NTUST OOP Midterm Problem Design

Subject: Meerkat Habitats

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Main testing concept:

Basics	Functions
■ C++ BASICS	□ SEPARATE COMPILATION AND NAMESPACES
■ FLOW OF CONTROL	□ STREAMS AND FILE I/O
■ FUNCTION BASICS	□ RECURSION
□ PARAMETERS AND OVERLOADING	□ INHERITANCE
■ ARRAYS	□ POLYMORPHISM AND VIRTUAL FUNCTIONS
□ STRUCTURES AND CLASSES	□ TEMPLATES
□ CONSTRUCTORS AND OTHER TOOLS	□ LINKED DATA STRUCTURES
□ OPERATOR OVERLOADING, FRIENDS, AND REFERENCES	□ EXCEPTION HANDLING
□ STRINGS	□ STANDARD TEMPLATE LIBRARY
□ POINTERS AND DYNAMIC ARRAYS	□ PATTERNS AND UML

Description

A team of wildlife researchers has discovered a remote desert where meerkats live in scattered groups. The landscape consists of meerkat habitats, surrounded by a barren desert. To study their colony distribution, the researchers need a program that counts the number of distinct meerkat habitats and identifies the size of the largest one.

The landscape consists of two types of cells:

1. Habitat cells ('1') - These represent land where meerkats reside.
2. Desert cells ('0') - These represent desert with no meerkat presence.

A habitat is a group of adjacent habitat cells ('1') that are directly connected either horizontally or vertically (not diagonally). A habitat is considered distinct if it is not connected to another habitat. The size of a habitat is the total number of habitat cells ('1') that form a single connected group.

You have to write a function that takes an m x n grid (represents the landscape) and returns:

- The total number of meerkat habitats.
- The size of the largest habitat.

It can be assumed that the four boundaries are surrounded by desert ('0').

Input

- The program should read from standard input until EOF.
- First line: Two integers m and n representing the grid dimensions.
  ($1 \leq m \leq 300$, $1 \leq n \leq 300$)
- Next m lines: Each line contains n integers (0 or 1), representing the grid.

Output

- If m or n is out of range, print: "Invalid grid size" and wait for a new input.
- If the input is valid, print a single line contains two space-separated integers:
  1. The number of meerkat habitats.
  2. The size of the largest habitat.

Sample Input	Sample Output
5 5 1 1 0 0 0 1 1 0 1 1 0 0 0 1 0 1 0 1 0 0 1 1 1 0 0 3 6 0 1 0 0 0 1 1 0 1 1 1 0 0 0 0 1 0 0 1 999	3 5 4 4 Invalid grid size

□ **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: 25 minutes

Other Notes:

- m represents the number of rows.
- n represents the number of elements in each row.
- Grid contains only '0' (desert) and '1' (habitat).