ME1 Computing- Session 8: Matrices

Learning outcomes:

- Being able to define and generate matrices
- Being able to compute basic matrix operations

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Before you start

In your H drive create a folder *H:\ME1MCP\Session8* and work within it.

Task A: Matrix-vector multiplication

Write a function, *MatVec*, that receives a matrix, of size N x M, and a vector, of size M x 1, and multiplies the two, i.e.

$$C = A \cdot b$$

where

$$c_i = \sum_{j=1}^{M} A_{ij} b_j$$

The function returns the result vector.
The function must check that the dimensions of the matrix and the vector are compatible: if not, it should return the value 0 only.

Answer Question 1

Task B: Write a script to generate a *N x N* matrix, with the following pattern:

$$\begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix}$$

Generate a matrix of size 11 x 11 and save it in the file *ChessBoard.txt*, by writing in lines: 1) the number of rows, 2) the number of columns, 3) every single entry of the matrix, row-by-row, i.e.:

11 (N)
11 (N)
1 (A_{00})
0 (A_{01})
1 (A_{02}), etc.

Task C: Playing chess

A 8x8 integer matrix represents the chess board. In each cell there is either a zero, to represent an empty cell, or an integer number to represent a piece. Black pieces are described by positive numbers, while white pieces by negative numbers. The Black King is represented by the integer 1.

Write a script to search for the Black King. Once found, check if there are enemy pieces surrounding him, in adjacent cells, and alert the player of a potential checkmate.

[Look at the slides on BB for some hints and inspiration].

A few set up games, for testing, are stored in files *Game1.txt*, *Game2.txt* and *Game3.txt*. Data are stored with the same sequence as in file *ChessBoard.txt* that you have generated in Task B, i.e.:

N number of rows
N number of columns
A_{00}
A_{01}
A_{02}, etc.

Answer Question 2

Task D: Transpose of a matrix

Write a function *Transpose* that receives a matrix and returns its transpose, i.e.

$$T_{i,j} = A_{j,i}$$

Answer Question 3