Homework II

Deadline: 2019-6-1

Reminder. Homework must be done using MATLAB publish for coding problems and using MATLAB Publish/LATEX for calculation and analysis problems.

1. Consider using Algorithm 1 in "11RNL(Matrix Product).pdf" to approximate the product of two 2×2 matrices A and B by picking only $k = 1$ column of A and the corresponding row of B.

   - (10 pts) Give an example where uniform sampling (i.e., sampling each column of A and the corresponding row of B with equal probability) gives the exact solution to AB.

   - (10 pts) Give an example where uniform sampling does not return an exact solution but length-squared sampling (see lecture notes for definition) returns an exact solution.

   - (10 pts) Give an example where neither uniform sampling norm length-squared sampling returns an exact solution.

   - (10 pts) For the last problem, compare the variance for the two different sampling schemes. What is your observation?

   Note. You should justify your examples rigorously rather than just giving two matrices.

2. (10 pts) Try to prove the theorem in the "Error Bound in Spectral Norm" slide of "11RNL(Matrix Product).pdf". Even the outline of the proof can be found in the supplement, you should fill in as many details as possible. Copy&Paste proof will not be accepted.