ECS130 Midterm I Review Checklist

1. Tools of the trade:
   - matrix-matrix multiplication in different ways
   - BLAS
   - vector and matrix norms, $\|\cdot\|_1, \|\cdot\|_2, \|\cdot\|_F, \|\cdot\|_\infty$.
2. Floating-point arithmetic
   - Floating point representation of numbers
   - IEEE floating-point numbers, single and double precision
   - Rounding modes and errors
   - Floating-point arithmetic
   - Catastrophic cancellation
3. Lower and upper triangular linear systems
   row-majored or column-majored
   componentwise or vecctorized
4. Gaussian Elimination = LU factorization with pivoting

   $$PA = LU$$

   The need of pivoting, *mathematically and numerically*
   Cholesky decomposition of a symmetric positive definite matrix
   Applications:
   - solve $Ax = b$
   - solve $AX = B$, where B is a $n \times p$ matrix
   - compute A^{-1}
5. Error analysis for a computed solution of $Ax = b$.
   Rule of thumb:

   $$\text{relative forward error} \leq \text{condition number} \times \text{relative error in } b$$