

Assignment 4 - Island Perimeter

Due Feb 21 by 11:59pm **Points** 20 **Submitting** a file upload **File Types** h and cpp **Available** until Feb 24 at 12:01am

This assignment was locked Feb 24 at 12:01am.



CPT-182 - Programming in C++

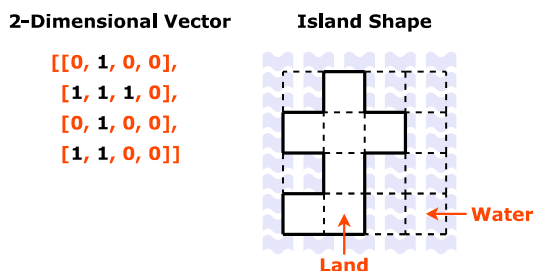
Programming Assignment - Island Perimeter (20 Points)

(Number in Question Bank: Assignment 4.1)

This question appeared in the job interview of **Apple**, **Amazon**, **Bloomberg**, **Facebook**, **Google**, and **Microsoft**.

Program Overview

In this assignment, you will be given a map which is represented by a **2-dimensional vector** (vector of vectors). Each cell in the **2-dimensional** vector stores either 0 or 1 where **1** represents **land** and **0** represents **water**. A graphical explanation of the map is shown below:



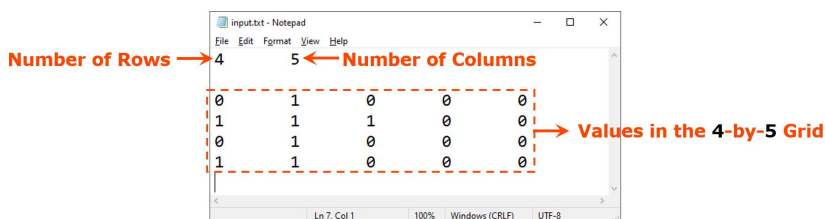
In this assignment, you can assume that all the following conditions are true:

- Grid cells are connected **horizontally** and **vertically** (**not diagonally**).
- The grid is completely **surrounded by water**.
- There is exactly **1** island (**1 set of connected land cells**).
- The island does **not** have "**lakes**" (**water inside that is not connected to the water around the island**).
- Each cell is a square with side length **1**.
- The grid is **rectangular**.

In this assignment, you are going to write a C++ program that reads in a **2-dimensional vector** (representing land/water) from an input file, **calculates the perimeter** of the island, and writes the result to an output file.

The Input File

- The input file is a **plain text file** (filename: **island.txt**).
- First row in the input file contains **2 positive integers**, which are the **number of rows** and **number of columns** in the grid (**in that order**).
- After the first row, values in the grid are listed in the input file (**in row-major order**).
- The picture below explains the data in the input file.



- Please note that you **cannot** assume (**or guess**) the dimensions of the grid. In other words, no matter how large the grid is, your program should correctly process it.

- Please refer to the **sample input files** to better understand the input file format.

The Output File

- The output file is a **plain text file** (filename: **perimeter.txt**).
- Your program writes the calculated **perimeter of the island** to the output file.
- Please refer to the **sample output files** to better understand the expected output file format.

The calc_perimeter() Function

- In this assignment, other than the **main()** function, you **must** write another function, **calc_perimeter()**.
- The **calc_perimeter()** function takes in a **2-dimensional vector of unsigned integers** (type **vector<vector<unsigned int>>**) as its **only** argument, which represents the grid of land/water. **It is your responsibility to determine whether the argument should be passed by value, by reference, or by **const** reference.**
- The **calc_perimeter()** function calculates the perimeter of the island in the grid, and returns the calculated perimeter.
- Docstring of the **calc_perimeter()** function is **required**, in which the function behavior, function parameter, and function return value are explained.
- For your convenience, in this assignment, please write the **calc_perimeter()** function and the **main()** function in the same file.
- The challenging part of this assignment is that you need to **set up a correct algorithm** to calculate the perimeter of the island. You need to use nested **for** loops to iterate through the **2-dimensional vector**. **Hint: if the current cell has row index **i** and column index **j**, can you correctly find the row/column index of its possible **4** neighbors (top, right, bottom, left)?**

The main() Program

- Your **main()** program should read the input file and get the dimensions of the grid first.
- Create a **2-dimensional vector of unsigned integers** with the dimensions just read from the input file.
- Read the rest values from the input file and store them in the **2-dimensional vector** just created.
- Call the **calc_perimeter()** function to calculate the perimeter of the island.
- Write the calculated perimeter to the output file.

Sample Input and Output Files (Click to Download)

Sample Input File 1  (https://drive.google.com/uc?export=download&id=1AcO2kMhnKsEDp00U8neyZFkZikRXq_iF) **Sample Input File 2**  (https://drive.google.com/uc?export=download&id=19IETyH0YY1G-hn50j_imzK5Q_Sa66OsJ) **Sample Output File 1**  (https://drive.google.com/uc?export=download&id=19IETyH0YY1G-hn50j_imzK5Q_Sa66OsJ) **Sample Output File 2** 

Assignment Submission and Grading (Please Read)

- Please upload all your **.h** (if any) and **.cpp** files (**not the entire Microsoft Visual Studio project folder**) on Canvas.
- Before the assignment deadline, you can submit your work **unlimited times**. However, only your **latest submission** will be graded.
- At least **20%** of your code should be **comments**. All variable, function (if any), and class (if any) names should "make good sense". You should let the grader put **least effort** to understand your code. Grader will **take off points**, even if your program passes all test cases, if he/she has to put extra **unnecessary** effort to understand your code.
- Please **save a backup copy** of all your work in your computer hard drive.
- Your program will be graded (**tested**) using another valid input file (**still named **island.txt****) to check whether it can generate the expected (**correct**) output file (**with correct format and correct output values in it**). As long as the input file is valid, your program should generate a correct output file. In other words, your program should work for **any** valid input file, **not** just the sample input files provided in the assignment instructions.
- In this class, you can assume that the input file (**input data**) is always **valid** and **has correct format**. You do **not** need to deal with **invalid input** or **error handling**.
- Your work will be graded after the assignment deadline. All students will receive their assignment grades at (**almost**) the same time.