Problem 3: Matrix Multiplication 2 (matrix2)

Given an $R_A \times C_A$ matrix A and an $R_B \times C_B$ matrix B, with $1 \leq R_A, R_B, C_A, C_B \leq 1000$, 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 provided in the file matrix2.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.

```
typedef struct Matrix_s {
  size_t R, C;
  int *index;
} Matrix;
```

In this problem, the memory for each matrix will be dynamically allocated on the heap, and must be freed at the end of the program. You will need to implement a function to allocate a matrix capable of storing $R \times C$ elements, as well as a function that will destroy the memory for such a matrix.

Do not submit your solution to problem 'matrix' for this problem or use statically allocated memory; such solutions will not receive any points for the assignment, even though they would pass the grader's tests.

Resource Limits

For this problem you are allotted 3 seconds of runtime and up to 32 MB of RAM.

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 matrix2.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 matrix2.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 3×3 matrix

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

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