

Math 5327 Assignment 10, due Friday, April 11th.

- (1) Read sections 5.15, 7.2, 7.3, and 7.5 from the text.
- (2) Ungraded problems: 5.8.13, 5.15.1, 7.3.1, 7.3.6, 7.3.13, 7.3.17.
- (3) Let $\text{sinc}_k(t) = \frac{\sin(kt)}{kt}$ for $t \neq 0$, and $\text{sinc}_k(0) = 1$. Compute the discrete Fourier transform of $n = 512$ values of $\text{sinc}_k(t)$ for $t \in (-\pi, \pi)$ and $k = 1, 5, 31, 255$ and plot the data and the absolute value of their transforms. How large can you make n before the computation takes several minutes?
- (4) Investigate the eigenvalues of $n \times n$ matrices with random entries. Use entries from a normal distribution with mean = 0 and standard deviation $n^{-1/2}$ for $n = 8, 32, 128$ (at least; you are encouraged to experiment). Use at least 100 matrices of each type before trying to draw any conclusions. You do not have to prove anything, but you should formulate some hypotheses as clearly as you can.
- (5) Suppose T is a Hermitian linear operator ($\langle Tv|v \rangle = \langle v|Tv \rangle$ for all v) with non-negative eigenvalues. Show that T has a 'square root' S such that $S^2 = T$.