

COP 2200 Introduction to C

Homework 6

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In this assignment, you are going to turn in **a single** cpp file. Your goal is to compute the following two basic operations in linear algebra: (1) inner products, and (2) matrix multiplications.

Task 1: In this task, you are going to write a function that computes inner product of two vectors (represented by arrays). In particular, the function takes four inputs: `int * a`, `int n`, `int * b`, `int m`, and the function returns an integer which is supposed to be their inner product. Here `a` is a pointer to the first array (vector), and `n` is its dimension; `b` is another pointer to the second array (vector), and `m` is its dimension. Here you need to consider the case where `n` and `m` do not match. In this case, the inner product is not well-defined.

For those who don't know inner products, look at "http://en.wikipedia.org/wiki/Dot_product".

Task 2: In this task, you are going to write a function that computes matrix multiplications. In particular, the function takes in inputs `int ** A`, `int n1`, `int m1`, `int ** B`, `int n2`, `int m2`, where `A` is a pointer to a 2D array with dimension $n1 \times m1$, and `B` is a pointer to a 2D array with dimension $n2 \times m2$. Your goal is to compute the matrix $C = A \cdot B$. You need to consider a case if the dimensions do not match, i.e. $m1 \neq n2$. In this case, the matrix multiplication is not well-defined.

The function needs to return the matrix `C` and its dimension. However, it cannot return three things per time. So we need to use our trick of pointers. That means, the function takes in additional input `int ** C`, `int * n3`, `int * m3`. You should write the output matrix to `C` (the place where `C` points to), and the dimension to `n3` and `m3` (i.e. the places where they point to).

For those who don't know matrix multiplications, look at "<http://www.mathsisfun.com/algebra/matrix-multiplying.html>", or "http://en.wikipedia.org/wiki/Matrix_multiplication".

Task 3: In this task, you are going to write things in your main function. You need to declare two vectors (e.g. 1-D arrays) and two matrices (e.g. 2-D arrays) of arbitrary dimensions and values of your choice. You can either let the user cin the values or just initialize them in the code. Then you need to call the functions in Tasks 1 and 2, and cout the outcomes. The format and style are flexible.