Matrix M of size $(n-m+1)^2$ represents the values of the $m \times m$ contiguous submatrices at all positions in T interpreted as m^2-bit integers.

If we assume the first row and column of M are calculated, the rest can be computed using this recurrence:

$$M[i,j] =$$

$$2M[i-j-1] + 2^m M[i-1,j] + 2^{m+1} M[i-1,j-1] + 2^{m^2+m} x[i-1,j-1]$$

$$-2^m x[i+m-1,j+1] - 2^{m^2} x[i-1,j-m+1]$$

The intuition is that the bits in the two submatrices immediately to the left and up are being shifted to their positions relative to the new submatrix, and the submatrix diagonally up and to the left one unit each is being shifted in the same way and subtracted off to cancel both the doubly-counted values and most of the extra values of the other two submatrices, which leaves only 4 corner values to be corrected manually.