



# Sample Solution to Assignment 1, Problem 3

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```
/*
```

```
PROG: matrix
```

```
LANG: C
```

```
*/
```

```
#include <stdio.h>
```

```
#include <stdlib.h>
```

```
#define MAXN 300
```

```
typedef struct Matrix {  
    size_t R, C;  
    int index[MAXN][MAXN];  
} Matrix;
```

```
void read_matrix( FILE *fin, Matrix *matrix ) {  
    fscanf( fin, "%zu %zu", &matrix->R, &matrix->C );
```

```
    if( matrix->R >= MAXN || matrix->C >= MAXN ) {  
        printf( "Error: tried to read matrix with a dimension larger than %d\n", MAXN );  
        exit( EXIT_FAILURE );  
    }
```

```
    for( size_t r = 0; r < matrix->R; ++r ) {  
        for( size_t c = 0; c < matrix->C; ++c ) {  
            fscanf( fin, "%d", &matrix->index[r][c] );  
        }  
    }  
}
```

```
void print_matrix( FILE *fout, Matrix *matrix ) {  
    fprintf( fout, "%zu %zu\n", matrix->R, matrix->C );  
    for( size_t r = 0; r < matrix->R; ++r ) {
```

```

        for( size_t c = 0; c < matrix->C - 1; ++c ) {
            fprintf( fout, "%d ", matrix->index[r][c] );
        }
        fprintf( fout, "%d\n", matrix->index[r][matrix->C - 1] );
    }
}

void mult_matrix( Matrix *a, Matrix *b, Matrix *prod ) {
    if( a->C != b->R ) {
        printf( "Error: tried to multiply (%zu)x(%zu)\n", a->R, a->C, b->R, b->C );
        exit( EXIT_FAILURE );
    }

    size_t inner = a->C;
    prod->R = a->R;
    prod->C = b->C;

    for( size_t r = 0; r < prod->R; ++r ) {
        for( size_t c = 0; c < prod->C; ++c ) {
            prod->index[r][c] = 0;
            for( size_t i = 0; i < inner; ++i ) {
                prod->index[r][c] += a->index[r][i] * b->index[i][c];
            }
        }
    }
}

int main(void) {
    FILE *fin = fopen( "matrix.in", "r" ),
        *fout = fopen( "matrix.out", "w" );

    if( fin == NULL ) {
        printf( "Error: could not open matrix.in\n" );
        exit( EXIT_FAILURE );
    }

    if( fin == NULL ) {
        printf( "Error: could not open matrix.out\n" );
        exit( EXIT_FAILURE );
    }

    Matrix a, b, c;

    read_matrix( fin, &a );
    read_matrix( fin, &b );
    fclose( fin );

    mult_matrix( &a, &b, &c );

```

```

    print_matrix( fout, &c );
    fclose( fout );

    return 0;
}

```

Below is the output using the test data:

**matrix:**

```

1: OK [0.004 seconds]
2: OK [0.004 seconds]
3: OK [0.004 seconds]
4: OK [0.013 seconds]
5: OK [0.009 seconds]
6: OK [0.006 seconds]
7: OK [0.011 seconds]
8: OK [0.011 seconds]
9: OK [0.012 seconds]
10: OK [0.004 seconds]

```

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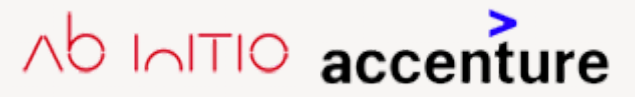
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