

Solution 1

```
1 // Copyright © 2020 AlgoExpert, LLC. All rights reserved.
2
3 using System;
4
5 public class Program {
6     // O(n + m) time | O(m) space
7     public static bool KnuthMorrisPrattAlgorithm(string str, string substring) {
8         int[] pattern = buildPattern(substring);
9         return doesMatch(str, substring, pattern);
10    }
11
12    public static int[] buildPattern(string substring) {
13        int[] pattern = new int[substring.Length];
14        Array.Fill(pattern, -1);
15        int j = 0;
16        int i = 1;
17        while (i < substring.Length) {
18            if (substring[i] == substring[j]) {
19                pattern[i] = j;
20                i++;
21                j++;
22            } else if (j > 0) {
23                j = pattern[j - 1] + 1;
24            } else {
25                i++;
26            }
27        }
28        return pattern;
29    }
30
31    public static bool doesMatch(string str, string substring, int[] pattern) {
32        int i = 0;
33        int j = 0;
34        while (i + substring.Length - j <= str.Length) {
35            if (str[i] == substring[j]) {
36                if (j == substring.Length - 1) return true;
37                i++;
38                j++;
39            } else if (j > 0) {
40                j = pattern[j - 1] + 1;
41            } else {
42                i++;
43            }
44        }
45        return false;
46    }
47 }
48
```

