# Topological neighbours as a function of distance

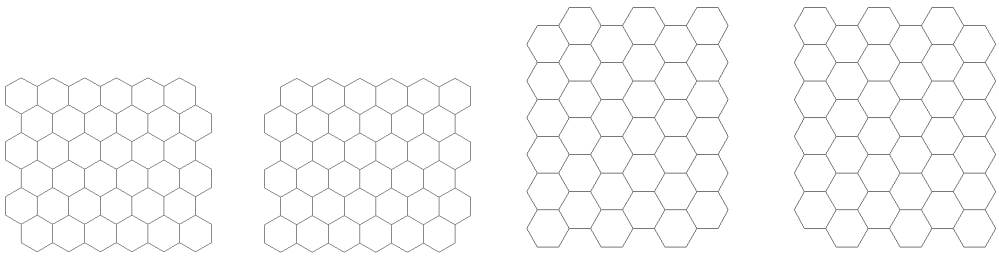
The pictures represent the effort to identify a pattern which could allow for the direct identification of neighbour positions relative to a central cell, at any distance **n**.

The neighbouring cells are distributed across 6 partitions, with respect to which which side of the central hexagon they are facing.

For any distance **n**, each partition contains that number of neighbours (e.g. for distance 5, each partition contains 5 neighbours, and there is a total of 6x5 = 30 neighbours).

The hexagons can have two possible orientations in a grid, pointy or flat topped.
If the hexagons are pointy topped, the grids can have two possible row offsets. Similarly, if the hexagons are flat topped, two column offsets are possible.

Odd-PointyTopped Even-PointyTopped Even-FlatTopped Odd-FlatTopped



For the pointy topped conformation, two neighbouring patterns (and therefore two methods) are distinguishable, depending on which row the hexagon is. Same applies for the flat topped, where the patterns depend on which column the cell is.
The only difference between the odd and even grid structures is to switch which of the two methods retrieves the neighbours.
The parameters to take into account are **n**, the distance to retrieve neighbours, and **i**, an iterator from **1** to **n**, in order to define the $(x, y)$ coordinates in each of the partitions.

## Even - Flat Topped topology

### Even column (green)

$a$ and $d$ partitions maintain their $x$ coordinate constant at respectively $n$ and $-n$.
For $a$, the starting $y$ coordinate is $ceil(-n/2)$ and until $n$ neighbours have been generated, $y$ increments one value.
The $y$ coordinate for $d$ starts at $ceil(n/2)$ and subtracts 1 until the total number of neighbours is reached.

$b$ and $f$ increment their $x$ coordinates one value for every neighbour. At each value of $i$, the $x$ value of $b$ is $i$, while for $f$ it is $i - 1$.
The $y$ coordinate starts respectively at $n$ and $-n$. It will decrease (respective increase) if $i$ is even.

$c$ and $e$ partitions have the same rationale as $b$ and $f$. The $x$ coordinate for $c$ and $e$ is $-(i-1)$ and $-i$. The $y$ coordinate starts at $n$ for $c$, and $-(n-1)$ for $e$, decreasing (respective increase) for odd $i$.

### Odd column (red)

$a$ and $d$ partitions maintain their $x$ coordinate constant at respectively $n$ and $-n$.

For $a$, the starting $y$ coordinate is $floor(-n/2)$ and until $n$ neighbours have been generated, $y$ increments one value.

The $y$ coordinate for $d$ starts at $floor(n/2)$ and subtracts 1 until the total number of neighbours is reached.

$b$ and $f$ increment their $x$ coordinates one value for every neighbour. At each value of $i$, the $x$ value of $b$ is $i$, while for $f$ it is $i - 1$.

The $y$ coordinate starts respectively at $n - 1$ and $-n$. It will decrease (respective increase) if $i$ is odd.

The $x$ coordinate for $c$ and $e$ is $-(i - 1)$ and $-i$.

The $y$ coordinate starts at $n$ for $c$, and $-n$ for $e$, decreasing (respective increase) for even $i$.

## Even - Pointy Topped topology

### Even row (green)

$a$ and $e$ partitions change their $y$ coordinates one value for every neighbour. At each value of $i$, the $y$ value of $a$ is $-i$, while for $e$ it is $-(i - 1)$.

The $x$ coordinate starts respectively at $n$ and $-n$. It will decrease (respective increase) if $i$ is even.

$b$ and $d$ partitions have their $y$ coordinate evolving as $i - 1$ and $i$ respectively, while their $x$ coordinate starts at $n$ and $-(n - 1)$. They will decrease (respective increase) for odd $i$ values.

$c$ and $f$ partitions maintain constant $y$ coordinate, at $n$ and $-n$. Their respective $x$ values start at $ceil(n/2)$ and $ceil(-n/2)$. They respectively decrease/increase until the total number of neighbours has been reached.

### Odd row (red)

$a$ and $e$ partitions change their $y$ coordinates one value for every neighbour. For each value of $i$, the $y$ value of $a$ is $-i$, while for $e$ it is $-(i - 1)$.

The $x$ coordinate starts respectively at $n - 1$ and $-n$. It will decrease (respective increase) if $i$ is odd.

$b$ and $d$ partitions have their $y$ coordinate evolving as $i - 1$ and $i$, while their $x$ coordinate starts at $n$ and $-n$. They will decrease (respective increase) for even $i$ values.

$c$ and $f$ partitions maintain constant $y$ coordinate, at $n$ and $-n$. Their respective $x$ values start at $floor(n/2)$ and $floor(-n/2)$. They respectively decrease/increase until the total number of neighbours has been reached.