PART ONE : PIN JUMP(ING) and **PIN-STEP**

QUESTION :
Do ****you*** know how to make a **17L 10B** THK *cordage route* (you are not asked, for the moment, to put any type of crossings in place) in the cordage when being given :
--- the necessary and sufficient length of cordage,
--- 20 PINS,
--- a cylinder / mandrel
--- (let us charitably add paper and pencil for those who cannot compute mentally).

I bet many will be lost without the usual gris-gris or fetish : a brainless ready made recipe.

Yet, it is a "no problem" answer. (Ingredients needed: just average intelligence and solid basic knowledge).

This is the point where no amount of so-called experience can save the day ; for me that is a good occasion to laugh*** !
No amount of practical experience will save you here without the necessary "second leg" : the theoretical or formalized distillation made from experience.

Two ways exist :

----- **IFF** you have '*A REAL KNOWLEDGE'* of the **ENLARGEMENT PROCESSES** then you will just make a **3L 2 B**.
This **3L 2 B** after a **LEFT** side enlargement will give you a **7L 4B**
In its turn this **7L 4B** after a **RIGHT** side enlargement will give you your **17L 10B.**
DONE ! BRAVO !

----- second way, easy as pie even for the none too favourable to so called 'theory', is to put **10** pins at the **TOP EDGE**, **10** pins at **BOTTOM EDGE,** then to take the cordage in hands. (PINs *in the correct position* ***please*** : 17L ; 17 is **ODD** so "shift" the BOTTOM PINS **CLOCKWISE** in relation with their equivalent on TOP)

Now you are ready for a really easy direct making of the **17L 10B** using the **PIN-STEPS**.

If you lack both of those 2 tools (ENLARGEMENTS and PINs-STEPs) then you are in a difficult situation..
I could almost feel sorrow for you; almost only, as it takes a few minutes to free oneself.

Knowing the **PIN-STEPS** (or instead, if you are so inclined, may be, the PINS-JUMPS) and the ultra simple **CLOCK-ADDITION** (**MODULUS** by its grand name) you can trace **ANY THK cordage route** ; it will only remain to add the CODING you want on it. (Ah! Yes! you do have to know the meaning of "the four types of coding").

CLOCK ADDITION
(12 HOURS AM , PM)(12 for 'day', 12 for 'night')

09:30 is **09:30** (**AM** as there is no change in the numbers)
15:20 is **03:20** (**PM** as there is change in the writing of the numbers, one 360° worth 12 hours 'round' has already been 'run')

note : when using modulo 24, so forgetting the 'convention' of AM, PM which being letters cannot translate into numbers, then **24:00** (midnight) is **00:00** and not **01:00** (modulo **N** use **0** to **N-1** and NOT **1** to **N**)

Cannot be simpler really, yet it is a rare one (I have yet to meet one, either in person or on forums !) that seems to able to make a THK of any arbitrary L & B dimensions from scratch.

Let us first see a method I don't favour though it works all right and is 'solid'.
Simply I find that it feels cumbersome and that it does not comply economically with an easy algorithm.
This is **PIN-JUMPING** or **PIN-SKIPPING**

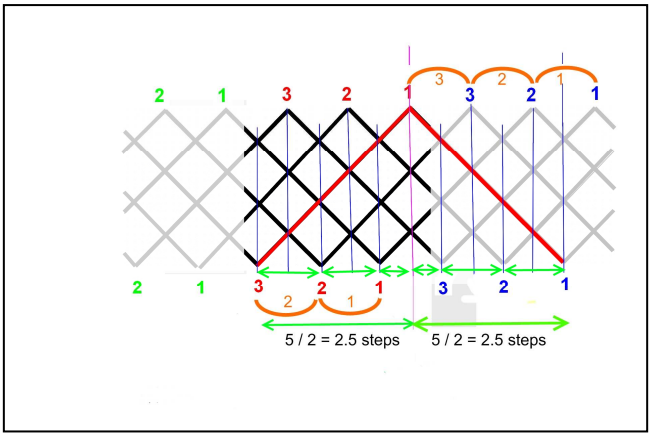
Computation of **PIN JUMPING** is quite easy.
(Excellent diagrams are given there and you should not miss studying them at http://www.shurdington.org/Scouts/TurksHead.htm)

Remember that when laying a Regular Knot (RK**) on a **VERTICAL CYLINDER** using **PINS** (ONE BIGHT==ONE PIN) at the **TOP** and at the **BOTTOM** (or at the **RIGHT** and the **LEFT** if **MANDREL** held HORIZONTAL) you need to **JUMP** or **SKIP PINS** when going from one PIN situated on one border to another PIN situated on the other border when laying a Half-Period. **(RK means that it is made on a THK cordage route with a single strand)

PINS JUMPS = (Number of desired LEAD – 2) / 2 = (Number of LEADS / 2) - 1
This gives you the NUMBER OF PINS you have to JUMP OVER

JUMP can be **0 to n** ; note that **JUMP=0** is **ONE STEP**.

BUT ***pins jumped over,*** IMO, is neither the most rational method, nor the one the more closely related to the structural mathematical facts that explain that it works.
Fig A



That is why I will not dwell on the subject (it is more than adequately treated on the site I just gave above) ; I prefer to spend time on the way more satisfactory to me, the **PINS STEPS**

You will observe that if the square grid respects the symmetry and the PIN-STEPS it completely puts out of kilter the relation between the dimensions en LEADs and in BIGHTs.

A **5L 3B** should be, quite evidently, greater in height that in width which is not really the case in ***Fig A***.
This is why the square grid is inferior to the *isometric* grid for representing those cylindrical knots. (compare with ***Fig C***)

Fig B

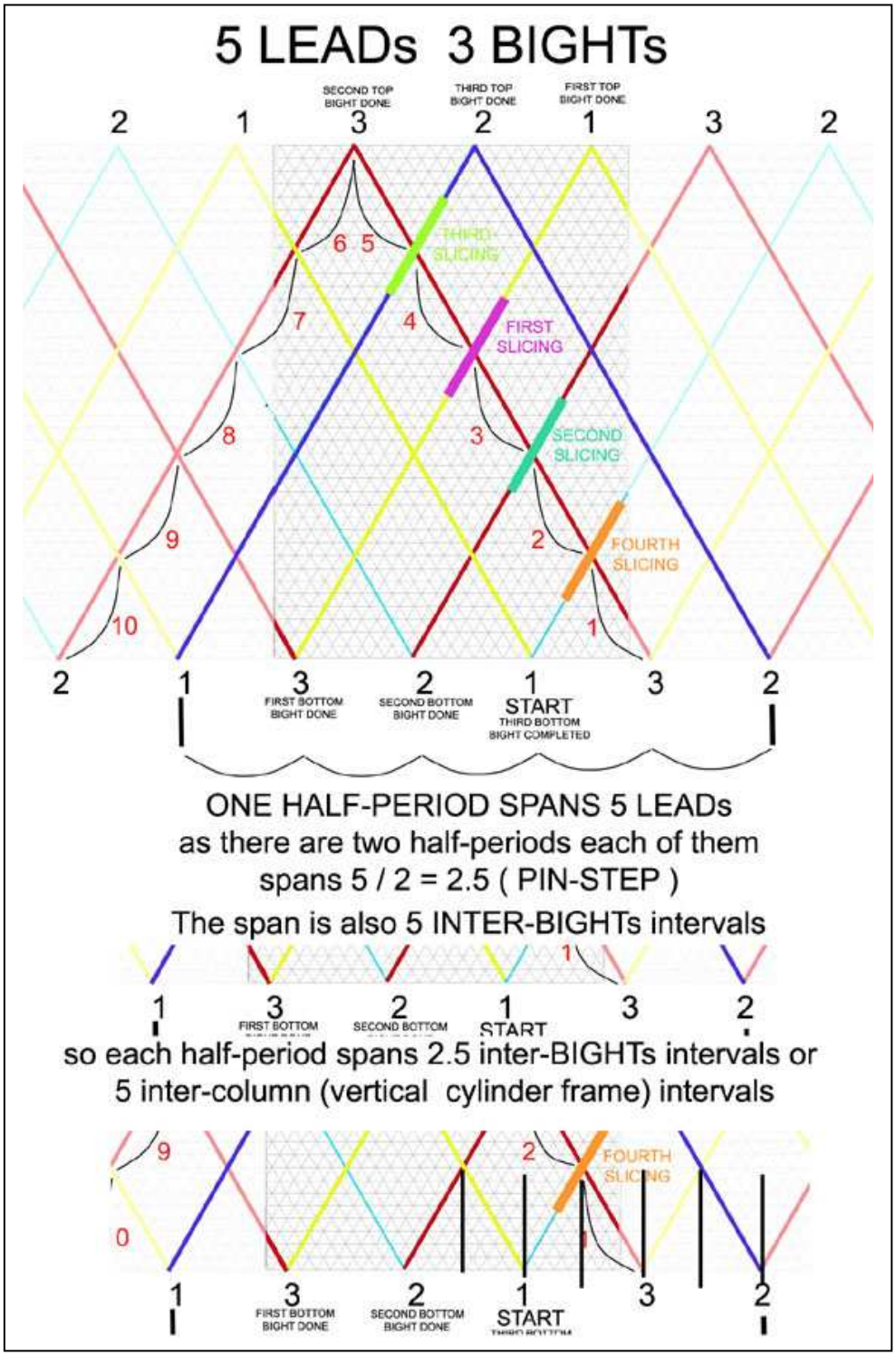
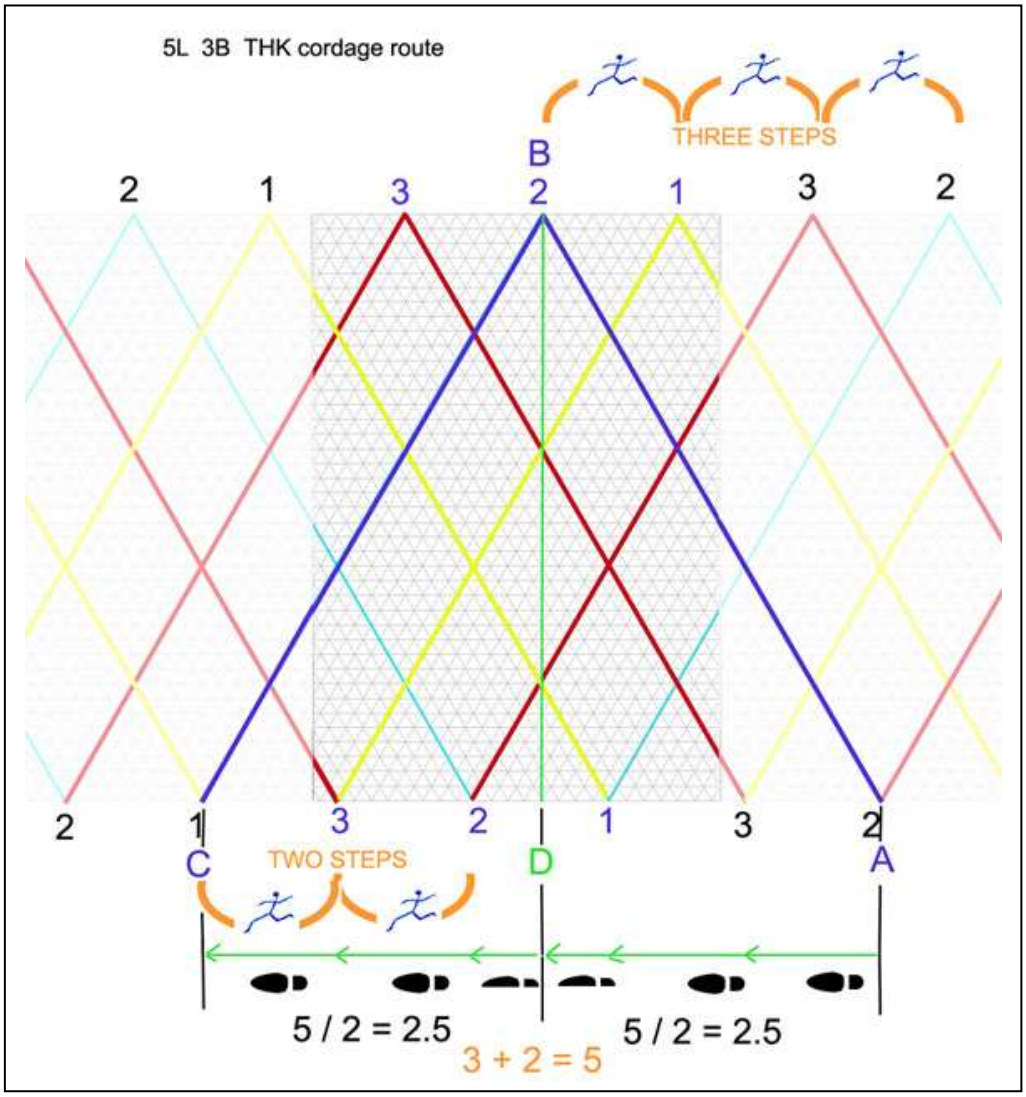


Fig B *explain the "slicing" of one Half-Period into LEADs , really, here* ***PARTs*** *seems much better, by Half-periods of different direction. Note that in this case one Half-period makes TWO slicing.*

Fig C



Read and have a second attentive look at ***Fig C,*** in particular the shoes marks and the stepping stick figure.

L/2 or PIN-STEPS My preference goes to **PIN-STEPS** which I find more immediately derived from the anatomical and mathematical structure of the THK than the JUMPS can be.

PINS JUMPED OVER and **PINS STEPS** are like the old pickets and intervals problem : either you count the pickets or you count the interval between *two* pickets.
number of intervals = number of pickets (NP) minus one.

2 pins JUMPs : start PIN is A then jumped are B and C, arrival pin is D.
Hurdles jumped over.

3 STEPs = start is PIN A, first step is on PIN B, second step is on PIN C, the third step arrives on PIN D.
Japanese stepping stones

The simple formula to get, in a direct fashion, the "count"to do in order to be on the *NEXT PIN* (instead of the awkward number of *skipped* pins between the 2 extremity pins that PIN JUMPS use) is :

PIN STEPS = L / 2 **ex 7 / 2 = 3. 5 so 3 and 4**

(USING THIS DEMANDS A PROPER NUMBERING OF THE PINS ON BOTH KNOT EDGES AND OF ONE KNOT-EDGE RELATIVELY TO THE OTHER KNOT-EDGE – see annexe part 3-)

Let us take again our **17L 10B**

17 / 2 = **8.5**
8.5 so it will be **9** and **8** , **9** at the TOP , **8** for the BOTTOM

DO NOT forget that the pins go a merry go round so use **MODULUS($_{B}$)**, here MODULUS($_{B}$)=10

Start is at the BOTTOM, ODD –numbered HP go from BOTTOM-RIGHT to TOP-LEFT (cylinder) and EVEN-numbered HP go from TOP-RIGHT to BOTTOM-LEFT.

Note that you have the choice to number your PINS either **1 to 10** or **0 to 9**.
(no importance for "in the cord" but highly important when using formulas). So it is :

```
start  at BOTTOM PIN   1
          go to TOP PIN  10  ( 1 + 9 = 10 ; 10 modulo(10) is '0')
                    go to BOTTOM PIN   8 ( 10 +8 =18 ; 18 modulo(10) == 8)
                              go top TOP PIN 7 ( 8 + 9 = 17 ; 17 modulo(10) ==  7)
                    go to BOTTOM PIN   5
          go top TOP PIN 4
 go to BOTTOM PIN   2
          go top TOP PIN 1
                    go to BOTTOM PIN   9
                              go top TOP PIN 8
                    go to BOTTOM PIN   6
          go top TOP PIN 5
 go to BOTTOM PIN 3
          go top TOP PIN 2
                    go to BOTTOM PIN 10
                              go top TOP PIN 9
   go to BOTTOM PIN 7
          go top TOP PIN 6
                    go to BOTTOM PIN   4
                              go top TOP PIN 3
                    go to BOTTOM PIN   1   curve has closed on itself, the Working End meets with the
Standing Part.
```

Now you know how to accomplish that horribly difficult feat (just jesting!) of making ANY THK CORDAGE ROUTE you want.

PART TWO : HOW TO POSITION AND NUMBER THE PINS.

Chosen frame of reference : a vertical cylinder.

*** With an **ODD** number of LEADS the **numbered pins** are best laid in this manner (less deformation induced in the knot as tension are more balanced all over) :

```
    0     5     4     3     2     1
0     5     4     3     2     1
NOT
0     5     4     3     2     1
0     5     4     3     2     1
NOT
0     5     4     3     2     1
    0     5     4     3     2     1
```

MNEMONIC == with ODD keep the oddness == SHIFT the pins

*** With an **EVEN** number of LEADS the **numbered pins** are best laid in this manner (less …) :

```
0     5     4     3     2     1
0     5     4     3     2     1

NOT
    0     5     4     3     2     1
0     5     4     3     2     1
NOT
0     5     4     3     2     1
    0     5     4     3     2     1
```

MNEMONIC == with EVEN keep the evenness == DO NOT SHIFT the pins

The way the PINs seem disposed in computed grids makes sense ONLY if you see it as being A CIRCULAR disposition and NOT AS A LINEAR disposition.

There is, apparently,' a lesser difficulty in seeing that particular point when having, like Schaake did, **ROW ZERO** ANYWHERE *BUT* AT THE LOWERMOST LINE in the grid.

Alas that can be somewhat impractical for a computer program, so it may be decided to go for standardization: **ROW ZERO == lowermost**.

This makes for easier computing and also allows comparability between grids being constantly maintained.

This illustration under (***Fig D)*** is intended as a summary to be kept in mind after understanding it.

The whole point of this is not to say that you will not be able to make knots but that if you do not comply with that you will induce deformations in your knots that will always be keep, despite dressing, fairing and tightening, vestigial remnants of that skewed laying.

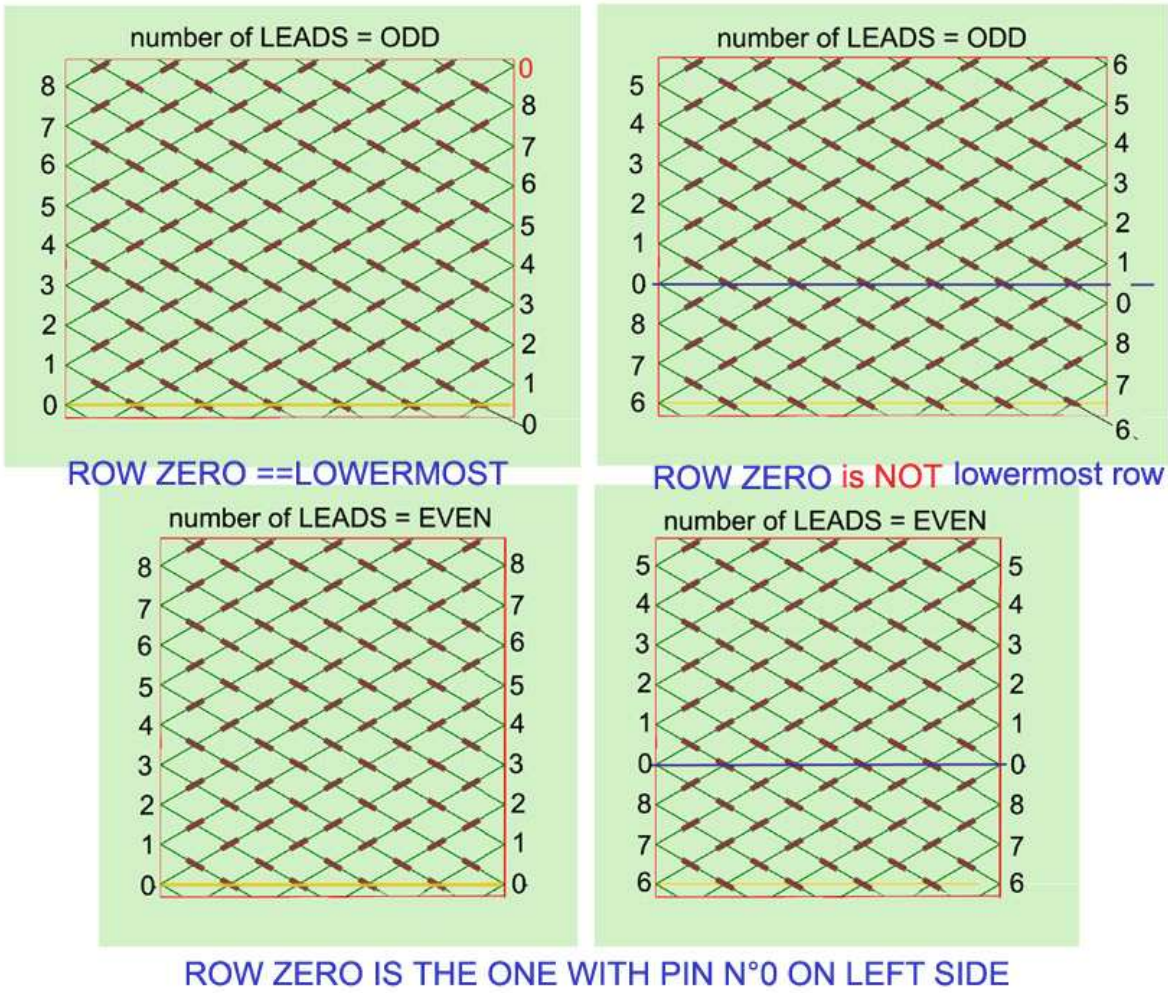


Fig D

Any perceived discrepancy is a mirage created by the fact that software like **HP by HP** or **RKB** *always* put **ROW ZERO** as the lowermost **ROW** while Schaake's put this **ROW ZERO** *anywhere **BUT*** on the lowermost line.

This choice was made for **software** for the sake of maintaining comparability between different grids **AND** for ease of writing the command lines but it may be hiding some points to the eyes of the inattentive.

Fig E gives the 'vertical cylinder perspective'.

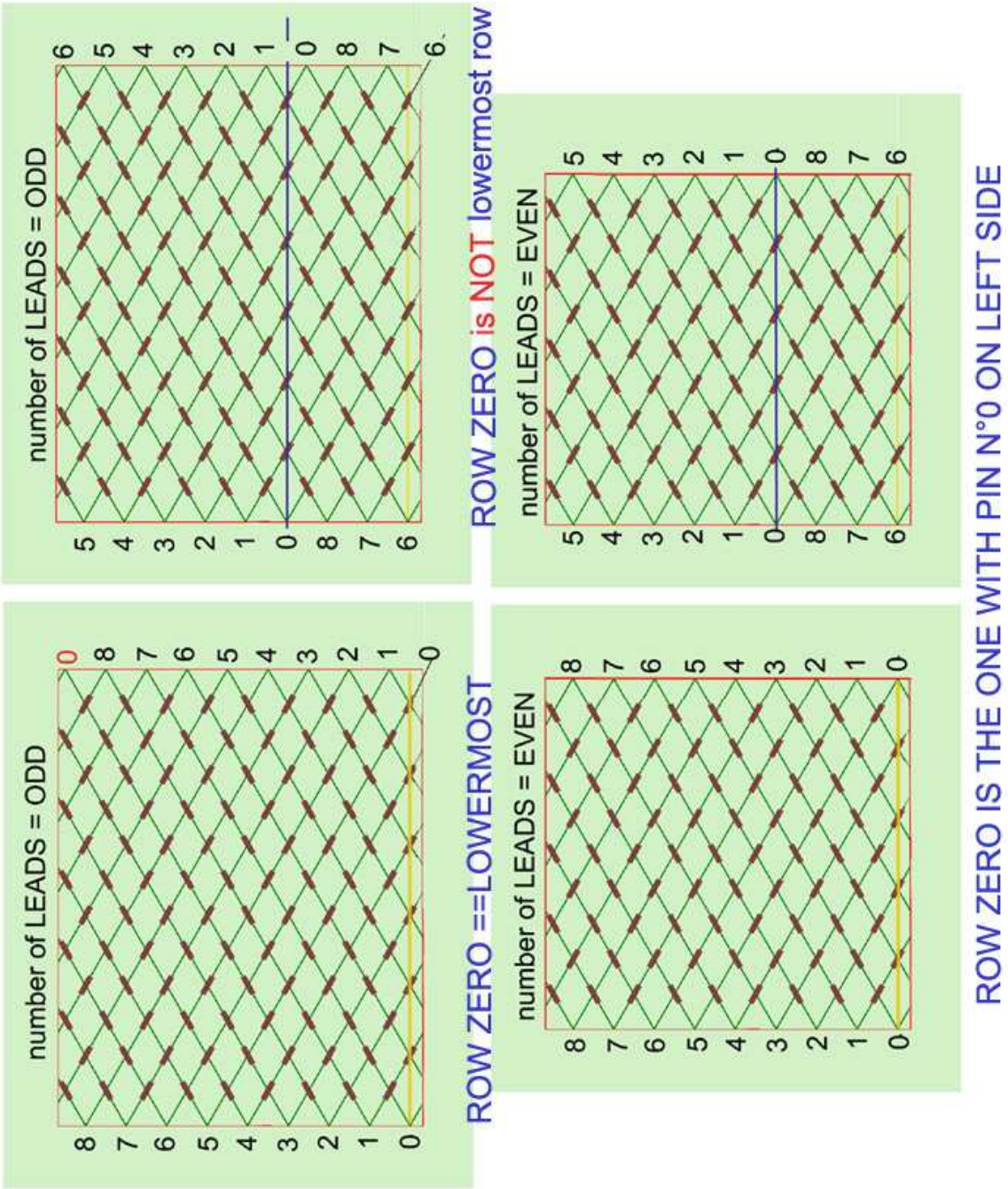


Fig E

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People using **PINS NUMBERS***.....**
You may dispense with PINS NUMBERS (except that you need then to know PINS STEPS)
Then it suffices to know the START PIN on each BIGHT RIM and the PIN STEP(S)

Fig F

IN THE NATURAL COURSE OF EVENTS, FIRST YOU DETERMINE YOUR ROW ZERO BY PUTTING ITS NUMBER ON THE LEFT BIGHT RIM (start of HP1); here, for clarity's sake only, all the ODD numbered ROWS get their number on the LEFT BIGHT RIM while all the EVEN numbered ROWS get their number written on the RIGHT BIGHT RIM.
THIS IS YOUR ONLY degree of liberty because the Numbering of ROWS goes UPWARD from ROW ZERO (not forgetting MODULO 2*B).
Now for the NUMBER OF PIN : there is a PIN at each BIGHT (or every 2 rows).
BIGHT ON THE LEFT SIDE OF ROW ZERO GETS A PIN ZERO then FIRST RIGHT BIGHT HIGHER THAN ROW ZERO GETS A PIN 1 (you add 1 each time you go from LEFT to RIGHT and nothing when going from RIGHT to LEFT. This is equivalent to NUMBERING THE PIN going UPWARD ON EACH BIGHT RIM (minding modulo B and "going around")