LAB # 4

(SYMBOLIC ALGORITHMS IN LINEAR ALGEBRA)

1. Given the numbers $a_1, \dots, a_s \in \mathbb{R}$ and $n_1, \dots, n_s \in \mathbb{N}$ create a procedure to generate a non triangular matrix of order $n = n_1 + \cdots + n_s$ with eigenvalues $a_1, \dots, a_s$ whose algebraic multiplicities are $n_1, \dots, n_s$ respectively.

2. Obtain the formula to compute the characteristic polynomial of a 3×3 matrix.

3. Compute the eigenvalues of the matrix $\begin{pmatrix} 0 & a & a & \cdot\cdot\, a \\ a & 0 & a & \cdot\cdot\, a \\ \vdots & \ddots & \ddots & \vdots \\ a & \cdots & a & 0 \end{pmatrix}$.

4. Obtain a numeric approximation of the eigenvalues of the matrix:

$$A = \begin{pmatrix} 4 & 1 & 3 & 2 & 1 \\ 3 & 0 & 1 & 3 & 3 \\ 0 & 4 & 0 & 1 & 0 \\ 4 & 4 & 0 & 2 & 2 \\ 3 & 2 & 4 & 0 & 1 \end{pmatrix}$$

5. Obtain using Bareiss Method the determinant of the matrices:

$$\begin{pmatrix} 1 & 5 & 3 \\ 1 & 2 & 2 \\ 1 & 3 & 4 \end{pmatrix}, \quad \begin{pmatrix} 2 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{pmatrix}, \quad \begin{pmatrix} 2 & 1 & 1 & 1 \\ 3 & 2 & 2 & 0 \\ 2 & 2 & 3 & 2 \\ 3 & 2 & 2 & 2 \end{pmatrix}.$$

6. Solve the following system of linear equations using Bareiss Method:

$$\left\{ \begin{array}{lcl} 3x_1 + 2x_2 + 2x_3 + x_4 & = & 2 \\ x_1 + 4x_2 + x_3 + 3x_4 & = & 1 \\ x_1 + x_2 + x_3 + x_4 & = & 2 \\ x_1 + x_2 + x_3 + 2x_4 & = & 2 \end{array} \right.$$