HW for 2019-08-30

(due: 2019-09-09)

You may (and should) talk about problems with each other and with me, providing attribution for any good ideas you might get. Your final write-up should be your own.

1: About you Tell me a few things about yourself:

- How do you prefer to be called?
- Why are you taking the class?
- Are there things you particularly hope to see?
- Do you have any concerns (about background, schedule, etc)?

2: A problem of performance Julia and MATLAB support both sparse and dense matrix data structures, and they have different performance characteristics. For a variety of square matrices of size n and sparsity level s (where s is the fraction of entries that are nonzero), compare the speed of dense and sparse matrix-vector multiply. You may use As = sparse(A) to make a sparse version of a dense matrix A. What do you observe about the relative performance of these options?

Note: If you want examples of how to write timing tests, Julia scripts will be added to the MATLAB scripts already in the class repository.

3: Seeking structure Rewrite the following code fragment to run in $O(n)$ time (in MATLAB; Julia code and tests at https://github.com/dbindel/cs6210-f19/tree/master/hw/code).

```
% u, v, and x are length n
A = eye(n) + u*v';

y  = A*x;
z  = A'*x;
d  = diag(A);
df = diag(flipud(A));
t  = trace(A);
c  = det(A);
```

Hint (last line): For any $X, Y \in \mathbb{R}^{n \times k}$: $\det(I + XY^T) = \det(I + Y^T X)$.