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^{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 $M[i,j] = yes$ 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:

> $M[i,j] = yes$ if and only if $M[i-1,j] = yes$ and $s[i+j] = x'[i]$, or $M[i,j-1] = yes$ 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