Homework Assignment for Week 14

1. Section 6.6: Problems 3(a,c), 7(a,c), 14(a,b).

   Remark: These are paper and pencil assignments. You are asked to construct the matrices L and D. Do so by performing Gauss elimination with paper and pencil and collect l_{ij} and d_i in the process. Then in problem 7, you can either use matlab backslash or a few loops to solve for the corresponding linear systems.

2. Section 6.6: Problems 17, 20, 21, 25, 32.

3. Prove Corollary 6.29.

4. Construct the matrix for 2D and 3D Laplace equation $\Delta u = f$ on $[0,1]^2$ and $[0,1]^3$ with Dirichlet boundary condition (u prescribed on the boundary) using the partition $0 = x_0 < x_1 < \cdots < x_N = 1$, $0 = y_0 < y_1 < \cdots < y_N = 1$, $0 = z_0 < z_1 < \cdots < z_N = 1$ with uniform mesh size $x_i - x_{i-1} = y_j - y_{j-1} = z_k - z_{k-1} = h = \frac{1}{N}$. The unknowns are u_{ij} or u_{ijk} with $1 \le i, j, k \le N-1$, respectively. Give the leading order operation KN^p for for LU decomposition and forward, backward substitution in 2D and 3D, respectively.

5. Implement your own tridiagonal solver using indexing of the entries as in problem 27.