HOMEWORK #6:

Dungeons and Clams

Due Thursday, May the 8th, 11:59pm

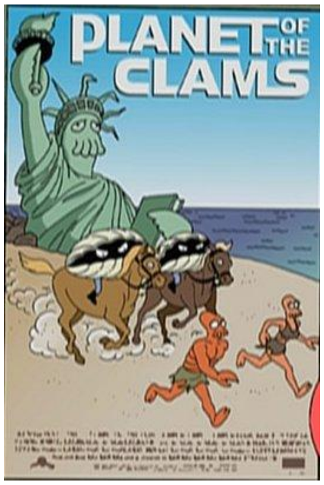
For this assignment, submit as many files as you need, but let your 'main()' function be in a file called : 'dungeonclam.cpp'.

Remember to put your name and section at the top of all files.
Your simulation program should expect all input to come from 'cin', and all your output should be to 'cout'.

Problem

Dr. Zoidberg is trapped in the middle of a dungeon! The dungeon looks like a maze, and there are giant mutant clams that will eat Dr. Zoidberg if disturbed. Thankfully he smuggled a collection of maps, and with your help he shall be able to escape.

Your job is to write a program that finds, for every map, a path to the exit of the dungeon.



Escape from the Planet of the Clams.

Input

The input will consist of a sequence of maps. Each map input starts with the number of columns and the number of rows of the map. In a map, a '#' character denotes a wall. 'C' denotes a giant mutant clam. A ' ' (blank space) character denotes a clear section. 'Z' marks Dr. Zoidberg's starting point and 'E' marks the exit. The input is finished when a maze of size 0 by 0 is indicated.

Output

Output each map with a path from the “Start point” to the “Exit” . Mark the path using cookie crumbles (character ‘.’). Follow the format as in the sample output.

Details:

- Use Recursive Backtracking.
- Dr. Zoidberg can move in any of the cardinal directions (North, East, West and South). No diagonal moves are possible.
- Each map will have only one path from Start to Exit, but loops are possible.

Sample

Input

```
11 4
###########
#   #C#   #
#Z#     #E#
###########
16 10
################
#      #    # C#
# # #### ##   ##
# #      #######
# ###### #E    #
# #C#Z # ### ###
# # ## #     #C#
# # ## ####### #
#              #
################
0 0
```

Output

```
Map : 0
###########
#...#C#...#
#Z#.....#E#
###########

Map : 1
################
#...   #    # C#
#.#.#### ##   ##
#.#......#######
#.######.#E..  #
#.#C#Z.#.###.###
#.# ##.#.....#C#
#.# ##.####### #
#......        #
################
```

Implementation Guidelines:

- Build your own simple test cases.
- Print plenty of status messages to track the progress of your algorithm.
- Start with the Recursive Backtracking algorithm, and refine it into your implementation as done in class.

HINT: Recursive Backtracking Algorithm:

```
try i'th step
    Initialize possible choices
    DO
        select choice
        IF choice acceptable
            record choice
            IF solution complete
                return success!!
            ELSE
                try i+1'th step
                IF successful
                    return success!!
                ELSE
                    cancel choice recording
    WHILE not successful AND more choices available.
```

HINT: Reading Lines with White-Space

In this assignment, you are required to read lines with white spaces.
You may attempt to use something like:

```
      cin >> maze[i][j];
```

But that would **NOT** work.. as the extraction operator '>>' **ignores** white spaces.

You will therefore be forced to one of the following library functions:

1. string function `getline()` to read string objects.
2. stream function `getline()` to read "null terminated character arrays".
3. stream function `get()` to read character by character.

See the following code samples:

Code Sample: Reading Strings

```
.
  // Maze is an array of strings
  string* maze;

  // Readin size of maze
  cin >> cs >> rs;
  cout << cs << " " << rs << endl;
  cin.ignore();              // to move read head to next line

  // Allocate Maze Array
  maze = new string[rs];

  // Read Maze, each row is a string;
  for(int k=0; k < rs; k++){
    getline(cin, maze[k]);
  }

  // Print Maze Array
  for(int k=0; k < rs; k++){
    cout << maze[k] << endl;
  }

  // De-allocate Maze Array
  delete [] maze;
.
```

Code Sample: Reading “Null Terminated Character Arrays”

```
.
  // Maze is a 2D array of characters
  char** maze;

  // Readin size of Maze
  cin >> cs >> rs;
  cout << cs << " " << rs << endl;
  cin.ignore();    // to move read head to next line

  // Allocate Maze Array
  // Notice that an EXTRA cell is added to the columns
  // to account for NULL termination
  maze = new char*[rs];
  for(int k=0; k < rs; k++){
    maze[k] = new char[cs+1];
  }

  // Read Maze Array
  // Notice that we are reading each line as
  // a NTCA, "NULL Terminated Character Array"
  for(int k=0; k < rs; k++){
    cin.getline(maze[k], cs+1);
  }

  // Print Maze Array
  for(int k=0; k < rs; k++){
    cout << maze[k] << endl;
  }

  // De-allocate Maze Array
  for(int k=0; k < rs; k++){
    delete [] maze[k];
  }
  delete [] maze;
.
```

Code Sample: Reading Character by Character

```
.
  // Maze is a 2D array of characters
  char** maze;// Readin size of Maze

  // Readin size of Maze
  cin >> cs >> rs;
  cout << cs << " " << rs << endl;
  cin.ignore();    // to move read head to next line

  // Allocate Maze Array
  maze = new char*[rs];
  for(int k=0; k < rs; k++){
    maze[k] = new char[cs];
  }
  // Read Maze Array
  // Notice that we are reading *Character by Character*
  // and after every row we need to read an extra character
  // to account for the 'end-of-line' character
  char dummy;
  for(int k=0; k < rs; k++){
    for(int j=0; j < cs; j++){
      cin.get(maze[k][j]);
    }
    cin.get(dummy);   // read end-of-line
  }

  // Print Maze Array
  for(int k=0; k < rs; k++){
    for(int j=0; j < cs; j++){
      cout << maze[k][j];
    }
    cout << endl;   // read end-of-line
  }

  // De-allocate Maze Array
  for(int k=0; k < rs; k++){
    delete [] maze[k];
  }
  delete [] maze;
.
```

END.