You may (and should) talk about problems with each other and with me, providing attribution for any good ideas you might get. Your final write-up should be your own.

1: **Tree falling** The code tree_solve in the repository computes the solution to $Ax = b$ where $A$ is a tree-structured symmetric positive definite matrix. Rewrite the reference code to run in $O(n)$ time.

2: **Remove a row** Suppose $A \in \mathbb{R}^{m \times n}$ is decomposed as

$$A = \begin{bmatrix} A_1 \\ a_2 \end{bmatrix}, \quad A_1 \in \mathbb{R}^{(m-1) \times n}, a_2 \in \mathbb{R}^{1 \times n}$$

and both $A$ and $A_1$ are rank $n$. Suppose we have an economy QR of $A$, show how to compute $\hat{x} = A_1^T b_1$ in $O(n^2)$ time (no code is needed for this problem, just give the idea).

3: **Pesky probability** Supposing $Z$ is a standard normal random variable, find the degree 8 polynomial $p(z)$ that minimizes

$$\phi(p) = E_Z[(p(Z) - \cos(Z))^2].$$

What is the optimal value of $\phi$? Please use the Gauss-Hermite quadrature code included in the repository (gausshq.m and gausshq.jl) to compute $E_Z[f(Z)]$ for any $f$ appearing in your computations.