

18.06 Spring 2012 – Problem Set 5

This problem set is due Thursday, March 22nd, 2012 at 4pm (hand in to Room 2-106). The textbook problems are out of the 4th edition. For computational problems, please include a printout of the code with the problem set (for MATLAB in particular, `diary('filename')` will start a transcript session, `diary off` will end one.)

Every problem is worth 10 points.

1. Do Problems 11 & 16 from Section 4.2.
2. Do Problem 27 from Section 4.2.
3. Do Problem 30 from Section 4.2.
4. Do Problem 31 from Section 4.2.
5. Do Problems 1 & 3 from Section 4.3.
6. Do Problem 26 from Section 4.3.
7. Do Problems 4 & 14 from Section 4.4.
8. Do Problem 7 from Section 4.4.
9. Do Problems 18 & 24 from Section 4.4.
10. In this exercise, we use MATLAB for learning about Gram-Schmidt.

Suppose the 4×3 matrix A has 1's when $i = j$ and -1 's when $i = j + 1$ and otherwise $A_{ij} = 0$. From the MATLAB command

$$[Q, R] = \text{qr}(A),$$

find the Gram-Schmidt orthonormal basis for the column space $C(A)$. Renormalize those basis vectors to contain nice fractions by dividing by the diagonal entries of R . Now the vectors are orthogonal, not orthonormal.

Guess what the pattern you see here is, and use this to find a 4th vector in \mathbb{R}^4 orthogonal to these three columns of Q (and of A).

18.06 Wisdom. On problem sets and exams, always try to think of ways to check your results. It both assists your own learning, when you reflect on and relate to what you've worked through, plus you avoid losing points!