

CECS 524  
Assignment 8  
Total: 40 Points

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General Instruction

- I absolutely recommend that you use L<sup>A</sup>T<sub>E</sub>X for documenting.
  - I strongly recommend that you use `Linux terminal` environment for programming.
  - Your submitted work will be examined by plagiarism detection tools.
  - Submit the uncompressed file(s) via BeachBoard (Not email or in class).
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1. (20 points) Write a program that does matrix multiplication in `C++` without using any external library.

- i. The file names of the source codes should be `Assn8.cpp`.
- ii. The program should read the command-line arguments passed to the program. (`argv[]`).

`argv[1]`: number of rows in the matrix 1 ( $r_1$ )  
`argv[2]`: number of columns in the matrix 1 ( $c_1$ )  
`argv[3]`: number of rows in the matrix 2 ( $r_2$ )  
`argv[4]`: number of columns in the matrix 2 ( $c_2$ )

- iii. The program should allocate the memory space dynamically for the matrices in the row major order.
- iv. The program should use the bracket operator(`[]`) to access the each element of the matrices.
- v. The program should assign the numbers  $\{1, 2, \dots, r_1 \times c_1\}$  to the **first** matrix in **ascending** order. For  $3 \times 3$  example,

```
1 2 3
4 5 6
7 8 9
```

- vi. The program should assign the numbers  $\{1, 2, \dots, r_2 \times c_2\}$  to the **second** matrix in **descending** order. For  $3 \times 3$  example,

```
9 8 7
6 5 4
3 2 1
```

- vii. Execution command and the expected output would be:

```
g++ Assn8.cpp -o Assn8; ./Assn8 3 3 3 3
Matrix 1
1 2 3
4 5 6
7 8 9
Matrix 2
9 8 7
6 5 4
3 2 1
Matrx 1 * Matrix 2
30 24 18
84 69 54
138 114 90
```

- viii. Submit your source code, `Assn8.cpp`.
2. (20 points) Compare and analyze the four assembly codes which are generated by the *gcc* compiler without an optimization option and with the three different optimization levels (`-O1`, `-O2`, `-O3`).
- Your report should address the differences in terms of assembly codes without an optimization option and with the optimization levels.
  - Submit your report, `Assn8.pdf`.