

# Palindromes: Calculation Materials

## *Tables of morphic palindromes*

Rudolf Kaehr Dr. @

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### Abstract

#### Calculations

##### System

SML/NJ: <http://www.smlnj.org/>,

##### Morphogramatics

<http://www.thinkartlab.com/pkl/SML-sources.NJ/ALL-MG-nov2012.sml>

##### Book Morphogrammatik

<http://www.thinkartlab.com/pkl/media/mg-book.pdf>

##### ML approach to palindromes

```
fun kref ks = tnf(rev ks);
fun ispalindrome l = (l = kref l);
val ispalindrome = fn : int list -> bool
fun palindrome l = (l = rev l);
fun dref ks = dnf(rev ks);
fun dnfpalindrome l = (l = dref l);
```

#### Theoretical text at:

<http://memristors.memristics.com/Morphospheres/Asymmetric%20Palindromes.html>

<http://memristors.memristics.com/Morphospheres/Asymmetric%20Palindromes.pdf>

(Work in progress v. 0.3.6, Jan. 2013)

## 1. Kenogrammatic operations

<sup>1</sup> - `List.filter ispalindrome "kconcat [1,2,3,1,4,5,2,4] [1,2,3,1,4,5,2,4]"`:

```
val it =
[[1,2,3,1,4,5,2,4,1,2,3,1,4,5,2,4],[1,2,3,1,4,5,2,4,1,2,5,1,4,3,2,4],
 [1,2,3,1,4,5,2,4,1,3,5,1,4,2,3,4],[1,2,3,1,4,5,2,4,1,5,2,1,4,3,5,4],
 [1,2,3,1,4,5,2,4,2,4,1,2,5,3,4,5],[1,2,3,1,4,5,2,4,2,4,3,2,1,5,4,1],
 [1,2,3,1,4,5,2,4,2,4,5,2,1,3,4,1],[1,2,3,1,4,5,2,4,2,4,5,2,3,1,4,3],
 [1,2,3,1,4,5,2,4,3,1,5,3,2,4,1,2],[1,2,3,1,4,5,2,4,3,2,1,3,5,4,2,5],
 [1,2,3,1,4,5,2,4,3,2,5,3,1,4,2,1],[1,2,3,1,4,5,2,4,3,5,2,3,1,4,5,1],
 [1,2,3,1,4,5,2,4,4,1,3,4,2,5,1,2],[1,2,3,1,4,5,2,4,4,1,5,4,2,3,1,2],
 [1,2,3,1,4,5,2,4,4,2,1,4,5,3,2,5],[1,2,3,1,4,5,2,4,4,2,3,4,1,5,2,1],
 [1,2,3,1,4,5,2,4,4,2,5,4,1,3,2,1],[1,2,3,1,4,5,2,4,4,2,5,4,3,1,2,3],
 [1,2,3,1,4,5,2,4,4,3,1,4,5,2,3,5],[1,2,3,1,4,5,2,4,4,3,5,4,1,2,3,1],
 [1,2,3,1,4,5,2,4,4,5,2,4,1,3,5,1],[1,2,3,1,4,5,2,4,4,5,2,4,3,1,5,3],
 [1,2,3,1,4,5,2,4,5,1,4,5,2,3,1,2],[1,2,3,1,4,5,2,4,5,2,4,5,1,3,2,1],
```

[1,2,3,1,4,5,2,4,5,2,4,5,3,1,2,3],[1,2,3,1,4,5,2,4,5,3,4,5,1,2,3,1],  
 [1,2,3,1,4,5,2,4,1,2,6,1,4,3,2,4],[1,2,3,1,4,5,2,4,1,3,6,1,4,2,3,4],  
 [1,2,3,1,4,5,2,4,2,4,6,2,1,3,4,1],[1,2,3,1,4,5,2,4,2,4,6,2,3,1,4,3],  
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 [1,2,3,1,4,5,2,4,4,2,6,4,3,1,2,3],[1,2,3,1,4,5,2,4,4,3,6,4,1,2,3,1],  
 [1,2,3,1,4,5,2,4,6,1,3,6,2,5,1,2],[1,2,3,1,4,5,2,4,6,1,5,6,2,3,1,2],  
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 [1,2,3,1,4,5,2,4,1,2,6,1,4,7,2,4],[1,2,3,1,4,5,2,4,2,4,6,2,1,7,4,1],  
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 [1,2,3,1,4,5,2,4,6,1,7,6,2,8,1,2],[1,2,3,1,4,5,2,4,6,2,7,6,1,8,2,1],  
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 [1,2,3,1,4,5,2,4,6,7,1,6,5,3,7,5],[1,2,3,1,4,5,2,4,6,7,3,6,1,5,7,1],  
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 [1,2,3,1,4,5,2,4,6,7,8,6,1,3,7,1],[1,2,3,1,4,5,2,4,6,7,8,6,3,1,7,3],  
 [1,2,3,1,4,5,2,4,1,6,5,1,4,7,6,4],[1,2,3,1,4,5,2,4,4,6,1,4,5,7,6,5],  
 [1,2,3,1,4,5,2,4,4,6,5,4,1,7,6,1],[1,2,3,1,4,5,2,4,5,6,4,5,1,7,6,1],  
 [1,2,3,1,4,5,2,4,1,6,7,1,4,8,6,4],[1,2,3,1,4,5,2,4,4,6,7,4,1,8,6,1],  
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 [1,2,3,1,4,5,2,4,4,2,5,4,6,3,2,6],[1,2,3,1,4,5,2,4,4,3,5,4,6,2,3,6],  
 [1,2,3,1,4,5,2,4,4,5,2,4,6,3,5,6],[1,2,3,1,4,5,2,4,5,2,4,5,6,3,2,6],  
 [1,2,3,1,4,5,2,4,5,3,4,5,6,2,3,6],[1,2,3,1,4,5,2,4,2,4,6,2,7,3,4,7],  
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 [1,2,3,1,4,5,2,4,4,3,6,4,7,2,3,7],[1,2,3,1,4,5,2,4,6,2,3,6,7,5,2,7],  
 [1,2,3,1,4,5,2,4,6,2,5,6,7,3,2,7],[1,2,3,1,4,5,2,4,6,3,5,6,7,2,3,7],  
 [1,2,3,1,4,5,2,4,6,5,2,6,7,3,5,7],[1,2,3,1,4,5,2,4,6,2,7,6,8,3,2,8],  
 [1,2,3,1,4,5,2,4,6,3,7,6,8,2,3,8],[1,2,3,1,4,5,2,4,2,4,5,2,6,7,4,6],  
 [1,2,3,1,4,5,2,4,4,2,5,4,6,7,2,6],[1,2,3,1,4,5,2,4,4,5,2,4,6,7,5,6],  
 [1,2,3,1,4,5,2,4,5,2,4,5,6,7,2,6],[1,2,3,1,4,5,2,4,2,4,6,2,7,8,4,7],  
 [1,2,3,1,4,5,2,4,4,2,6,4,7,8,2,7],[1,2,3,1,4,5,2,4,6,2,5,6,7,8,2,7],  
 [1,2,3,1,4,5,2,4,6,5,2,6,7,8,5,7],[1,2,3,1,4,5,2,4,6,2,7,6,8,9,2,8],  
 [1,2,3,1,4,5,2,4,3,6,5,3,7,4,6,7],[1,2,3,1,4,5,2,4,4,6,3,4,7,5,6,7],  
 [1,2,3,1,4,5,2,4,4,6,5,4,7,3,6,7],[1,2,3,1,4,5,2,4,5,6,4,5,7,3,6,7],  
 [1,2,3,1,4,5,2,4,3,6,7,3,8,4,6,8],[1,2,3,1,4,5,2,4,4,6,7,4,8,3,6,8],  
 [1,2,3,1,4,5,2,4,6,7,3,6,8,5,7,8],[1,2,3,1,4,5,2,4,6,7,5,6,8,3,7,8]

```

[1,2,3,1,4,5,2,4,6,7,8,6,9,3,7,9],[1,2,3,1,4,5,2,4,4,6,5,4,7,8,6,7],
[1,2,3,1,4,5,2,4,5,6,4,5,7,8,6,7],[1,2,3,1,4,5,2,4,4,6,7,4,8,9,6,8],
[1,2,3,1,4,5,2,4,6,7,5,6,8,9,7,8],[1,2,3,1,4,5,2,4,6,7,8,6,9,10,7,9]]
: int list list
- length it;
val it = 142 : int-

```

```
kconcat [1,2,3,1,3,1,4,3] [1,2,3,1,4,5,2,4];
```

```
val it =
```

```

[[1,2,3,1,3,1,4,3,1,2,3,1,4,5,2,4],[1,2,3,1,3,1,4,3,1,2,3,1,5,4,2,5],
[1,2,3,1,3,1,4,3,1,2,4,1,3,5,2,3],[1,2,3,1,3,1,4,3,1,2,4,1,5,3,2,5],
[1,2,3,1,3,1,4,3,1,2,5,1,3,4,2,3],[1,2,3,1,3,1,4,3,1,2,5,1,4,3,2,4],
[1,2,3,1,3,1,4,3,1,3,2,1,4,5,3,4],[1,2,3,1,3,1,4,3,1,3,2,1,5,4,3,5],
[1,2,3,1,3,1,4,3,1,3,4,1,2,5,3,2],[1,2,3,1,3,1,4,3,1,3,4,1,5,2,3,5],
[1,2,3,1,3,1,4,3,1,3,5,1,2,4,3,2],[1,2,3,1,3,1,4,3,1,3,5,1,4,2,3,4],
[1,2,3,1,3,1,4,3,1,4,2,1,3,5,4,3],[1,2,3,1,3,1,4,3,1,4,2,1,5,3,4,5],
[1,2,3,1,3,1,4,3,1,4,3,1,2,5,4,2],[1,2,3,1,3,1,4,3,1,4,3,1,5,2,4,5],
[1,2,3,1,3,1,4,3,1,4,5,1,2,3,4,2],[1,2,3,1,3,1,4,3,1,4,5,1,3,2,4,3],
[1,2,3,1,3,1,4,3,1,5,2,1,3,4,5,3],[1,2,3,1,3,1,4,3,1,5,2,1,4,3,5,4],
[1,2,3,1,3,1,4,3,1,5,3,1,2,4,5,2],[1,2,3,1,3,1,4,3,1,5,3,1,4,2,5,4],
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[1,2,3,1,3,1,4,3,2,1,3,2,4,5,1,4],[1,2,3,1,3,1,4,3,2,1,3,2,5,4,1,5],
[1,2,3,1,3,1,4,3,2,1,4,2,3,5,1,3],[1,2,3,1,3,1,4,3,2,1,4,2,5,3,1,5],
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[1,2,3,1,3,1,4,3,2,5,1,2,3,4,5,3],[1,2,3,1,3,1,4,3,2,5,1,2,4,3,5,4],
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- kconcat[1,2,2,1,3,4,4,3] [1,2,2,1,3,4,4,3]
- length(kconcat[[1,2,2,1,3,4,4,3] [1,2,2,1,3,4,4,3]);
val it = 209 : int
ispalindrome: 43
val it =
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val it =
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 [1,2,1,2,3,2,4,5,4,2,3,2,1,2,1],[1,2,1,3,4,3,2,1,2,3,4,3,1,2,1],
 [1,2,1,3,4,3,4,1,4,3,4,3,1,2,1],[1,2,1,3,4,3,5,1,5,3,4,3,1,2,1],
 [1,2,1,3,4,3,2,3,2,3,4,3,1,2,1],[1,2,1,3,4,3,2,5,2,3,4,3,1,2,1],
 [1,2,1,3,4,3,4,3,4,3,4,3,1,2,1],[1,2,1,3,4,3,5,3,5,3,4,3,1,2,1],
 [1,2,1,3,4,3,4,5,4,3,4,3,1,2,1],[1,2,1,3,4,3,5,6,5,3,4,3,1,2,1]]
: int list list
- length it;
val it = 18 : int
length of palindromes: |[1,2,1|x|1,2,3,2,1| = 15
- length(kmul[1,2,3][1,2,3]);

```

val it = 588 : int

List.filter ispalindrome "kmul[1,2,3][1,2,3]": 44 palindromes

```
[[1,2,3,2,3,1,3,1,2],[1,2,3,3,1,2,2,3,1],[1,2,3,2,1,4,3,4,1],
 [1,2,3,2,1,4,5,4,1],[1,2,3,2,4,1,3,1,2],[1,2,3,2,4,1,5,1,2],
 [1,2,3,4,1,2,3,4,1],[1,2,3,4,1,2,5,4,1],[1,2,3,3,1,4,4,5,1],
 [1,2,3,4,3,1,3,5,4],[1,2,3,4,1,5,2,3,1],[1,2,3,4,1,5,3,6,1],
 [1,2,3,4,1,5,6,7,1],[1,2,3,4,5,1,2,3,4],[1,2,3,4,5,1,3,6,4],
 [1,2,3,4,5,1,6,7,4],[1,2,3,2,3,4,3,4,1],[1,2,3,2,3,4,3,4,5],
 [1,2,3,3,4,2,2,3,1],[1,2,3,3,4,2,2,3,5],[1,2,3,4,3,2,3,4,1],
 [1,2,3,4,3,2,3,4,5],[1,2,3,2,4,5,3,5,1],[1,2,3,2,4,5,6,5,1],
 [1,2,3,2,4,5,3,5,6],[1,2,3,2,4,5,6,5,7],[1,2,3,4,5,2,3,4,1],
 [1,2,3,4,5,2,6,4,1],[1,2,3,4,5,2,3,4,6],[1,2,3,4,5,2,6,4,7],
 [1,2,3,3,4,5,5,1,2],[1,2,3,3,4,5,5,6,1],[1,2,3,3,4,5,5,6,7],
 [1,2,3,4,3,5,3,1,2],[1,2,3,4,3,5,3,6,1],[1,2,3,4,3,5,3,6,7],
 [1,2,3,4,5,6,2,3,1],[1,2,3,4,5,6,3,1,2],[1,2,3,4,5,6,7,1,2],
 [1,2,3,4,5,6,3,7,1],[1,2,3,4,5,6,7,8,1],[1,2,3,4,5,6,2,3,7],
 [1,2,3,4,5,6,3,7,8],[1,2,3,4,5,6,7,8,9]] : int list list
```

List.filter ispalindrome "kmul[1,2,1][1,2,1]": 4 palindromes

```
[[1,2,1,2,1,2,1,2,1],[1,2,1,3,1,3,1,2,1],[1,2,1,2,3,2,1,2,1],
 [1,2,1,3,4,3,1,2,1]] : int list list
```

## 2. Palindromes

<sup>10</sup> palindromes: asymPalin(8), includes symPalin(8)

val it =

```
[[1,1,1,1,1,1,1,1],[1,1,1,1,2,2,2,2],[1,1,1,2,1,2,2,2],[1,1,2,1,2,1,2,2],
 [1,1,2,2,1,1,2,2],[1,1,2,2,2,2,1,1],[1,2,1,1,2,2,1,2],[1,2,1,2,1,2,1,2],
 [1,2,1,2,2,1,2,1],[1,2,2,1,1,2,2,1],[1,2,2,1,2,1,1,2],[1,2,2,2,1,1,1,2],
 [1,1,1,2,2,1,1,1],[1,1,2,1,1,2,1,1],[1,2,1,1,1,1,2,1],[1,2,2,2,2,2,2,1],
 [1,1,1,2,2,3,3,3],[1,1,2,3,3,1,2,2],[1,1,2,1,3,2,3,3],[1,1,2,3,1,2,3,3],
 [1,2,1,3,3,2,1,2],[1,2,2,3,3,1,1,2],[1,2,3,1,2,3,1,2],[1,2,3,2,1,3,1,2],
 [1,2,1,1,3,3,2,3],[1,2,1,3,1,3,2,3],[1,2,3,1,3,1,2,3],[1,2,3,3,1,1,2,3],
 [1,2,2,2,3,3,3,1],[1,2,2,3,2,3,3,1],[1,2,3,2,3,2,3,1],[1,2,3,3,2,2,3,1],
 [1,1,2,2,3,3,1,1],[1,1,2,3,2,3,1,1],[1,1,2,3,3,2,1,1],[1,2,1,2,3,1,3,1],
 [1,2,1,3,2,1,3,1],[1,2,1,3,3,1,2,1],[1,2,2,1,1,3,3,1],[1,2,3,1,1,2,3,1],
 [1,2,3,1,1,3,2,1],[1,2,2,1,3,2,2,3],[1,2,2,3,1,2,2,3],[1,2,2,3,3,2,2,1],
 [1,2,1,2,2,3,2,3],[1,2,3,2,2,1,2,3],[1,2,3,2,2,3,2,1],[1,1,2,2,2,2,3,3],
 [1,2,3,3,3,3,1,2],[1,2,3,3,3,2,1],[1,1,1,2,3,1,1,1],[1,1,2,1,1,3,1,1],
 [1,2,1,1,1,1,3,1],[1,2,2,2,2,2,2,3],[1,1,2,2,3,3,4,4],[1,1,2,3,2,3,4,4],
 [1,1,2,3,3,2,4,4],[1,2,1,2,3,4,3,4],[1,2,1,3,2,4,3,4],[1,2,1,3,3,4,2,4],
 [1,2,2,1,3,4,4,3],[1,2,2,3,1,4,4,3],[1,2,2,3,3,4,4,1],[1,2,3,1,4,2,3,4],
 [1,2,3,1,4,3,2,4],[1,2,3,2,4,1,4,3],[1,2,3,2,4,3,4,1],[1,2,3,3,4,4,1,2],
 [1,2,3,3,4,4,2,1],[1,2,3,4,1,2,3,4],[1,2,3,4,1,3,2,4],[1,2,3,4,2,1,4,3],
 [1,2,3,4,2,3,4,1],[1,2,3,4,3,4,1,2],[1,2,3,4,3,4,2,1],[1,2,3,4,4,1,2,3],
 [1,2,3,4,4,2,3,1],[1,2,3,4,4,3,1,2],[1,2,3,4,4,3,2,1],[1,1,1,2,3,4,4,4],
 [1,1,2,3,4,1,2,2],[1,1,2,1,3,4,3,3],[1,1,2,3,1,4,3,3],[1,2,1,3,4,2,1,2],
 [1,2,2,3,4,1,1,2],[1,2,3,1,2,4,1,2],[1,2,3,2,1,4,1,2],[1,2,1,1,3,3,4,3],
 [1,2,1,3,1,3,4,3],[1,2,3,1,3,1,4,3],[1,2,3,3,1,1,4,3],[1,2,2,2,3,3,3,4],
 [1,2,2,3,2,3,3,4],[1,2,3,2,3,2,3,4],[1,2,3,3,2,2,3,4],[1,1,2,3,4,2,1,1],
 [1,1,2,3,3,4,1,1],[1,2,1,3,4,1,2,1],[1,2,3,1,1,4,2,1],[1,2,1,3,3,1,4,1],
 [1,2,3,1,1,3,4,1],[1,2,2,3,4,2,2,1],[1,2,3,2,2,4,2,1],[1,2,3,3,3,3,4,1],
 [1,2,2,3,3,2,2,4],[1,2,3,2,2,3,2,4],[1,2,3,3,3,3,2,4],[1,1,2,3,4,2,5,5],
 [1,1,2,3,3,4,5,5],[1,2,1,3,4,5,2,5],[1,2,2,3,4,5,5,1],[1,2,3,4,5,1,2,3],
 [1,2,3,4,5,2,3,1],[1,2,3,4,5,3,1,2],[1,2,3,4,5,3,2,1],[1,2,3,1,4,5,2,4],
```

```
[1,2,3,2,4,5,4,1],[1,2,3,4,1,5,2,4],[1,2,3,4,2,5,4,1],[1,2,3,4,4,5,1,2],
[1,2,3,4,4,5,2,1],[1,2,1,3,3,4,5,4],[1,2,3,1,4,3,5,4],[1,2,3,3,4,4,5,1],
[1,2,3,4,1,3,5,4],[1,2,3,4,3,4,5,1],[1,2,3,4,4,1,5,3],[1,2,3,4,4,3,5,1],
[1,2,2,3,3,4,4,5],[1,2,3,2,4,3,4,5],[1,2,3,3,4,4,2,5],[1,2,3,4,2,3,4,5],
[1,2,3,4,3,4,2,5],[1,2,3,4,4,2,3,5],[1,2,3,4,4,3,2,5],[1,1,2,3,4,5,1,1],
[1,2,1,3,4,1,5,1],[1,2,3,1,1,4,5,1],[1,2,2,3,4,2,2,5],[1,2,3,2,2,4,2,5],
[1,2,3,3,3,3,4,5],[1,1,2,3,4,5,6,6],[1,2,3,4,5,6,1,2],[1,2,3,4,5,6,2,1],
[1,2,1,3,4,5,6,5],[1,2,3,4,5,1,6,3],[1,2,3,4,5,3,6,1],[1,2,3,1,4,5,6,4],
[1,2,3,4,1,5,6,4],[1,2,3,4,4,5,6,1],[1,2,2,3,4,5,5,6],[1,2,3,4,5,2,3,6],
[1,2,3,4,5,3,2,6],[1,2,3,2,4,5,4,6],[1,2,3,4,2,5,4,6],[1,2,3,4,4,5,2,6],
[1,2,3,3,4,4,5,6],[1,2,3,4,3,4,5,6],[1,2,3,4,4,3,5,6],[1,2,3,4,5,6,7,1],
[1,2,3,4,5,6,2,7],[1,2,3,4,5,3,6,7],[1,2,3,4,4,5,6,7],[1,2,3,4,5,6,7,8]]
: int list list
length it;
```

```
val it=164
```

**Palindromes from [1] to [1,2,3,4,5,6,7]:**

```
[[1],
[1,1],[1,2],
[1,1,1],[1,2,1],[1,2,3],
[1,1,1,1],[1,1,2,2],[1,2,1,2], [1,2,2,1],[1,2,2,3],[1,2,3,1],[1,2,3,4],
[1,1,1,1,1], [1,1,2,1,1],[1,1,2,3,3],[1,2,1,2,1],[1,2,1,3,1],[1,2,2,2,1],[1,2,2,2,3],
[1,2,3,1,2],[1,2,3,2,1],[1,2,3,2,4],[1,2,3,4,1],[1,2,3,4,5],
[1,1,1,1,1,1],[1,1,1,2,2,2],[1,1,2,1,2,2],[1,1,2,2,1,1],[1,1,2,2,3,3],[1,1,2,3,1,1],[1,1,2,3,4,4],
[1,2,1,1,2,1],[1,2,1,1,3,1],[1,2,1,2,1,2],[1,2,1,3,2,3], [1,2,1,3,4,3],[1,2,2,1,1,2],[1,2,2,2,2,1],
[1,2,2,2,2,3],[1,2,2,3,3,1],[1,2,2,3,3,4], [1,2,3,1,2,3],[1,2,3,1,4,3],[1,2,3,2,3,1],[1,2,3,2,3,4],
[1,2,3,3,1,2],
[1,2,3,3,2,1], [1,2,3,3,2,4],[1,2,3,3,4,1],[1,2,3,3,4,5], [1,2,3,4,1,2], [1,2,3,4,2,1],[1,2,3,4,2,5],
[1,2,3,4,5,1],[1,2,3,4,5,6],
[1,1,1,1,1,1,1],
[1,1,1,2,1,1,1],[1,1,1,2,3,3,3],[1,1,2,1,2,1,1],
[1,1,2,1,3,1,1],[1,1,2,2,2,1,1],[1,1,2,2,2,3,3],[1,1,2,3,1,2,2],
[1,1,2,3,2,1,1],[1,1,2,3,2,4,4],[1,1,2,3,4,1,1],[1,1,2,3,4,5,5],
[1,2,1,1,1,2,1],[1,2,1,1,1,3,1],[1,2,1,2,1,2,1],[1,2,1,2,3,2,3],
[1,2,1,3,1,2,1],[1,2,1,3,1,4,1],[1,2,1,3,2,1,2],[1,2,1,3,4,2,4],
[1,2,1,3,4,5,4],[1,2,2,1,2,2,1],[1,2,2,1,3,3,1],[1,2,2,2,2,2,1],
[1,2,2,2,2,2,3],[1,2,2,3,1,1,2],[1,2,2,3,2,2,1],[1,2,2,3,2,2,4],
[1,2,2,3,4,4,1],[1,2,2,3,4,4,5],[1,2,3,1,2,3,1],[1,2,3,1,3,2,1],
[1,2,3,1,3,4,1],[1,2,3,1,4,2,1],[1,2,3,1,4,5,1],[1,2,3,2,1,2,3],
[1,2,3,2,3,2,1],[1,2,3,2,3,2,4],[1,2,3,2,4,2,1],[1,2,3,2,4,2,5],
[1,2,3,3,3,1,2],[1,2,3,3,3,2,1],[1,2,3,3,3,2,4],[1,2,3,3,3,4,1],
[1,2,3,3,3,4,5],[1,2,3,4,1,2,3],[1,2,3,4,1,5,3],[1,2,3,4,2,3,1],
[1,2,3,4,2,3,5],[1,2,3,4,3,1,2],[1,2,3,4,3,2,1],[1,2,3,4,3,2,5],
[1,2,3,4,3,5,1],[1,2,3,4,3,5,6],[1,2,3,4,5,1,2],[1,2,3,4,5,2,1],
[1,2,3,4,5,2,6],[1,2,3,4,5,6,1],[1,2,3,4,5,6,7].
```

**Symmetric palindromes from [1] to [1,2,3,4,5,6,7]: 31**

```
[[1],[1,1],
[1,1,1],[1,2,1],
[1,1,1,1],[1,2,2,1],
[1,1,1,1,1],[1,1,2,1,1],[1,2,1,2,1],[1,2,2,2,1],[1,2,3,2,1],
[1,1,1,1,1,1],[1,1,2,2,1,1],[1,2,1,1,2,1],[1,2,2,2,2,1],[1,2,3,3,2,1],
[1,1,1,1,1,1,1],[1,1,1,2,1,1,1],
[1,1,2,1,2,1,1],[1,1,2,2,2,1,1],[1,1,2,3,2,1,1],[1,2,1,1,1,2,1],
[1,2,1,2,1,2,1],[1,2,1,3,1,2,1],[1,2,2,1,2,2,1],[1,2,2,2,2,2,1],
[1,2,2,3,2,2,1],[1,2,3,1,3,2,1],[1,2,3,2,3,2,1],[1,2,3,3,3,2,1],[1,2,3,4,3,2,1]] : int list list
```

### 3. Palindromes and Tcontexts

**Tcontexture (9, 2)**

- [1,1,1,1,1,1,1,1,1],[1,1,1,1,1,2,2,2,2],[1,1,1,1,2,1,2,2,2],
- [1,1,1,1,2,2,1,2,2],[1,1,1,1,2,2,2,1,2],[1,1,1,1,2,2,2,2,1],
- [1,1,1,2,1,1,2,2,2],[1,1,1,2,1,2,1,2,2],[1,1,1,2,1,2,2,1,2],
- [1,1,1,2,1,2,2,2,1],[1,1,1,2,2,1,1,2,2],[1,1,1,2,2,1,2,1,2],
- [1,1,1,2,2,1,2,2,1],[1,1,1,2,2,2,1,1,2],[1,1,1,2,2,2,1,2,1],
- [1,1,1,2,2,2,2,1,1],[1,1,2,1,1,1,2,2,2],[1,1,2,1,1,2,1,2,2],
- [1,1,2,1,1,2,2,1,2],[1,1,2,1,1,2,2,2,1],[1,1,2,1,2,1,1,2,2],
- [1,1,2,1,2,1,2,1,2],[1,1,2,1,2,1,2,2,1],[1,1,2,1,2,1,2,1,2],
- [1,1,2,1,2,1,2,1,2],[1,1,2,1,2,1,2,2,1],[1,1,2,1,2,1,2,1,2],
- [1,1,2,1,2,2,1,2,1],[1,1,2,1,2,2,2,1,1],[1,1,2,2,1,1,1,2,2],
- [1,1,2,2,1,1,2,2,1],[1,1,2,2,1,1,2,2,1],[1,1,2,2,1,2,1,1,2],
- [1,1,2,2,1,2,1,2,1],[1,1,2,2,1,2,2,1,1],[1,1,2,2,2,1,1,1,2],
- [1,1,2,2,2,1,1,2,1],[1,1,2,2,2,1,2,1,1],[1,1,2,2,2,2,1,1,1],
- [1,1,2,2,2,2,1,1,1],[1,1,2,2,2,2,1,1,1],[1,1,2,2,2,2,2,1,1,1],
- [1,1,2,2,2,2,1,2,1,1],[1,1,2,2,2,2,1,1,2,1],[1,1,2,2,2,2,1,1,1,2],
- [1,1,2,2,2,2,1,2,2,1],[1,1,2,2,2,2,1,2,1,1],[1,1,2,2,2,2,1,2,1,2],
- [1,1,2,2,2,2,1,2,2,1],[1,1,2,2,2,2,1,2,2,1],[1,1,2,2,2,2,1,2,1,2],
- [1,1,2,2,2,2,2,1,1,1],[1,1,2,2,2,2,2,1,1,1],[1,1,2,2,2,2,2,1,1,1],
- [1,1,2,2,2,2,2,1,2,1],[1,1,2,2,2,2,2,1,2,1],[1,1,2,2,2,2,2,1,1,2],
- [1,1,2,2,2,2,2,2,1,1],[1,1,2,2,2,2,2,2,1,1],[1,1,2,2,2,2,2,2,1,1],
- [1,1,2,2,2,2,2,2,1,2],[1,1,2,2,2,2,2,2,1,2],[1,1,2,2,2,2,2,2,1,2],
- [1,1,2,2,2,2,2,2,2,1],[1,1,2,2,2,2,2,2,2,1],[1,1,2,2,2,2,2,2,2,1],
- [1,1,1,2,2,2,2,1,2],[1,1,1,2,2,2,2,2,1],[1,1,1,2,2,2,2,2,1],
- [1,1,1,2,2,2,2,2,2],[1,1,1,2,2,2,2,2,2],[1,1,1,2,2,2,2,2,2],
- [1,1,1,2,2,2,2,2,2],[1,1,1,2,2,2,2,2,2],[1,1,1,2,2,2,2,2,2],
- [1,1,1,1,2,2,2,2,2],[1,1,1,1,1,1,2,2,2],[1,1,1,1,1,1,2,2,2],
- [1,1,1,1,1,2,2,2,1,2],[1,1,1,1,1,2,2,2,1],[1,1,1,1,2,1,1,2,2],
- [1,1,1,1,2,1,2,1,2],[1,1,1,1,2,1,2,2,1],[1,1,1,1,2,2,1,1,2],
- [1,1,1,1,2,2,1,2,1],[1,1,1,1,2,2,2,1,1],[1,1,1,2,1,1,1,2,2],
- [1,1,1,2,1,1,2,1,2],[1,1,1,2,1,1,2,2,1],[1,1,1,2,1,2,1,1,2],
- [1,1,1,2,1,2,1,2,1],[1,1,1,2,1,2,2,1,1],[1,1,1,2,2,1,1,1,2],
- [1,1,1,2,2,1,1,2,1],[1,1,1,2,2,1,2,1,1],[1,1,1,2,2,2,1,1,1],
- [1,1,1,2,2,1,2,1,2],[1,1,1,2,2,2,1,2,1],[1,1,2,1,1,1,2,2,1],
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[1,2,2,2,2,2,2,2,2]
```

**Palindromes (9,2): 16**

```
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[1,2,2,1,1,1,2,2,1],[1,2,2,1,2,1,2,2,1],[1,2,1,2,2,2,1,2,1],
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[1,1,1,1,2,1,1,1,1]] : int list list
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**Tcontexture (9,3):**

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[1,1,2,2,3,1,3,2,3],[1,1,2,2,3,1,3,3,2],[1,1,2,2,3,2,1,3,3],
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 [1,2,3,2,3,2,2,3,2],[1,2,3,2,3,2,3,2,2],[1,2,3,2,3,3,2,2,2],  
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 [1,1,1,1,1,2,3,1,2],[1,1,1,1,1,2,3,2,1],[1,1,1,1,1,2,1,3,3],  
 [1,1,1,1,1,2,3,1,3],[1,1,1,1,1,2,3,3,1],[1,1,1,1,1,2,1,1,2,3],  
 [1,1,1,1,1,2,3,1,3],[1,1,1,1,1,2,3,3,1],[1,1,1,1,1,2,1,1,2,3],  
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 [1,1,1,1,2,1,3,1,2],[1,1,1,1,2,1,3,2,1],[1,1,1,1,2,2,1,1,3],  
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 [1,1,1,2,1,3,1,2,1],[1,1,1,2,1,3,2,1,1],[1,1,1,2,2,1,1,1,3],  
 [1,1,1,2,2,1,1,3,1],[1,1,1,2,2,1,3,1,1],[1,1,1,2,2,3,1,1,1],  
 [1,1,1,2,3,1,1,1,2],[1,1,1,2,3,1,1,2,1],[1,1,1,2,3,1,2,1,1],

[1,1,1,2,3,2,1,1,1],[1,1,1,2,1,1,1,3,3],[1,1,1,2,1,1,3,1,3],  
 [1,1,1,2,1,1,3,3,1],[1,1,1,2,1,3,1,1,3],[1,1,1,2,1,3,1,3,1],  
 [1,1,1,2,1,3,3,1,1],[1,1,1,2,3,1,1,1,3],[1,1,1,2,3,1,1,3,1],  
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 [1,2,2,2,2,3,2,1],[1,2,2,2,2,3,1,2],[1,2,2,2,2,1,2,2,3],  
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 [1,2,3,2,2,2,1,2],[1,2,3,2,2,2,1,2,2],[1,2,3,2,2,1,2,2,2],  
 [1,2,3,2,1,2,2,2,2],[1,2,3,1,2,2,2,2,2],[1,1,2,2,2,2,2,3],

```
[1,1,2,2,2,2,3,2],[1,1,2,2,2,3,2,2],[1,1,2,2,3,2,2,2],
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[1,1,1,1,2,1,1,3,1],[1,1,1,1,2,1,3,1,1],[1,1,1,1,2,3,1,1,1],
[1,1,1,2,1,1,1,3],[1,1,1,2,1,1,1,3,1],[1,1,1,2,1,1,3,1,1],
[1,1,1,2,1,3,1,1,1],[1,1,1,2,3,1,1,1,1],[1,1,2,1,1,1,1,3],
[1,1,2,1,1,1,1,3,1],[1,1,2,1,1,1,3,1,1],[1,1,2,1,1,3,1,1,1],
[1,1,2,1,3,1,1,1,1],[1,1,2,3,1,1,1,1,1],[1,2,1,1,1,1,1,3],
[1,2,1,1,1,1,3,1],[1,2,1,1,1,1,3,1,1],[1,2,1,1,1,3,1,1,1],
[1,2,1,1,3,1,1,1,1],[1,2,1,3,1,1,1,1,1],[1,2,3,1,1,1,1,1,1],
[1,2,2,2,2,2,3],[1,2,2,2,2,2,3,2],[1,2,2,2,2,3,2,2],
[1,2,2,2,3,2,2,2],[1,2,2,2,3,2,2,2,2],[1,2,2,3,2,2,2,2,2],
[1,2,3,2,2,2,2,2],[1,2,3,3,3,3,3,3,3]
```

**Palindromes (9, 3): 65**

```
[[1,1,1,2,2,3,3,3],[1,1,2,1,2,3,2,3,3],[1,1,2,3,2,1,2,3,3],
[1,1,2,3,3,3,1,2,2],[1,2,1,1,2,3,3,2,3],[1,2,1,3,2,1,3,2,3],
[1,2,1,3,3,3,2,1,2],[1,2,2,2,1,3,3,3,1],[1,2,2,3,1,2,3,3,1],
[1,2,2,3,3,3,1,1,2],[1,2,3,1,2,3,1,2,3],[1,2,3,1,3,2,3,1,2],
[1,2,3,2,1,3,2,3,1],[1,2,3,2,3,1,3,1,2],[1,2,3,3,1,2,2,3,1],
[1,2,3,3,2,1,1,2,3],[1,1,2,3,2,3,2,1,1],[1,1,2,3,3,3,2,1,1],
[1,2,1,3,2,3,1,2,1],[1,2,3,1,2,1,3,2,1],[1,2,1,3,3,3,1,2,1],
[1,2,3,1,3,1,3,2,1],[1,2,2,3,1,3,2,2,1],[1,2,3,2,1,2,3,2,1],
[1,2,3,3,1,3,3,2,1],[1,2,2,3,3,3,2,2,1],[1,2,3,2,3,2,3,2,1],
[1,2,3,3,2,3,3,2,1],[1,1,1,1,2,3,3,3,3],[1,1,1,2,3,1,2,2,2],
[1,1,2,1,3,2,1,2,2],[1,1,2,2,3,1,1,2,2],[1,1,2,2,3,2,2,1,1],
[1,2,1,1,3,2,2,1,2],[1,2,1,2,3,1,2,1,2],[1,2,1,2,3,2,1,2,1],
[1,2,2,1,3,1,2,2,1],[1,2,2,1,3,2,1,1,2],[1,2,2,2,3,1,1,1,2],
[1,1,2,2,1,3,3,1,1],[1,1,2,3,1,2,3,1,1],[1,1,2,3,1,3,2,1,1],
[1,2,1,2,1,3,1,3,1],[1,2,1,3,1,2,1,3,1],[1,2,1,3,1,3,1,2,1],
[1,2,2,1,1,1,3,3,1],[1,2,3,1,1,1,2,3,1],[1,2,3,1,1,1,3,2,1],
[1,2,2,1,2,3,2,2,3],[1,2,2,3,2,1,2,2,3],[1,2,2,3,2,3,2,2,1],
[1,2,1,2,2,2,3,2,3],[1,2,3,2,2,2,1,2,3],[1,2,3,2,2,2,3,2,1],
[1,1,2,2,2,2,3,3],[1,2,3,3,3,3,3,1,2],[1,2,3,3,3,3,3,2,1],
[1,1,1,2,3,2,1,1,1],[1,1,2,1,3,1,2,1,1],[1,2,1,1,3,1,1,2,1],
[1,2,2,2,3,2,2,2,1],[1,1,1,2,1,3,1,1,1],[1,1,2,1,1,1,3,1,1],
[1,2,1,1,1,1,1,3,1],[1,2,2,2,2,2,2,3]] : int list list
```

**Symmetric palindromes (9, 3): 25**

```
[[1,1,2,3,2,3,2,1,1],[1,1,2,3,3,3,2,1,1],[1,2,1,3,2,3,1,2,1],
[1,2,3,1,2,1,3,2,1],[1,2,1,3,3,3,1,2,1],[1,2,3,1,3,1,3,2,1],
[1,2,2,3,1,3,2,2,1],[1,2,3,2,1,2,3,2,1],[1,2,3,3,1,3,3,2,1],
```



[1,2,2,3,3,2,2,1],[1,2,3,2,3,2,3,2,1],[1,2,3,3,2,3,3,2,1],  
 [1,1,2,2,3,2,2,1,1],[1,2,1,2,3,2,1,2,1],[1,2,2,1,3,1,2,2,1],  
 [1,1,2,3,1,3,2,1,1],[1,2,1,3,1,3,1,2,1],[1,2,3,1,1,1,3,2,1],  
 [1,2,2,3,2,3,2,2,1],[1,2,3,2,2,2,3,2,1],[1,2,3,3,3,3,3,2,1],  
 [1,1,1,2,3,2,1,1,1],[1,1,2,1,3,1,2,1,1],[1,2,1,1,3,1,1,2,1],  
 [1,2,2,2,3,2,2,2,1]

**Tcontexture (9, 4):**

[1,1,1,2,2,3,3,4,4],  
 [1,1,1,2,2,3,4,3,4],[1,1,1,2,2,3,4,4,3],[1,1,1,2,3,2,3,4,4],  
 [1,1,1,2,3,2,4,3,4],[1,1,1,2,3,2,4,4,3],[1,1,1,2,3,3,2,4,4],  
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**Palindromes (9, 4)**

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[[1,2,3,1,4,3,1,2,3],[1,2,3,3,4,1,1,2,3],[1,2,2,2,3,4,4,4,1],  
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 [1,1,2,3,2,4,2,1,1],[1,1,2,3,3,3,4,1,1],[1,2,1,3,2,4,1,2,1],  
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[[1,2,3,3,1,3,3,4,1],[1,2,2,3,3,3,2,2,4],[1,2,3,2,3,2,3,2,4],  
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 [1,2,3,3,3,3,3,2,4],[1,1,1,2,3,4,1,1,1],[1,1,2,1,3,1,4,1,1],  
 [1,2,1,1,3,1,1,4,1],[1,2,2,2,3,2,2,2,4]]

**Reductions: Dcontexture**

- Dcontexture 9: 30

val it =

[[1,1,1,1,1,1,1,1,1],[1,1,1,1,1,2,2,2,2],[1,1,1,1,1,1,2,2,2],  
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 [1,1,1,1,2,2,2,3,3],[1,1,1,1,2,2,2,2,3],[1,1,1,1,1,2,2,3,3],  
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 [1,1,1,2,2,3,3,4,4],[1,1,1,2,2,2,3,3,4],[1,1,1,1,2,2,3,3,4],  
 [1,1,1,1,2,2,2,3,4],[1,1,1,1,2,2,3,4],[1,1,1,1,1,2,3,4]]

```
[1,1,2,2,3,3,4,4,5],[1,1,1,2,2,3,3,4,5],[1,1,1,2,2,2,3,4,5],
[1,1,1,1,2,2,3,4,5],[1,1,1,1,1,2,3,4,5],[1,1,2,2,3,3,4,5,6],
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[1,1,1,2,3,4,5,6,7],[1,1,2,3,4,5,6,7,8],[1,2,3,4,5,6,7,8,9]]
: int list list
```

Palindrome “Dcontexture 9”:

```
val it = [[1,1,1,1,1,1,1,1,1],[1,1,1,2,2,2,3,3,3],[1,2,3,4,5,6,7,8,9]]
: int list list
```

**Tcontexture (9,5); parts of Tcontexture (9,6)**

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### Parts of Tcontexture (9, 6)

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