MTH 4300/4299: Algorithms, Computers, and Programming II

HW #2

Due Date: October 10th, 2025

Instructions

You will need to submit one files to brightspace, a cpp file named: name_hw2.cpp. Each problem below should be written as a function, that is called in your main function.

1 Implement a Dynamic 2D Array (Matrix) Using Pointers

Write a C++ program to dynamically create a 2D array (matrix) of integers of size m x n using dynamic memory allocation. You should:

- Ask the user to input the number of rows (m) and columns (n).
- Dynamically allocate memory for the 2D array.
- Initialize the 2D array with some values (e.g., fill with consecutive numbers).
- Print the matrix to the console.
- Deallocate the memory properly after use to avoid memory leaks.
- Handle edge cases where the user might input invalid sizes (like 0 or negative values).

2 Recursion

Write a recursive function to compute the sum of all elements in an array of integers, the input parameters to the function should just be the array, and the size of the array, and the function should return the sum as an int. Note, I will test your function with arrays of different sizes. No user input is required for this question.

3 Rotations

Problem: You need a function that checks if one array is a *rotation* of another.

Function signature (C++):

```
bool isRotation(const int arr1[], const int arr2[], int n);
```

Parameters:

- `arr1` → the first array
- `arr2` → the second array
- `n` → the number of elements in each array (the size)

Definition of rotation: Both arrays must have the same size and contain the same elements in the same order, but `arr2` may start from a different position and wrap around.

Examples (rotations):

$$\text{arr1} = \{10, 20, 30, 40\}, \quad \text{arr2} = \{30, 40, 10, 20\} \quad \Rightarrow \text{true}$$

$$\text{arr1} = \{7, 8, 9, 10\}, \quad \text{arr2} = \{9, 10, 7, 8\} \quad \Rightarrow \text{true}$$

Example (not a rotation):

$$\text{arr1} = \{1, 2, 3, 4\}, \quad \text{arr2} = \{4, 3, 2, 1\} \quad \Rightarrow \text{false}$$