

Solution 1

```
1  # Copyright © 2020 AlgoExpert, LLC. All rights reserved.
2
3  # O(n + m) time | O(m) space
4  def knuthMorrisPrattAlgorithm(string, substring):
5      pattern = buildPattern(substring)
6      return doesMatch(string, substring, pattern)
7
8
9  def buildPattern(substring):
10     pattern = [-1 for i in substring]
11     j = 0
12     i = 1
13     while i < len(substring):
14         if substring[i] == substring[j]:
15             pattern[i] = j
16             i += 1
17             j += 1
18         elif j > 0:
19             j = pattern[j - 1] + 1
20         else:
21             i += 1
22     return pattern
23
24
25 def doesMatch(string, substring, pattern):
26     i = 0
27     j = 0
28     while i + len(substring) - j <= len(string):
29         if string[i] == substring[j]:
30             if j == len(substring) - 1:
31                 return True
32             i += 1
33             j += 1
34         elif j > 0:
35             j = pattern[j - 1] + 1
36         else:
37             i += 1
38     return False
39
```

