Introduction to Programming

Matrix Addition

Introduction

A “matrix” is a list of lists. It often referred to as a 2-dimensional array. It’s widely used in the sciences, engineering, finance, and the social sciences.

As we saw in class, the following code:

\[ x = \begin{bmatrix} [1,2,3], [4,5,6], [7,8,9] \end{bmatrix} \]

creates a “2-dimensional” list () where particular elements can be accessed using the syntax \( x[i][j] \) where \( 0 \leq i \leq 2 \) and \( 0 \leq j \leq 2 \) and denotes the jth element of the ith sublist.

For example, \( x[1][2] \) is 6 since it is the third element of the second sublist. Remember that indexing a list starts at index value 0.

We can think of list \( x \) as a table that looks like this (though this is not the way that it’s represented in the computer):

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

The table has three rows and three columns. This particular matrix has the same number of rows as columns, but this needn’t be the case in general. So \( x[i][j] \) denoted the element at row \( i \) and column \( j \).

An operation that is frequently called for is matrix addition. In the following example matrix \( C \) is the sum of matrices \( A \) and \( B \):

\[
\begin{bmatrix} 2 & 5 & 3 \\ 6 & 6 & 8 \\ 10 & 8 & 11 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} + \begin{bmatrix} 1 & 3 & 0 \\ 2 & 1 & 2 \\ 3 & 0 & 2 \end{bmatrix}
\]

\[
C = A + B
\]
Definition: We say that matrix C is the sum of matrices A and B. This means that

\[ C[i][j] = A[i][j] + B[i][j] \] for all i and j where 0 <= i <= 2 and 0 <= j <= 2.

So, for example, \( C[1][2] = 8 = A[1][2] + B[1][2] \) or \( 6 + 2 \).

The problem

Write a program that, using the data above for A and B, creates a matrix C such that C = A + B as defined above.

In your program, initialize A and B by just typing the values into the lists. For matrix C however, you may not fill in the values “by hand.” Your program must do it using for loops.

Note … before you assign a value to C[i][j], that “place” must exist in C.