

21-241 Exam 1 Study Guide

If you understand and can do the following things, you should do well on the first exam. Remember, it is closed book, closed notes, no calculator, no electronic devices, etc.

1 Vectors

You should know/be able to do

- vectors in \mathbb{R}^n (vectors),
- addition and scalar multiplication of vectors,
- properties of addition and scalar multiplication of vectors,
- dot product of vectors,
- norm of vectors,
- properties of the norms of vectors,
- unit vectors,
- Cauchy-Schwarz inequality (be able to use it, you don't need to prove it),
- projection of vectors,
- equations of lines in \mathbb{R}^2 and \mathbb{R}^3 , and planes in \mathbb{R}^3 ,
- find the distance between a point and a line and a point and a plane,
- find the intersection of two lines or a line and a plane.

2 Systems of Linear Equations

You should be able to handle the following topics

- recognize if a system of equations is linear,
- what it means to be a solution to a system of linear equations,
- what it means for two systems to be equivalent,

- how to form the augmented matrix of a linear system,
- how to reduce a matrix into row echelon form and reduced row echelon form, and how to use this to solve a system of linear equations,
- what a homogeneous system is,
- the rank of a coefficient matrix,
- how to quickly determine if a homogeneous system has infinitely many solutions,
- the span of a set of vectors,
- linear independence and linear dependence,
- how to determine if a vector is in the span of a set of vectors,
- how to determine if a set of vectors is linearly independent/dependent,
- the applications from section 2.4: resource allocation, balancing a chemical equation, network analysis, electric circuit analysis,
- Jacobi and Gauss-Seidel iterative methods.

3 Matrices

We will not get to these topics until the week of the exam, but you will still need to know the following for the exam:

- addition and scalar multiplication of matrices,
- properties of addition and scalar multiplication of matrices,
- transpose of a square matrix,
- symmetric matrices,
- multiplication of matrices and when it is defined.