assignment8

Connor Baker

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1 Summary of Problem Specification

1.1 Abstract

Finding the product of two given matrices, assuming that the order of columns matches the number of rows of a matrix (that is to say that their product is defined).

1.2 Algorithm

Matrix multiplication is most easily done by hand by using the row-column method. It operates as follows:

1. Take the first row of the leading matrix.
2. Multiply each element with its counterpart in the second matrix's first column (first row element multiplied by the first column element, etc).
3. Take the sum of the resultant values.
4. This value is the first entry in the first row of the resultant matrix.

   It follows that had it been the result of the second row and first column that it would be in the second row, first column of the resultant matrix.
5. Repeat this process by distributing the rows onto each column of the second matrix.

2 Attacking the Problem

2.1 Example One

Given the matrices A and B below, find AB.

$$A = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 0 & 1 \\ 4 & 2 & 3 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -3 & 1 \\ -1 & -2 & -3 \end{bmatrix}$$

We begin by distributing the first row of A to the first column of B.

$$AB = \begin{bmatrix} 1*1+3*2+5*(-1) & \\ & \end{bmatrix}$$

$$AB = \begin{bmatrix} 2 & \\ & \end{bmatrix}$$

This gives us the first entry of AB. Next, we distribute the first row of A to the second column of B.

$$AB = \begin{bmatrix} 2 & 1*0+3*(-3)+5*(-2) \\ & \end{bmatrix}$$

$$AB = \begin{bmatrix} 2 & -19 \\ & \end{bmatrix}$$

This gives us the second entry of AB. Next, we distribute the first row of A to the third column of B.

$$AB = \begin{bmatrix} 2 & -19 & 1*2+3*1+5*(-3) \\ & & \end{bmatrix}$$

$$AB = \begin{bmatrix} 2 & -19 & -10 \\ & & \end{bmatrix}$$

Now that we have the first row of the resultant matrix, we repeat the above steps of distribution onto the columns of the second matrix, but this time with the second row of A. This gives us:

$$AB = \begin{bmatrix} 2 & -19 & -10 \\ 1 & -2 & 1 \\ & & \end{bmatrix}$$

Finally, distributing the last row of A onto the columns of B yields:

$$AB = \begin{bmatrix} 2 & -19 & -10 \\ 1 & -2 & 1 \\ 5 & -12 & 1 \end{bmatrix}$$