

## Comp 206

### Question 1

Generate 100 random in [0,100] and plot following function in matlab

- exp
- log
- sine
- cosine

save the resulting figures in eps format and import them in LaTeX and compile.

### Question 2

Load input.txt file from Canvas and create following matrix:

$$\mathbf{P} = \mathbf{I} - \mathbf{D}^{-1/2} \mathbf{A} \mathbf{D}^{-1/2}$$

- Compute first two eigenvalues and eigenvectors of this matrix and report running time of this computation, where  $\mathbf{D}$  is degree matrix,  $\mathbf{I}$  denotes identity matrix and  $\mathbf{A}$  is adjacency matrix.
- Scatter plot the first two eigenvectors and save it as eps file.
- For  $\sigma = 0.6$  compute the eigenvalues of  $\mathbf{P} + \sigma \mathbf{I}$
- compute eigenvectors of  $\mathbf{P}^{20}$  and report time by using tic; toc in matlab

### Question 3

Create a new matrix as:

$$\hat{\mathbf{P}} = \mathbf{I} - 0.85 * \mathbf{D}^{-1/2} \mathbf{A} \mathbf{D}^{-1/2}$$

- Solve  $\hat{\mathbf{P}} \mathbf{x} = \mathbf{b}$ , where vector  $\mathbf{b}$  contains 1/10 in the first 10 entries and 0 otherwise. and report time
- Can you solve this problem writing more efficient algorithm, argue it and if you can show time of the algorithm you propose here.

### Question 4

Compare the run time of three solutions:

- Write a recursive function for computing Fibonacci series for  $n = 1000$ .
- Write another algorithm solve this problem as matrix vector product.
- Solve the same problem as an eigenvalue problem.