Let's suppose that $s$ has $n$ characters total. To make things easier to think about, let's consider the repetition $x'$ of $x$ consisting of exactly $n$ characters, and the repetition $y'$ of $y$ consisting of exactly $n$ characters. Our problem can be phrased as: is $s$ an interleaving of $x'$ and $y'$? The advantage of working with these elongated strings is that we don't need to "wrap around" and consider multiple periods of $x'$ and $y'$ — each is already as long as $s$.

Let $s[j]$ denote the $j^{\text{th}}$ character of $s$, and let $s[1:j]$ denote the first $j$ characters of $s$. We define the analogous notation for $x'$ and $y'$. We know that if $s$ is an interleaving of $x'$ and $y'$, then its last character comes from either $x'$ or $y'$. Removing this character (wherever it is), we get a smaller recursive problem on $s[1:n-1]$ and prefixes of $x'$ and $y'$.

Thus, we consider sub-problems defined by prefixes of $x'$ and $y'$. Let $M[i,j] = \mathit{yes}$ if $s[1:i+j]$ is an interleaving of $x'[1:i]$ and $y'[1:j]$. If there is such an interleaving, then the final character is either $x'[i]$ or $y'[j]$, and so we have the following basic recurrence:

> $M[i,j] = \mathit{yes}$ if and only if $M[i-1,j] = \mathit{yes}$ and $s[i+j] = x'[i]$, or $M[i,j-1] = \mathit{yes}$ and $s[i+j] = y'[j]$.

We can build these up via the following loop.

```
M[0,0] = yes
For k = 1,2,...,n
  For all pairs (i,j) so that i + j = k
    If M[i-1,j] = yes and s[i+j] = x'[i] then
      M[i,j] = yes
    Else if M[i,j-1] = yes and s[i+j] = y'[j] then
      M[i,j] = yes
    Else
      M[i,j] = no
  Endfor
Endfor
Return ``yes'' if and only there is some pair (i,j) with i + j = n
  so that M[i,j] = yes.
```

There are $O(n^2)$ values $M[i,j]$ to build up, and each takes constant time to fill in from the results on previous sub-problems; thus the total running time is $O(n^2)$.

[1] ex357.417.692