Search a Word in a 2D Grid of characters

Given a 2D grid of characters and a word, find all occurrences of given word in grid. A word can be matched in all 8 directions at any point. Word is said be found in a direction if all characters match in this direction (not in zig-zag form).

The 8 directions are, Horizontally Left, Horizontally Right, Vertically Up and 4 Diagonal directions.

Example:

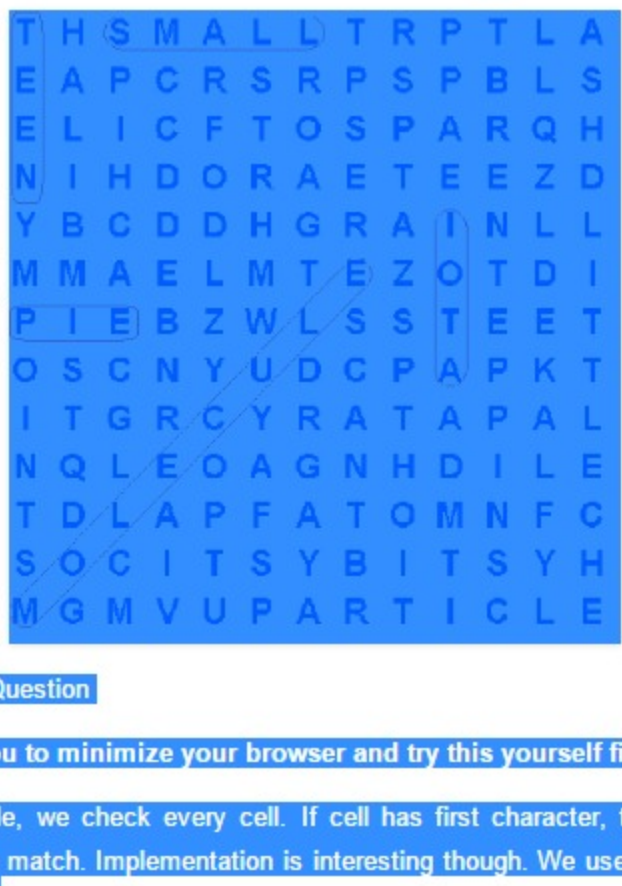
```
Input:  grid[][] = {"GEEKSFORGEEKS",
                    "GEEKSQUIZGEEK",
                    "IDEQAPRACTICE"};
        word = "GEEKS"

Output: pattern found at 0, 0
        pattern found at 0, 8
        pattern found at 1, 0

Input:  grid[][] = {"GEEKSFORGEEKS",
                    "GEEKSQUIZGEEK",
                    "IDEQAPRACTICE"};
        word = "EEE"

Output: pattern found at 0, 2
        pattern found at 0, 10
        pattern found at 2, 2
        pattern found at 2, 12
```

Below diagram shows a bigger grid and presence of different words in it.



Source: Microsoft Interview Question

We strongly recommend you to minimize your browser and try this yourself first.

The idea used here is simple, we check every cell. If cell has first character, then we one by one try all 8 directions from that cell for a match. Implementation is interesting though. We use two arrays x[] and y[] to find next move in all 8 directions.

Below is C++ implementation of the same.

```
// C++ programs to search a word in a 2D grid
#include<bits/stdc++.h>
using namespace std;

// Rows and columns in given grid
#define R 3
#define C 14

// For searching in all 8 direction
int x[] = { -1, -1, -1, 0, 0, 1, 1, 1 };
int y[] = { -1, 0, 1, -1, 1, -1, 0, 1 };

// This function searches in all 8-direction from point
// (row, col) in grid[][]
bool search2D(char grid[R][C], int row, int col, string word)
{
    // If first character of word doesn't match with
    // given starting point in grid.
    if (grid[row][col] != word[0])
      return false;

    int len = word.length();

    // Search word in all 8 directions starting from (row,col)
    for (int dir = 0; dir < 8; dir++)
    {
        // Initialize starting point for current direction
        int k, rd = row + x[dir], cd = col + y[dir];

        // First character is already checked, match remaining
        // characters
        for (k = 1; k < len; k++)
        {
            // If out of bound break
            if (rd >= R || rd < 0 || cd >= C || cd < 0)
                break;

            // If not matched,  break
            if (grid[rd][cd] != word[k])
                break;

            //  Moving in particular direction
            rd += x[dir], cd += y[dir];
        }

        // If all character matched, then value of must
        // be equal to length of word
        if (k == len)
            return true;
    }
    return false;
}

//  Searches given word in a given matrix in all 8 directions
void patternSearch(char grid[R][C], string word)
{
    // Consider every point as starting point and search
    // given word
    for (int row = 0; row < R; row++)
       for (int col = 0; col < C; col++)
          if (search2D(grid, row, col, word))
             cout << "pattern found at " << row << ", "
                  << col << endl;
}

// Driver program
int main()
{
    char grid[R][C] = {"GEEKSFORGEEKS",
                       "GEEKSQUIZGEEK",
                       "IDEQAPRACTICE"
                      };

    patternSearch(grid, "GEEKS");
    cout << endl;
    patternSearch(grid, "EEE");
    return 0;
}
```

Run on IDE

Output:

```
pattern found at 0, 0
pattern found at 0, 8
pattern found at 1, 0

pattern found at 0, 2
pattern found at 0, 10
pattern found at 2, 2
pattern found at 2, 12
```

Exercise: The above solution only print locations of word. Extend it to print the direction where word is present.

See this for solution of exercise.

This article is contributed by Utkarsh Trivedi. Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above