**Design decision for Toeplitz matrix filling**

The first step would be generating (2n-1) elements, that is the number of elements required to fill the Toeplitz matrix.

Possible approaches to fill up the Toeplitz matrix.

1. **Fill the upper triangular matrix first with the n elements and then fill the lower part of that matrix with remaning (n-1) elements**

Structure: 2x2 Matrix

Explanation: First n elements will be filled and shifted to right, creating upper triangular part.

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 0 | 1 | 1 |
| \* | 1 | 0 | 1 |
| \* | \* | 1 | 0 |
| \* | \* | \* | 1 |

The \* are the remaining n-1 elements that will be filled once upper triangular part is done.

Asymptotic time complexity: O(n2)

Actual time complexity = t(fill upper triangular matrix) \* t(lower triangular matrix)

= O(n2) \* O(n2) = O(n4).

This is the first implementation of Toeplitz matrix, it is taking huge time.

1. Create a temporary queue like structure using array and replace the end elements.
2. Instead of a 2X2 matrix, use a single array containing 2n-1 elements and perform the operation.