

Numerical Computing

Midterm Examination

February 27, 2026

Instructions: All questions carry ten marks. Marks will be allotted based on the logic of the answers and how well the answers actually work on Octave. Explain your thinking behind the code with plenty of remarks.

1. Define LU decomposition of a square matrix. Prove that for any square matrix A such a decomposition exists upto a permutation matrix. Give an example of a square matrix to prove that the permutation matrix is necessary for its LU decomposition.
2. Write a script which asks for an integer, checks if it is so, and if an integer is given it tells the highest power of 2 and the highest power of 3 dividing the given integer.
3. Write a script to compute the product of all 2×2 minors of a given matrix (not necessarily a square matrix). The answer should display 'the product of all 2×2 minors is ' followed by the value of the product, all in the same line.
4. A Toeplitz matrix is one whose diagonals have constant values. Here is an example of a Toeplitz matrix of order 3:

$$\begin{matrix} 1 & 2 & 3 \\ 4 & 1 & 2 \\ 5 & 4 & 1 \end{matrix}$$

Write a function called `ToepZ` which asks for an vector of length $2n - 1$ and generates the Toeplitz matrix of order n whose diagonals are all the coordinates of the given vector.

5. Write a function called `Palindromesix` that asks for a six digit positive integer, checks if it is so and if it is, then informs the user if the given number was a Palindrome or not.