

This would normally be due on Wednesday, 11/15, but we have our second midterm on that day. I'll push the due date back to **Monday, November 20**, but realize that this material will be covered on the exam. Doing this assignment early would be a good way to study! I'll post answers to some similar problems before the exam.

Answers to homework problems should include any computations necessary to get the final answer. To receive full credit, you must also explain what you've done and why you did it. You should write in complete sentences with (reasonably) correct grammar. Granted, this is not a writing intensive course, but it *is* a 5000-level mathematics course, and at this level you're expected to be able to explain your work in a coherent, organized and logical manner.

Note that many of the problems in the textbook have answers in the back. If I assign any of those, explaining your reasoning becomes even more important, because it's assumed you have the right answer. Even if I don't assign them, it might be a good idea to do those problems and check your answers before working on the assigned problems.

Chapter 8: 8.18 (Read 8.17 and use the result there)

Chapter 9: 9.11, 9.12, 9.17, 9.19

Chapter 10: 10.04, 10.08, 10.09

Chapter 11: 11.10, 11.11

Chapter 13: 13.02, 13.05, 13.10

Also: in class we drew pictures of binary codes by interpreting codeword digits as coordinates of points on the unit cube in Euclidean Space, e.g. $01 = (0, 1)$. Now consider *ternary* codes of length 3 drawn as points (x, y, z) in Euclidean space, where $x, y, z \in \{0, 1, 2\} = \mathbb{F}_3$.

13.A: What is the volume of a Hamming 1-sphere surrounding a codeword? (We computed this formula in class, and it appears as a term in the Hamming Bound.) Draw the 1-spheres surrounding 000, 111, and 222. Is this code perfect? Why or why not?

13.B: Use Hamming's Bound to determine if it is even possible to have a perfect ternary code of length 3 which corrects *two* errors. Draw a picture of the Hamming 2-sphere centered at 111.

Note: You can download pictures to use with 13.A and 13.B on the website. When drawing pictures of spheres, it might be easier to start with the empty grid and draw the points which are included, rather than trying to draw lines around those points in the sphere like we did in class. (The in-class method works with binary codes, but it's messy in this case.)