

10802 CPP Midterm Exam

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Subject: Coastline

Main testing concept :

Basics

- C++ BASICS
- FLOW OF CONTROL
- FUNCTION BASICS
- PARAMETERS AND OVERLOADING
- ARRAYS
- STRUCTURES AND CLASSES
- CONSTRUCTORS AND OTHER TOOLS
- OPERATOR OVERLOADING, FRIENDS, AND REFERENCES
- STRINGS
- POINTERS AND DYNAMIC ARRAYS

Functions

- SEPARATE COMPILATION AND NAMESPACES
- STREAMS AND FILE I/O
- RECURSION
- INHERITANCE
- POLYMORPHISM AND VIRTUAL FUNCTIONS
- TEMPLATES
- LINKED DATA STRUCTURES
- EXCEPTION HANDLING
- STANDARD TEMPLATE LIBRARY
- PATTERNS AND UML

Description :

You have reached the sea planet after a long space exploration. As part of your task to survey the planet, you are required to measure the total area of all islands and the total length of all coastlines.

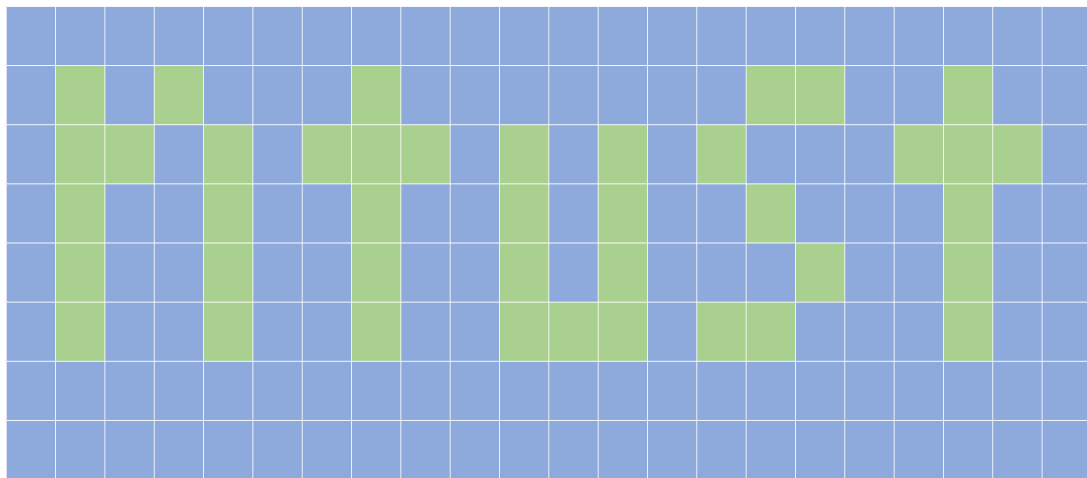


Figure 1 Grid-like Diagram

Figure 1 shows an example map, consisting of the sea of blue cells and lands of green cells on the sea planet. Please note that each cell is a unit square and all cells have the same size. All adjacent lands form an island. The adjacency is defined by the 4-neighboring rule where a cell is said to be the neighbor of the center cell if it is next to the cell in the vertical or horizontal direction, but not in diagonal ones. For instance, the lands at the left part of Figure 2 can be defined as an island, and the right part of Figure 2 are defined as two islands.

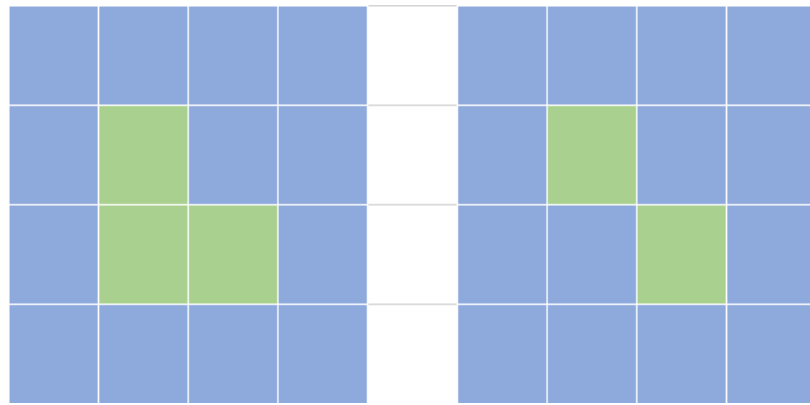


Figure 2 One-island example(left) and Two-island example(right)

Given a map with n islands, please find and output the total area and coastal length of each island in descending order based on the area and length. An example of area and coastline calculation is shown in Figure 3.

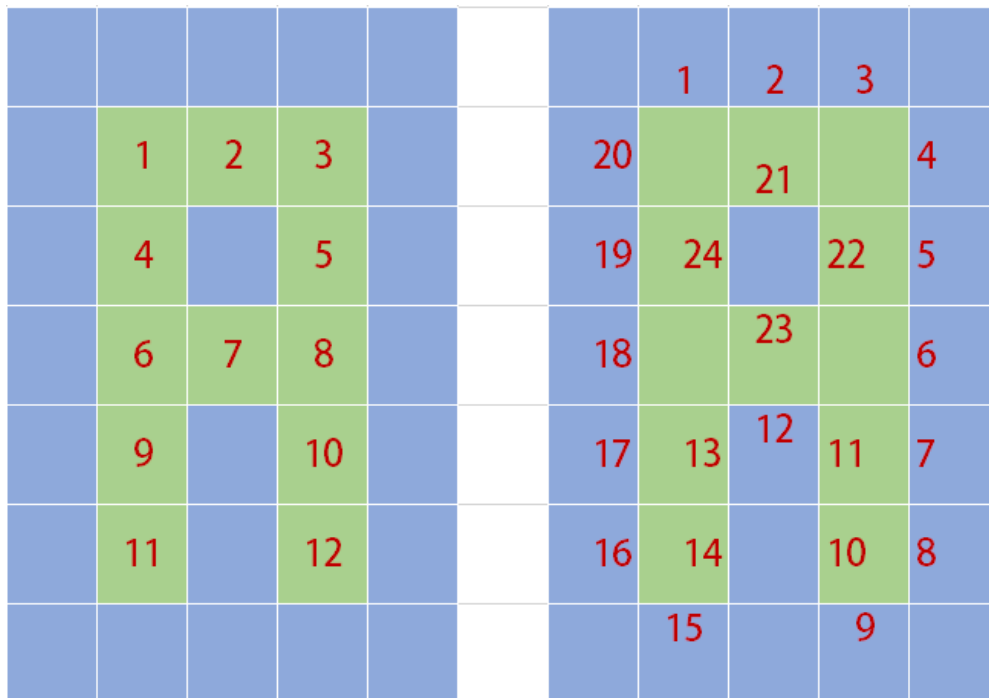


Figure 3 Area calculation(left) and Coastline calculation(right)

Input :

1. The first line contains two integers H and W, indicating the size of map, where $1 \leq H \leq 100$, and $1 \leq W \leq 100$.
2. For following H lines contains W characters each. Each character will be either '#' (indicates the land cell) or '.' (indicates the sea cells).

Output :

For all islands, output each island's area and coastal length in descending order first based on area and then based on the coastal length.

**** Time limit: 1 second.**

Sample Input / Output:

Sample Input	Sample Output
4 5 #.... #.#.# #..#. #...#.	4 10 3 8 1 4 1 4
3 5 ##..# ##..# ...##	4 10 4 8

- ☐ **Easy**, only basic programming syntax and structure are required.
- ☐ **Medium**, multiple programming grammars and structures are required.
- ☒ **Hard**, need to use multiple program structures or complex data types.

Expected solving time:

45 minutes

Other notes :

The following class can be extended as you need.

```
class Island
{
public:
    Island();
    ~Island() {}
    void pushPoint(int i, int j);
    void combine(Island land);
    int sealine()const;
    int area()const;
};
```