Problem 2: Matrix Multiplication (matrix)

Given an $R_A \times C_A$ matrix $A$ and an $R_B \times C_B$ matrix $B$, with $1 \leq R_A, R_B, C_A, C_B \leq 300$, write a program that computes the matrix product $C = AB$. All entries in matrices $A$ and $B$ are integers with absolute value less than 1000, so you don’t need to worry about overflow. If matrices $A$ and $B$ do not have the right dimensions to be multiplied, the product matrix $C$ should have its number of rows and columns both set to zero.

Use the code at provided in the file matrix.data.zip as a basis for your program—the input/output needed is already written for you. Matrices will be stored as a structure which we’ll typedef as Matrix. This structure will contain the size of our matrix along with a statically-sized two-dimensional array to store the entries.

```c
#define MAXN 300
typedef struct Matrix_s {
    size_t R, C;
    int index[MAXN][MAXN];
} Matrix;
```

Of course, this is rather inefficient if we need to create a lot of matrices, since every single matrix struct holds $MAXN \times MAXN$ ints! For this problem, we only use three matrices, so it’s fine for this use, but we’ll see how to dynamically allocate a matrix in problem matrix2.

Input Format

Line 1: Two space-separated integers, $R_A$ and $C_A$.
Lines $2 \ldots R_A + 1$: Line $i + 1$ contains $C_A$ space-separated integers: row $i$ of matrix $A$.
Line $R_A + 2$: Two space-separated integers, $R_B$ and $C_B$.
Lines $R_A + 3 \ldots R_A + R_B + 4$: Line $i + R_A + 3$ contains $C_B$ space-separated integers: row $i$ of matrix $A$.

Sample Input (file matrix.in)

```
3 2
1 1
1 2
-4 0
2 3
1 2 1
3 2 1
```

Output Format

Line 1: Two space-separated integers $R_C$ and $C_C$, the dimensions of the product matrix $C$.
Lines $2 \ldots R_C + 1$: Line $i + 1$ contains $C_C$ space-separated integers: row $i$ of matrix $C$.
If $A$ and $B$ do not have the right dimensions to be multiplied, your output should just be one line containing 0 0.

**Sample Output (file matrix.out)**

3 3
4 4 2
7 6 3
-4 -8 -4

**Output Explanation**

We are given

$$A = \begin{pmatrix} 1 & 1 \\ 1 & 2 \\ -4 & 0 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 2 & 1 \end{pmatrix}$$

so the product is the $3 \times 3$ matrix

$$AB = \begin{pmatrix} 1 & 1 \\ 1 & 2 \\ -4 & 0 \end{pmatrix} \begin{pmatrix} 1 & 2 & 1 \\ 3 & 2 & 1 \end{pmatrix} = \begin{pmatrix} 4 & 4 & 2 \\ 7 & 6 & 3 \\ -4 & -8 & -4 \end{pmatrix}.$$