Homework 5

MA430

As always, give full justification for your answers!

1. Read as much of Chapter 4 as I've given you!

2. Sketch (by hand) what Figure 4.1 in the text would look like if $p = 0$.

3. Solve the problem of minimizing

$$\phi(x_1, x_2) = |x_1|^p + |x_2|^p$$

   subject to the constraint $x_1 - 3x_2 = 3$, for the cases $p = 0, 1/2, 1, 2$, and ∞. Interpret the case $p = 0$ as the sparsity of (x_1, x_2) and the case $p = \infty$ as the usual infinity norm. Use Maple or Matlab and plots all you want—a visual minimizer is fine. It's probably easiest to use the constraint to eliminate one variable, minimize in the other.

4. Repeat the last problem but for

$$\phi(x_1, x_2, x_3) = |x_1|^p + |x_2|^p + |x_3|^p$$

   with the constraint $x_1 - x_2 + x_3 = 4$.

5. Repeat the last problem but add a second constraint $x_1 + x_2 + 2x_3 = 4$.

6. Convert the problem of minimizing $\|\mathbf{x}\|_1$ (assume $\mathbf{x} \in \mathbb{R}^3$) with constraints $x_1 - x_2 - x_3 = -2$ and $x_1 + x_2 + 3x_3 = 2$ into a linear program using BOTH methods in the notes.

7. Solve the last problem by using the `l1eq_pd.m` routine.

8. Use the `l1eq_pd.m` routine to solve problems 1 and 2 on Homework 4 (everywhere MP or OMP is used, just do BP).