**VECTORS AND MATRICES**

**quicksheets**

**The submatrix function**

\texttt{submatrix}(A, ir, jr, ic, jc): \textit{Returns the matrix consisting of rows ir through jr and columns ic through jc of array A.}

Arguments:
- A, B, C , ... are arrays having the same number of rows for augment, or the same number of columns for stack.
- ir, jr are the integer upper and lower indices of the rows to be extracted.
- ic, jc are the integer upper and lower indices of the columns to be extracted.

**Extracting a Submatrix**

This QuickSheet illustrates the use of the \texttt{submatrix} function.

\begin{equation*}
\text{Input matrix: } M := \begin{pmatrix}
1 & 7 & 1 & 4 & 4 \\
-5 & -8 & -2 & 3 & 3 \\
-6 & -9 & -3 & 2 & 3 \\
1 & 2 & 3 & 4 & 3 \\
4 & 5 & 5 & 6 & 8
\end{pmatrix}
\end{equation*}

Extract all elements common to both rows 1 and 2 and columns 0, 1, and 2:

\begin{equation*}
\text{submatrix}(M, 1, 2, 0, 2) = \begin{pmatrix}
-5 & -8 & -2 \\
-6 & -9 & -3
\end{pmatrix}
\end{equation*}

Swapping the last two arguments reverses the order of the columns:

\begin{equation*}
\text{submatrix}(M, 1, 2, 2, 0) = \begin{pmatrix}
-2 & -8 & -5 \\
-3 & -9 & -6
\end{pmatrix}
\end{equation*}
Swapping the first two scalar arguments reverses the order of the rows:

\[ \text{submatrix}(M, 2, 1, 2, 0) = \begin{pmatrix} -3 & -9 & -6 \\ -2 & -8 & -5 \end{pmatrix} \]

You can also use the picture operator to extract pieces of an array visually.