ASSIGNMENT #2

SUBJECT & BASIC INFORMATION

Write down the C++ program that calculates a result matrix depending on these criteria below:

- A = B⁂C and ⁂ is a special matrix operation on B and C
- B is an input square matrix
- C is core square matrix
- A is the output/result matrix
- Initially, core matrix (C) is set onto numbers of the top left of the input matrix.
- The cells int the core matrix are multiplied by the cells in the input matrix (see Figure 1), the resulting products are summed and written to the relevant cell in the result matrix.
- In the next step, the core matrix is shifted by 1 to the right on the input matrix and the same processes are repeated until the end of the current column
- When the core matrix reaches the end of the column of related row as a result of iterative operations, it is taken to the beginning of the row again and shifted by 1 to the next row.
- The size of the output matrix depends on the size of input matrix, size of core frame and will be calculated as follows:
  - The number of colums of the output matrix will be calculates as follows:

    $$output\_row\_size = (input\_row\_size - core\_row\_size) + 1$$

  - Because, matrixes are square, the number of columns of the output matrix equals to the number of rows
- Figure 1 shows a sample input and core matrix and the calculation of the first two steps of the output matrix.

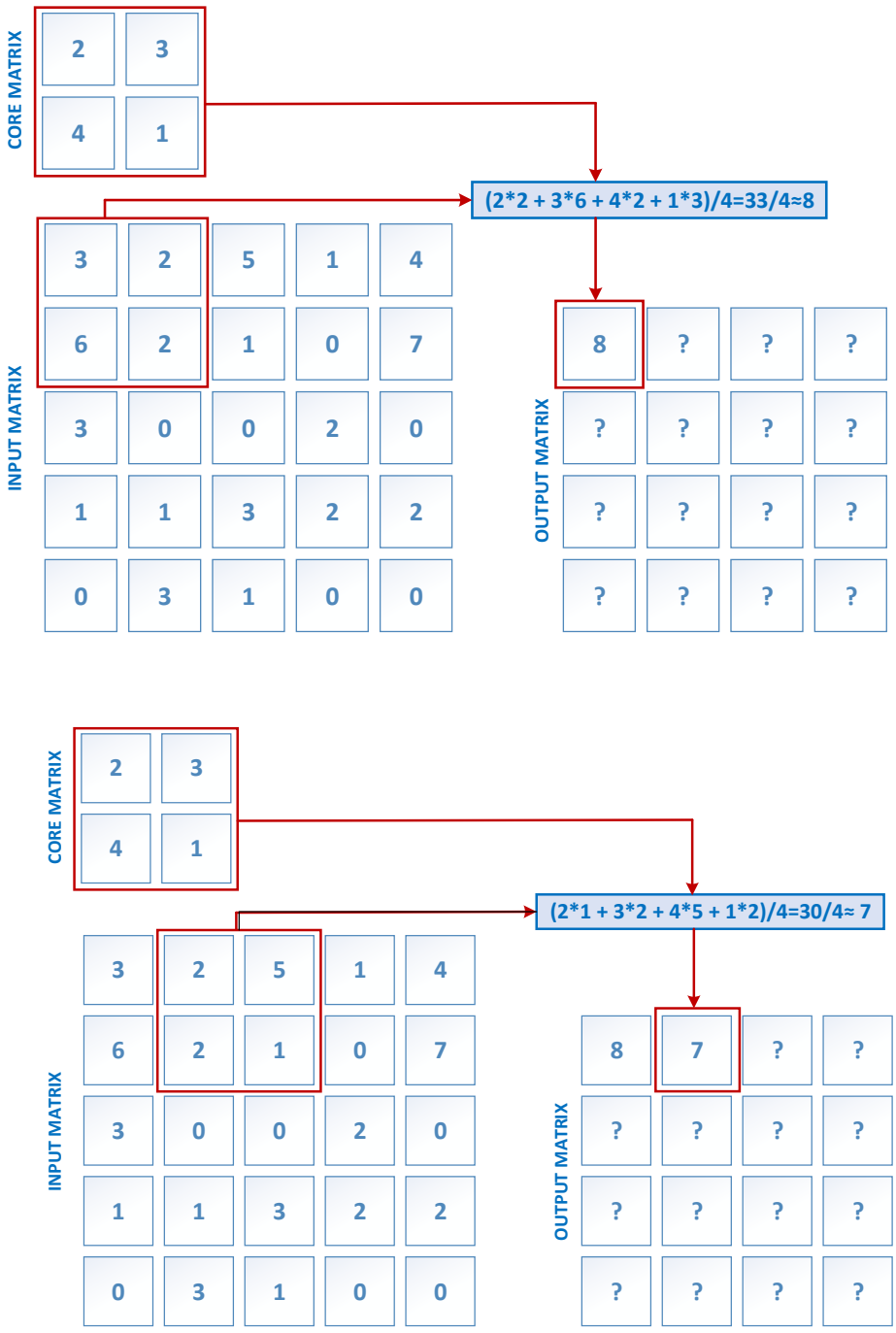

Figure 1. First two steps of output matrix calculation for a sample 5x5 input and 2x2 core matrix

REQUIREMENTS

- The input, core and output matrixes should ve declared dynamically.
- The websites listed below will help you when creating 2D dynamic arrays.
  - https://www.codespeedy.com/how-to-dynamically-allocate-a-2d-array-in-cpp/
  - https://www.techiedelight.com/dynamic-memory-allocation-in-c-for-2d-3d-array/
  - https://www.guru99.com/cpp-dynamic-array.html
  - https://stackoverflow.com/questions/936687/how-do-i-declare-a-2d-array-in-c-using-new
- Size of input matrix (A) will be between 5x5 and 20x20 and will include numbers between [10-20]. The size and the values of this matrix should be generated randomly.
- Size of core matrix (B) will be between 2x2 and 5x5 and will include numbers between [1-10]. The size and the values of this matrix should be generated randomly.
- There will be two menu options in the entry of the program (1 – Generate new matrixes, 2- Read matrixes from existing file)
  - If the first option is selected, then new matrixes (input and core) should be generated and these values should be stored in a text file (named "**data.txt**")
  - If the second one is selected, then the matrixes (input and core) should be read from the current file (named "**data.txt**"). It should be noted here that if the file does not exist, again the first option will be active.
- An example of the format of the text file is given as follows:

```
INPUT MATRIX
3 2 5 11 4 15 7 8 1 10
6 12 1 0 17 4 1 0 13 1
13 10 0 2 0 12 5 2 0 0
1 1 13 12 2 4 3 13 3 1
10 3 11 0 0 4 16 1 1 2
7 1 12 2 11 0 3 13 4 7
4 13 6 0 3 19 9 8 18 1
5 13 1 2 17 6 1 5 3 11
0 3 14 0 10 4 6 11 1 2
3 0 1 2 10 1 4 12 1 15
CORE MATRIX
1 3
5 2
```

- The output should include each of these on the screen
  - input matrix in the matrix format
  - core matrix in the matrix format
  - output matrix in the matrix format

RULES & EVALUATION

- Using a **goto** statement is strictly prohibited.
- Each C++ file should include the comment lines below at the beginning of the C++ file

```
// ********************************************************************************
// ******                STUDENT NAME :                                      *****
// *****               STUDENT NUMBER :                                     *****
// *****                 ASSIGNMENT # :                                     *****
// *****                     - HONOR CODE -                                 *****
// ********************************************************************************
```

- You should compile your codes with **Microsoft Visual Studio 2022**. (NOTE: If you use another compiler, please test your codes with this compiler before uploading your homework on the system)
- **Deadline:** Control the SABIS system
- You should upload **only your C++ file (.cpp file)** together before the deadline.
- Evaluation Criteria
  - Comment lines (student information, explaining operations like variable names, if statements, loops, etc.)
  - Obeying the variable declaration rules
  - Being readable (intendation, comments, etc.)
  - Correct compilation of the code
  - The evaluation of projects will be competitive and copied assignments will be evaluated as 0.