplication?

What is associativity of matrix-matrix multiplication?

How can matrix-vector and vector-matrix multiplication be represented using matrix-matrix multiplication?

What is an outer product?

How can dot-product be represented using matrix-matrix multiplication?

What is the inverse of a matrix?

What is one criterion for whether two matrices are inverses of each other?

Review questions for *The Vector Space*

What is a linear combination?

What are coefficients?

What is the span of vectors?

What are standard generators?

What are examples of flats?

What is a homogeneous linear system?

What are the two kinds of representations of flats containing the origin?

What is a vector space?

What is a subspace?

What is an affine combination?

What is the affine hull of vectors?

What is an affine space?

What are the two kinds of representations of flats not containing the origin?

Is the solution set of a linear system always an affine space?

Review questions for *The Vector*

What is vector addition?

What is the geometric interpretation of vector addition?

What is scalar-vector multiplication?

What is the distributive property that involves scalar-vector multiplication but not vector addition?

What is the distributive property that involves both scalar-vector multiplication and vector addition?

How is scalar-vector multiplication used to represent the line through the origin and a given point?

How are scalar-vector multiplication and vector addition used to represent the line through a pair of given points?

What is dot-product?

What is the *homogeneity* property that relates dot-product to scalar-vector multiplication?

What is the distributive property property that relates dot-product to vector addition?

What is a linear equation (expressed using dot-product)?

What is a linear system?

What is an upper-triangular linear system?

How can one solve an upper-triangular linear system?

Argh! It's an imaginary number!

I see some people panicking about complex numbers and imaginary numbers. Please don't panic! There are three reasons I discuss complex numbers at this point:

1. as a third example of a field
2. because operations such as scaling and rotation that are "easy" with complex numbers come up later when we do vectors.
3. because complex numbers are needed when doing more advanced material such as Fourier transforms and eigenvectors (which we will not get to in this course but which I plan to cover in a follow-on course).

If complex numbers make sense to you, great---the ideas will lead into vectors.

If complex numbers don't make sense to you or even if you have to struggle to understand them, don't worry about it. We won't work with them later in this course.

Argh! This Python task is too hard to understand!

Some people struggled a lot with some of the tasks in the Python Lab, especially the one that involves base and digits. The Python lab is there to help you learn aspects of Python that might be unfamiliar to coders, especially comprehensions. It will be helpful to you in this course if you understand comprehensions and the rest. But no particular task is crucial. If you are spending too much time on a task, just skip it! This class is for you to learn. There's no need to make it into a test of character! Don't suffer.

I also want to mention that the Python Lab is unusual; each of the other labs has only a few tasks (although the tasks tend to be more involved).

Review questions for *The Field*

How does complex-number addition work?

How does complex-number multiplication work?

How can translation be defined in terms of complex numbers?

How can scaling be defined in terms of complex numbers?

How can rotation by 180 degrees be defined in terms of complex numbers?

How can rotation by 90 degrees be defined in terms of complex numbers?

How does addition of $GF(2)$ values work?

How does multiplication of $GF(2)$ values work?

Review questions for *The Function*

What does the notation $f : A \longrightarrow B$ mean?

What are the criteria for f to be an invertible function?

What is associativity of functional composition?

What are the criteria for a function to be a probability function?

Created Wed 26 Jun 2013 9:30 AM PDT (UTC -0700)

Last Modified Sun 4 Aug 2013 11:36 PM PDT (UTC -0700)