APM462H1S, Winter 2014 , Assignment 3,

due: Monday March 17, at the beginning of the lecture.

Exercise 1. Solve problem 4 on page 282 of the textbook by following these steps. (For the notation, consult the book).

a. Show that there exists a vector d_1 which is Q-conjugate to d, and such that x_1 belongs to the plane spanned by d and d_1.

hints: So, your goal is to show that you can find a vector d and numbers a and b such that

$$x_1 = ad + bd_1 \qquad \text{and} \qquad d^T Q d_1 = 0.$$

The problem is underdetermined, since you can always multiply b by a (nonzero) constant and divide d_1 by the same constant without changing the right-hand side.

Note also ,if $x = cd$ for some c, then you can choose d_1 to be any vector that is Q-conjugate to d. (Except that $d_1 = 0$ is not a good choice, since the problem talks about "the plane spanned by d and d_1," and hence implicitly assumes that $d_1 \neq 0$.)

(Without writing it down, note that the same argument shows that there exists a vector d_2 which is Q-conjugate to d, and such that x_2 belongs to the plane spanned by d and d_2.)

b. Explain why x_1 can be found by starting at the origin, and taking two steps of the conjugate directions method, using directions d and d_1.

(Without writing it down, note that the same argument shows that x_2 can be found by starting at the origin, and taking two steps of the conjugate directions method, using the directions d and d_2.)

c. Prove that $x_1 - x_2$ is Q-orthogonal to d

Exercise 2.
Minimize

$$f(x, y) = xy$$

subject to the constraints

$$x^2 + y^2 \leq 25, \qquad x + y \geq 1.$$

Exercise 3. Problem 10 on page 356 of the textbook.

Exercise 3. Problem 12 on page 356 of the textbook.