MATH 401, HW 9 and 10, FALL 2015

1. (10 points) Select 300 vectors from the handwritten digits database as follows: pick 30 examples of each of the digits $0, 1, 2, \ldots, 9$. Order them in two different ways:

- Group all like digits together, starting with zeros, followed then by ones, twos, etc,

- Start with a "zero", followed by a "one", a "two", etc, until a "nine", then repeat (30 times altogether).

2. (15 points) Implement Gram-Schmidt orthogonalization process for 300 vectors in $\mathbb{R}^{256}$ (you have learned G-S in MATH 240) in Matlab. You can use any existing and publicly available algorithm or code for this purpose, but if someone else wrote the code, it is your responsibility to make sure that you are allowed to use it.

3. (20 points) Apply Gram-Schmidt orthogonalization to your two collections of 300 vectors in $\mathbb{R}^{256}$, separately. Visualize the first 20 resulting vectors from each of the 2 datasets, as 16×16 images.

4. (5 points) Are there any differences you can see in the resulting collections? If so what might have caused these differences? How do the resulting orthonormal vectors look like as images? Do they resemble any handwritten digits? Compare and analyze the results you see.

For problems 1 and 2 return printouts of the codes. For problem 3 return 2 sets of 20 images. (Make sure each set fits on a single page and is visible.) Problem 4 is descriptive.

For administrative purposes problems 1 and 2 will count as HW 9, and problems 3 and 4 as HW 10. The whole assignment is due on December 9th.