
Matrix Operations Series Using C++ Arrays & Loops

Matrix Addition, Subtraction, & Multiplication

This assignment was designed to exercise the use of functions and the tool `make` which automates the compilation process.

Two matrices can be added or subtracted if they have the same size. Suppose $A = [a_{ij}]$ and $B = [b_{ij}]$ are two matrices of the size $m \times n$, in which a_{ij} denotes the element of A in the i th row and the j th column, and so on. The sum and difference of A and B are given by:

$$A + B = [a_{ij} + b_{ij}]$$

$$A - B = [a_{ij} - b_{ij}]$$

Multiplication

The multiplication of A and B ($A \cdot B$) is defined only if the number of columns of A is the same as the number of rows of B . If A is of the size $m \times n$ and B is of the size $n \times t$, the $A \cdot B = C$ (represented by $[c_{ik}]$) is of the size $m \times t$ and the element c_{ik} is given by the formula:

$$c_{ik} = a_{i1}b_{1k} + a_{i2}b_{2k} + \dots + a_{in}b_{nk}$$

Write a program that (1) reads two matrices from keyboard input, (2) populates corresponding *array* variables, and (3) performs matrix operations. Validate the dimensions of input values in the context of matrix operations. For instance, (1) prompt the user for the desired operation, (2) inform if dimensions are not compatible for such operation and (3) prompt the user for new input. Use loop(s) (repetition) to assign each element. Write functions to compute the addition, subtraction, and multiplication of the matrices. Output results to the screen. Each operation should be implemented in a separate function. Each function should be in its own file. Use a single header file, `hw04.hpp`, which should contain the necessary function prototypes, system `#includes`, etc. Configure a `Makefile` to compile the project such that individual changes (in the different source files) minimize the need for recompilation.

Use the command `script` to capture your interaction compiling and running the program, including all operations, as shown below:

```
drb@nest:~/cs1b/hw/04$ script hw04.scr
Script started, file is hw04.scr
drb@nest:~/cs1b/hw/04$ date
...
drb@nest:~/cs1b/hw/04$ ls -l
...
drb@nest:~/cs1b/hw/04$ make all
g++ -c hw04add.cpp -o hw04add.o
g++ -c hw04sub.cpp -o hw04sub.o
g++ -c hw04mul.cpp -o hw04mul.o
g++ -c hw04menu.cpp -o hw04menu.o
g++ hw04.cpp -o hw04 hw04add.o hw04sub.o hw04mul.o hw04menu.o
drb@nest:~/cs1b/hw/04$ ls -l
...
drb@nest:~/cs1b/hw/04$ ./hw04
Choose operation:
1. Addition
2. Subtraction
3. Multiplication
4. Exit
... // perform all operations
drb@nest:~/cs1b/hw/04$ exit
Script done, file is hw04.scr
drb@nest:~/cs1b/hw/04$ make tar
tar cf hw04.tar hw04.h hw04.cpp hw04add.cpp hw04sub.cpp hw04mul.cpp
hw04menu.cpp Makefile hw04.scr
```

Submit the tar package file hw04.tar to canvas by the due date on top of this page.