ECS130 Midterm II Review Checklist

1. Polynomial interpolation

   - Polynomial interpolation in power form
   - Polynomial interpolation in Lagrange form
   - Piecewise linear interpolation (= linear spline)

2. Least squares and curve fitting

   Least-squares problem: $\min_\beta \|X\beta - y\|_2$

   - Normal equation $(X^T X)\beta = X^T y$
   - QR method

   Tools of trade:

   - Householder reflection $H = I - \rho u u^T$
   - The QR factorization: A = QR
   - Pseudoinverse

   Curve fitting:

   - model
   - design matrix and parameters β

3. Eigenvalues and singular values

   - Eigenvalue and eigenvector definition
   - Eigenvalue decomposition: $A = XDX^{-1}$
   - Singular value and singular vector definition
   - Singular value decomposition (SVD): $A = U\Sigma V^T$
   - Relationship between eigenvalues/vectors and singular values/vectors
   - The power method and inverse iteration
   - Applications of SVD