Newberger Math 247 Spring 03

Review sheet for Exam 1

This exam will cover Sections 1.1 through 1.6 in Chapter 1. Use this list of questions to guide your studies. Look in the problems at the end of each sections for these questions and make sure you know what they are ansking and how to find the answers.

Vocabulary (Look up the definitions in the book to get them right!):

1. What is a linear combination of vectors?
2. What is the span of vectors $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$?
3. What does it mean for a system to be inconsistent? consistent?
4. What is a homogeneous equation?
5. What is the trivial solution to a homogeneous equation?
6. What does it mean for a set of vectors $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$ to be linearly independent?
7. What does it mean for a set of vectors $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$ to span $\mathbb{R}^m$?
8. What are free variables? What are basic variables?

About a system of equations:

1. What is the solution set? Write the solution set in parametric vector form.
2. Is the system consistent or inconsistent?
3. Does the system have a unique solution? an infinite number of solutions? Be prepared to solve h and k type problems.
4. What are the basic variables? What are the free variables?
5. Does the homogeneous equation have a nontrivial solution? What is the relationship between the solutions of the homogeneous equation $A\mathbf{x} = \mathbf{0}$ and the equation $A\mathbf{x} = \mathbf{b}$? See Theorem 6.

About vectors:

1. Is $\mathbf{b}$ a linear combination of vectors $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$? If so, find the weights.
2. Is $\mathbf{b}$ in the subset of $\mathbb{R}^m$ spanned by the vectors $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$? Or simply is $\mathbf{b}$ in Span$\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$?
3. Does $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$ span $\mathbb{R}^m$? See Theorem 4.
4. Is the set of vectors $\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$ linearly independent?
5. Describe Span$\{\mathbf{v_1}, \mathbf{v_2}, \ldots, \mathbf{v_n}\}$ geometrically.
6. What can you say about a linearly dependent set of vectors and linear combinations of those vectors?

About matrices:

1. Be able to reduce a matrix to reduced echelon form.

2. Be able to answer questions about pivot positions, for example Sections 1.2 #23-31, Section 1.4 #29-34, Section 1.5 #26-32 and Section 1.7 #23-29.
3. What is $A\mathbf{x}$?
4. Keep in mind that we can ask any of the questions that we can ask about vectors about the columns of a matrix.

Guarantees. There is a sample exam on the class web site. The questions on your exam will be neither harder nor easier than the problems on the sample exam, but the will not be identical. In particular, this exam does not have many "Explain Why" questions; your exam is likely to have several.

Here are some guarantees:

1. There will not be any true-false problems on the exam.
2. You will have to row reduce at least one matrix into reduced row echelon form.
3. You will be asked to determine the solution to a system of equations, express it perimetrically and describe it geometrically.
4. You may be asked to give examples of systems or vectors with certain properties.
5. You will be given particular systems, vectors and matrices and asked questions like those on this sheet.
6. You will be asked short answer "Explain Why" questions. To answer these correctly, many times the easiest approach is to answer in term of the pivots.

Use the resources on the class web site to help you prepare for the exam!

- Quiz Solutions.
- Homework solutions for the short answer problems in Section 1.2 and 1.4.
- Sample Exam (with solutions).

Come ask me questions if you need help. Study over the weekend and come to class Monday with questions.