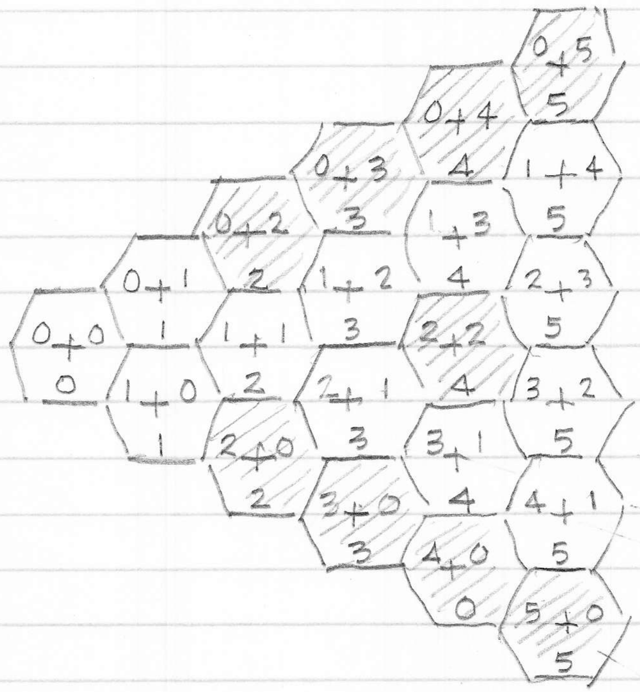
How is the Gral Keyboard Guide Generated?



1. Diophantine triplets
2. Straight-edge and scale-tree
3.

~~Scaletree~~ (Peirce) ~~information for a keyboard Octave at site 2x, 5y~~ can be

For example the Octave at site $(2x, 5y)^{.4000}$ has as it's respective, plus Generator at site $(1x, 3y)^{.3333}$

Co-prime Triangularis applied to Gral Keyboard Format

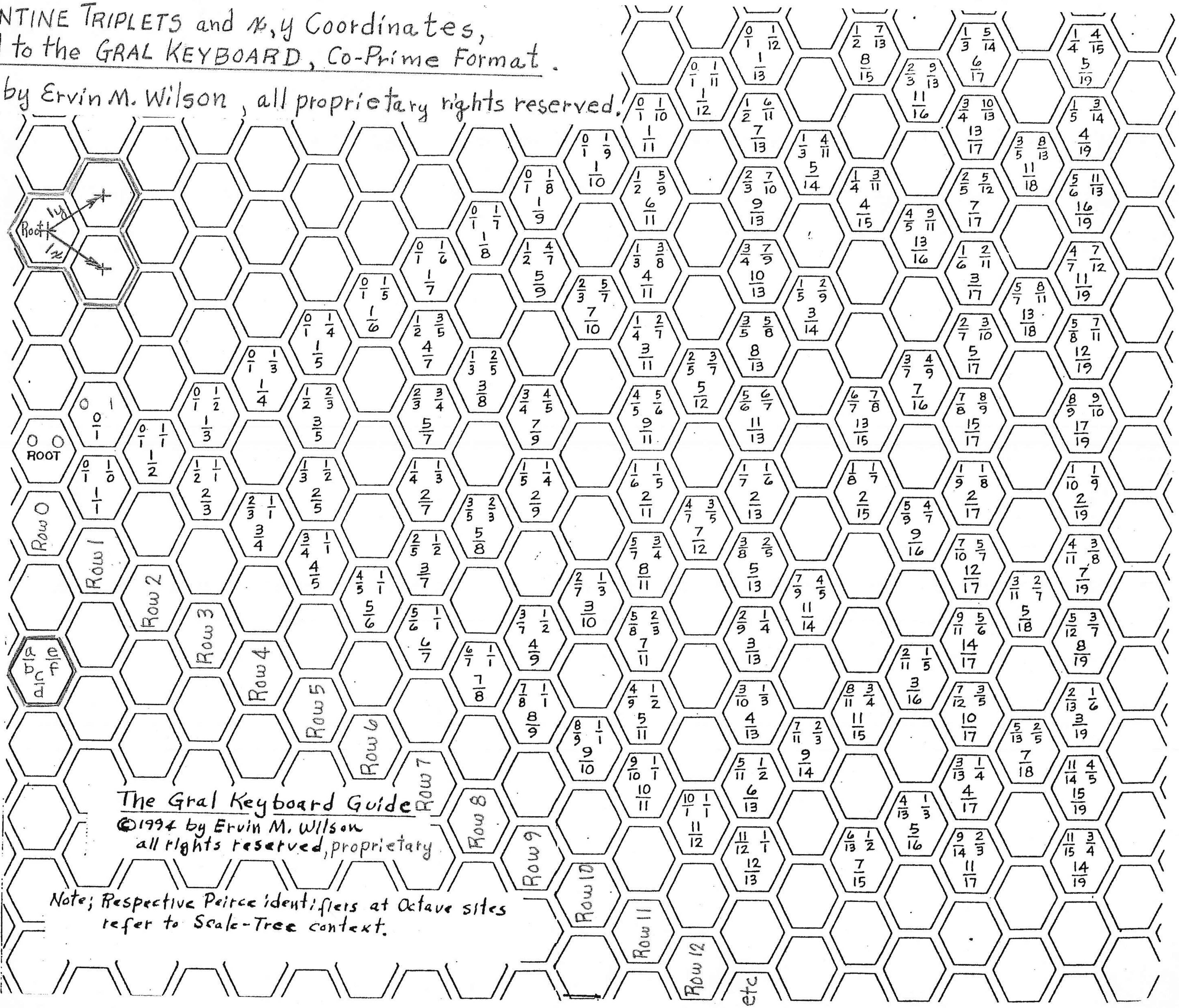
A single Variable can retune the full Kbd

Mon, June 22, 98, EW

The Gral Kbd has 2 axes; the Octave series and the Generator series. The Octave is variable but usually fixed at the frequency ratio 2/1. The Generator is highly variable but most commonly in the region near the frequency ratio 3/2 (Fifth) or 4/3 (Fourth)

All generalized keyboards are topologically equivalent,

DIOPHANTINE TRIPLETS and x,y Coordinates, Applied to the GRAL KEYBOARD, Co-Prime Format.



The Gral Keyboard Guide

Note; Respective Peirce identifiers at Octave sites refer to Scale-Tree context.

Six Items applied to Vath Keyboard 23JAN00. EW

1st Item: Every Keyboard is a Boomsliter & Creel Work Station; each note is ear-tuneable.

2nd Item: Alter-Octaves are expressible in logarithms to the base of the respective alter-octave.

3rd Item: Notes assigned to the Keyboard are optionally played in reciprocal; the same fingering will play the melody upside-down.

4th Item: Octaves are assignable to any Key which is a co-prime move on the x-y grid from the Root.

5th Item: The generator of a linear series is mutable live, and can be hand-controlled or set into continuum. Example; With C$\frac{1}{1}$ as root, and C$\frac{2}{1}$ as the Octave, and G$\frac{3}{2}$ as the generator of a chain-of-Fifths — the generator may be changed in size to give Pythagorean tuning or ¼-comma meantone, or any linear tuning in between and beyond.

6th Item: The x,y grid is selectable on the Keyboard, and may be rotated thru all its planes.

Co-Prime Triangularis Applied to Gral. Keyboard Format

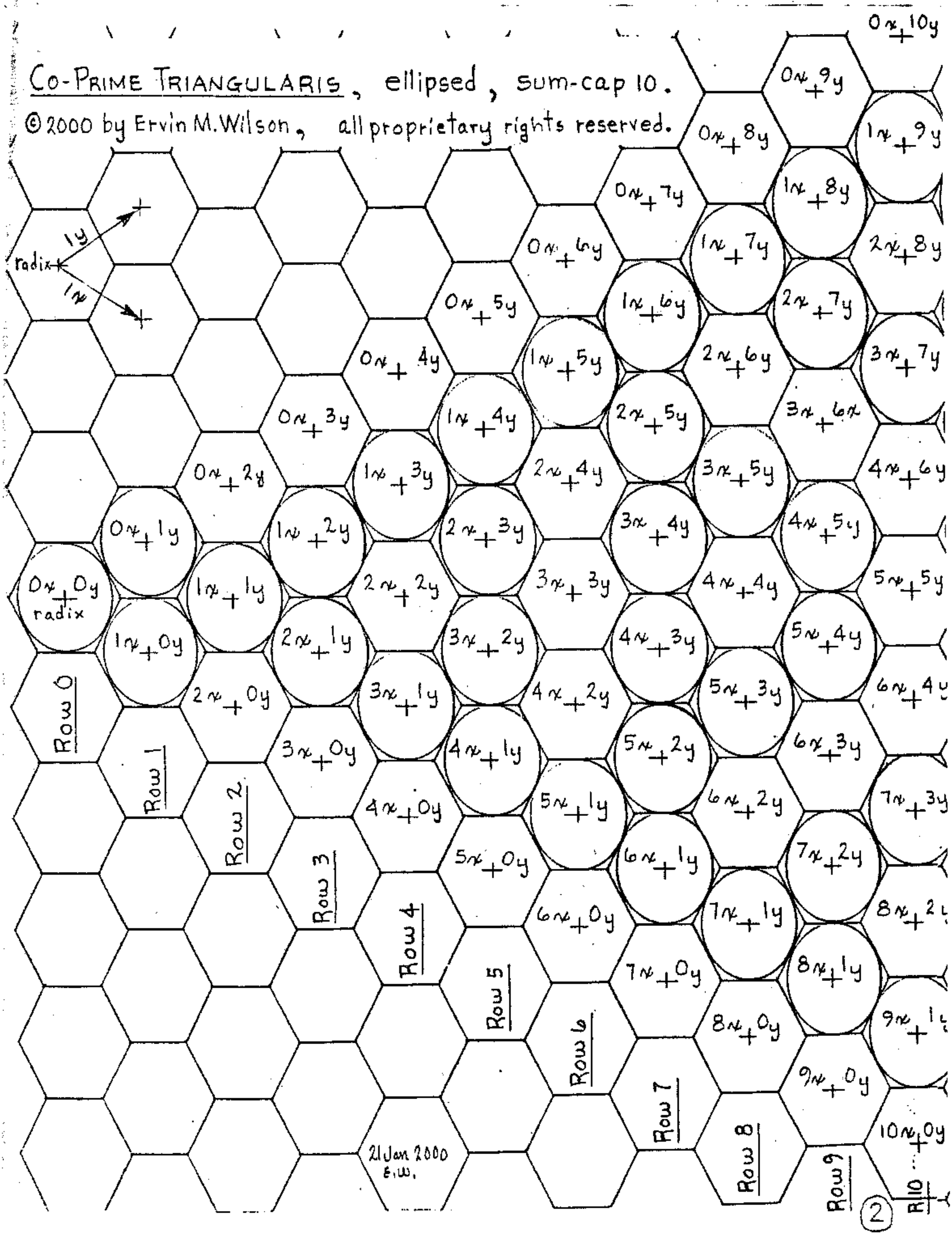
In the x,y coordinate system – consider the triangle whose corners are $(0x, 0y), (0x, 7y), (7x, 0y)$.
The row 7 from $(7x, 0y)$ to $(0x, 7y)$ has the obvious property that x and y add up to 7 in each hexagon, with a simple progression that includes all combinations of 2 numbers from (0, 1, 2, 3, 4, 5, 6, 7).
For the purpose of setting up a system of Keyboard Octaves and their associated Generators the co-prime sites (irreducibles) are of interest here. All the information needed to set up the spectrum of Keyboards cap 7 is carried right within the 7-cap Co-prime Triangularis.
For purposes of computing the Octave sites, along row 7, and their respective Generator sites the following series, derived from x, y values, is useful;

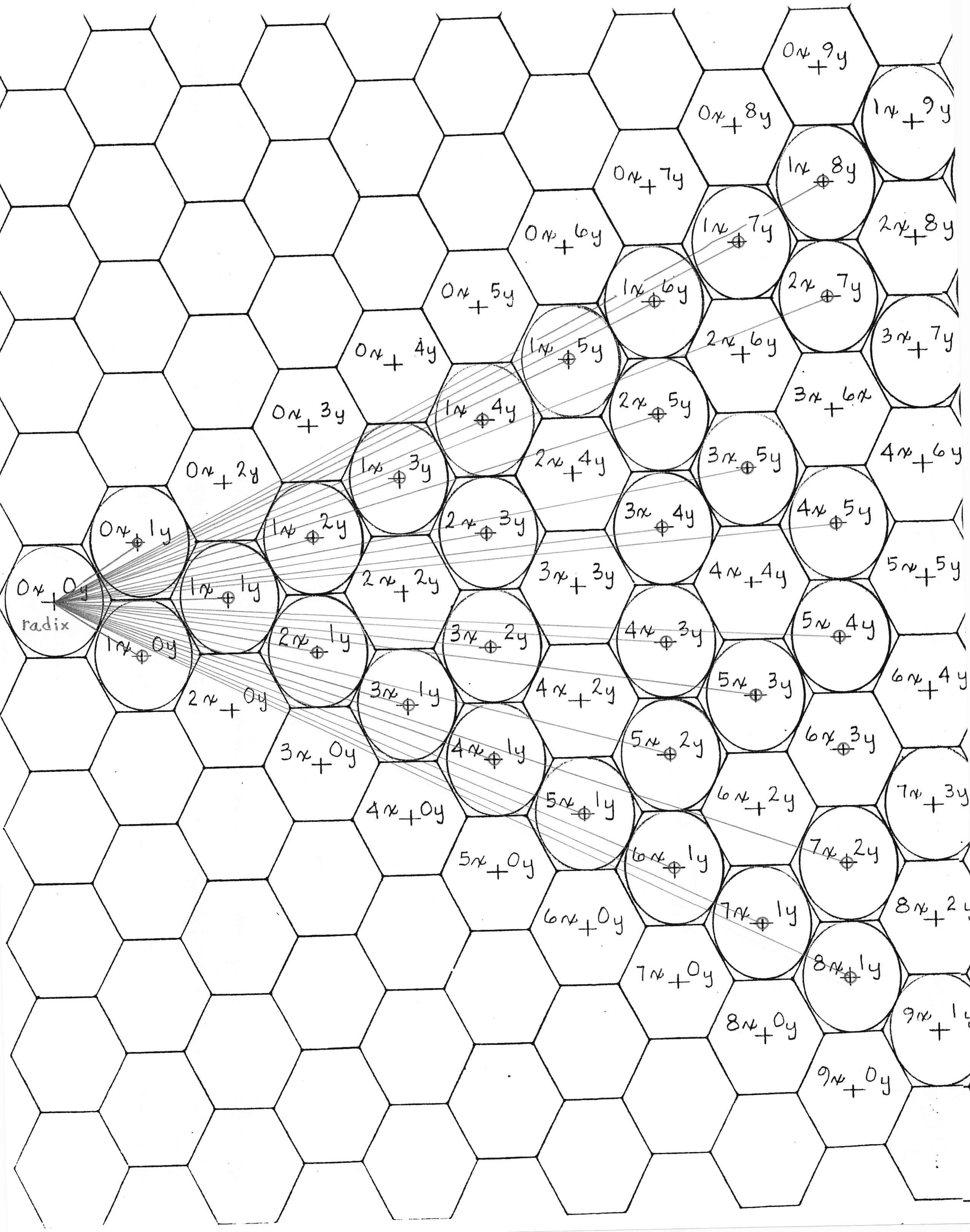
						Gen	8ve												
T_7 (Tau 7)	x	0	1	1	1	1	2	1	2	3	1	4	3	2	5	3	4	5	6	1
	y	1	6	5	4	3	5	2	3	4	1	3	2	1	2	1	1	1	1	0
decimal equiv.		.0000	.1667	.2000	.2500	.3333	.4000	.5000	.6667	.7500	1.0000	1.3333	1.5000	2.0000	2.5000	3.0000	4.0000	5.0000	6.0000	∞

The rationals are in order of their magnitude.
As an example the Octave site at $(2x, 5y)$ has adjacently its positive Generator site at $(1x, 3y)$. By placing 1, 3 over 2, 5 this way $\left(\begin{smallmatrix} 1 & 3 \\ 2 & 5 \end{smallmatrix}\right)$, and taking the Peirce mediant $\left(\begin{smallmatrix} \frac{1}{2} & & \frac{3}{5} \\ & \frac{4}{7} & \end{smallmatrix}\right)$ – a relation to the Scale-Tree is established. In this manner the Gral. Keyboard Guide translates the Co-prime Triangularis to the Scale-Tree (Peirce).

10.OCT00.EW

Co-Prime Triangularis, ellipsed, sum-cap 10.





0x + 0y
radix
0x + 1y
0x + 2y
0x + 3y
0x + 4y
0x + 5y
0x + 6y
0x + 7y
0x + 8y
0x + 9y
1x + 0y
1x + 1y
1x + 2y
1x + 3y
1x + 4y
1x + 5y
1x + 6y
1x + 7y
1x + 8y
1x + 9y
2x + 0y
2x + 1y
2x + 2y
2x + 3y
2x + 4y
2x + 5y
2x + 6y
2x + 7y
2x + 8y
3x + 0y
3x + 1y
3x + 2y
3x + 3y
3x + 4y
3x + 5y
3x + 6x
3x + 7y
4x + 0y
4x + 1y
4x + 2y
4x + 3y
4x + 4y
4x + 5y
4x + 6y
5x + 0y
5x + 1y
5x + 2y
5x + 3y
5x + 4y
5x + 5y
6x + 0y
6x + 1y
6x + 2y
6x + 3y
6x + 4y
7x + 0y
7x + 1y
7x + 2y
7x + 3y
8x + 0y
8x + 1y
8x + 2
9x + 0y
9x + 1

Co-prime Moves, on the cap 9 Lambdoma

0/0	1/0	~~2/0~~	~~3/0~~	~~4/0~~	~~5/0~~	~~6/0~~	~~7/0~~	~~8/0~~	~~9/0~~
0/1	1/1 1.000	2/1 2.000	3/1 3.000	4/1 4.000	5/1 5.000	6/1 6.000	7/1 7.000	8/1 8.000	9/1 9.000
~~0/2~~	1/2 .500	~~2/2~~	3/2 1.500	~~4/2~~	5/2 2.500	~~6/2~~	7/2 3.500	~~8/2~~	9/2 4.500
~~0/3~~	1/3 .333	2/3 .667	~~3/3~~	4/3 1.333	5/3 1.667	~~6/3~~	7/3 2.333	8/3 2.667	~~9/3~~
~~0/4~~	1/4 .250	~~2/4~~	3/4 .750	~~4/4~~	5/4 1.250	~~6/4~~	7/4 1.750	~~8/4~~	9/4 2.250
~~0/5~~	1/5 .2000	2/5 .400	3/5 .600	4/5 .800	~~5/5~~	6/5 1.200	7/5 1.400	8/5 1.600	9/5 1.800
~~0/6~~	1/6 .167	~~2/6~~	~~3/6~~	~~4/6~~	5/6 .833	~~6/6~~	7/6 1.167	~~8/6~~	~~9/6~~
~~0/7~~	1/7 .143	2/7 .286	3/7 .429	4/7 .571	5/7 .714	6/7 .857	~~7/7~~	8/7 1.143	9/7 1.286
~~0/8~~	1/8 .125	~~2/8~~	3/8 .375	~~4/8~~	5/8 .625	~~6/8~~	7/8 .875	~~8/8~~	9/8 1.125
~~0/9~~	1/9 .111	2/9 .222	~~3/9~~	4/9 .444	5/9 .556	~~6/9~~	7/9 .778	8/9 .889	~~9/9~~

The reducible rationals are struck out. The remaining, irreducible rationals form a co-prime moves pattern from "0/0". Compare this with Yasserian Keyboard Guide, by Erv Wilson 1994.

20NOV99. EW

Definition: $\frac{0}{1}\ \frac{1}{1}\ \frac{1}{0}$ is the most extensive Diophantine Triplet $\frac{a}{b}\ \frac{c}{d}\ \frac{e}{f}$; $be-af=1$
$bc-ad=1$
$de-cf=1$

On The Application of Diophantine Equations To Musical Instrument Keyboard Format

(work in progress)

"Keyboard noun --- arrangement of the keys as of an organ, piano, etc."
Funk & Wagnalls New College Standard Dictionary 1947

Diophantus of Alexandria was a 3rd century mathmetician

His equation, $b \cdot c - a \cdot d = 1$, is applicable to musical instrument keyboard format. Where $\frac{a}{b}\ \frac{c}{d}$, the most comprehensive form is $\frac{0}{1}\ \frac{1}{0}$. Charles Sanders Peirce, 19th century logician embodies this Diophantine Couplet in his series (Peirce Series), which I call the Scale Tree. This is how it progresses; add the top numbers $(a+c)$ and the bottom numbers $(b+d)$ to get the intermediate fraction, $\frac{0}{1}\ \frac{1}{1}\ \frac{1}{0}$, the Diophantine Triplet $\frac{a}{b}\ \frac{c}{d}\ \frac{e}{f}$.
Continue procedure to get $\frac{0}{1}\ \frac{1}{2}\ \frac{1}{1}\ \frac{2}{1}\ \frac{1}{0}$, and then
$\frac{0}{1}\ \frac{1}{3}\ \frac{1}{2}\ \frac{2}{3}\ \frac{1}{1}\ \frac{3}{2}\ \frac{2}{1}\ \frac{3}{1}\ \frac{1}{0}$ and so on, endlessly, Thus;

$$\left(\frac{0}{0}\right)$$

State 0 $\frac{0}{1}\quad \frac{1}{0}$

State 1 $\frac{0}{1}\quad \frac{1}{1}\quad \frac{1}{0}$

State 2 $\frac{0}{1}\quad \frac{1}{2}\quad \frac{1}{1}\quad \frac{2}{1}\quad \frac{1}{0}$

State 3 $\frac{0}{1}\ \frac{1}{3}\ \frac{1}{2}\ \frac{2}{3}\ \frac{1}{1}\ \frac{3}{2}\ \frac{2}{1}\ \frac{3}{1}\ \frac{1}{0}$

State 4 $\frac{0}{1}\ \frac{1}{4}\ \frac{1}{3}\ \frac{2}{5}\ \frac{1}{2}\ \frac{3}{5}\ \frac{2}{3}\ \frac{3}{4}\ \frac{1}{1}\ \frac{4}{3}\ \frac{3}{2}\ \frac{5}{3}\ \frac{2}{1}\ \frac{5}{2}\ \frac{3}{1}\ \frac{4}{1}\ \frac{1}{0}$

State 5 $\frac{0}{1}\ \frac{1}{5}\ \frac{1}{4}\ \frac{2}{7}\ \frac{1}{3}\ \frac{3}{8}\ \frac{2}{5}\ \frac{3}{7}\ \frac{1}{2}\ \frac{4}{7}\ \frac{3}{5}\ \frac{5}{8}\ \frac{2}{3}\ \frac{5}{7}\ \frac{3}{4}\ \frac{4}{5}\ \frac{1}{1}\ \frac{5}{4}\ \frac{4}{3}\ \frac{7}{5}\ \frac{3}{2}\ \frac{8}{5}\ \frac{5}{3}\ \frac{7}{4}\ \frac{2}{1}\ \frac{7}{3}\ \frac{5}{2}\ \frac{8}{3}\ \frac{3}{1}\ \frac{7}{2}\ \frac{4}{1}\ \frac{5}{1}\ \frac{1}{0}$

? (Iterated) The Diophantine Equation $a \cdot b - c \cdot d = 1$ applied to Generalized Keyboard Design

work in progress

The primary genus of the Peirce triplet is constructed from the Peirce pair; 23 Feb 00. E.W.

	example
$a \quad e$	$8 \quad 5$
$b \quad f$	$11 \quad 7$
where $b \cdot e - a \cdot f = 1$	$8 \cdot 7 - 11 \cdot 5 = 1$
add $a + e = c$	$11 + 7 = 18$
and $b + f = d$	$8 + 5 = 13$
and place $\frac{c}{d}$ in between	
$a \quad c \quad e$	$11 \quad 18 \quad 7$
$b \quad d \quad f$	$8 \quad 13 \quad 5$
now $b \cdot c - a \cdot d = 1$	$8 \cdot 18 - 11 \cdot 13 = 1$
and $d \cdot e - c \cdot f = 1$	$13 \cdot 7 - 18 \cdot 5 = 1$

invert these

NOT SCRAP! .580482 — about ; 28JAN00·EW

Method

Peirce Triplet				where	then	and (Diophantine equation)
$\frac{0}{1}$	$\frac{1}{1}$	$\frac{1}{0}$	1.000	$\boxed{\frac{a}{b}\ \frac{c}{d}\ \frac{e}{f}}$,	$\frac{c}{d} = \frac{a+e}{b+f}$,	$b \cdot e - a \cdot f = 1$

←

Hence $b \cdot c - a \cdot d = 1$

and $d \cdot e - c \cdot f = 1$

achtung! application to Keyboard Sites

						(Root)	Gen	8ve	
	$\frac{0}{1}$	$\frac{1}{2}$	$\frac{1}{1}$	.500	→				
	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{1}$	.666	←				
	$\frac{1}{2}$	$\frac{3}{5}$	$\frac{2}{3}$	.600	←				
Gen. info / 8ve. info	$\frac{1}{2}$	$\frac{4}{7}$	$\frac{3}{5}$	.5714	→	$0_x, 0_y$	a_x, e_y (1x, 3y)	b_x, f_y (2x, 5y)	←
	$\frac{4}{7}$	$\frac{7}{12}$	$\frac{3}{5}$	.5833	←	0, 0	4x, 3y	7x, 5y	
	$\frac{4}{7}$	$\frac{11}{19}$	$\frac{7}{12}$	.578947	→	0, 0	4x, 7y	7x, 12	
	$\frac{11}{19}$	$\frac{18}{31}$	$\frac{7}{12}$	.580645	←				
	$\frac{11}{19}$	$\frac{29}{50}$	$\frac{18}{31}$	.586000	→				
	$\frac{29}{50}$	$\frac{47}{81}$	$\frac{18}{31}$	.580247	→				
	$\frac{47}{81}$	$\frac{65}{112}$	$\frac{18}{31}$						

Notes 1. x, y coordinates cannot be casually slapped on the scale-tree.
2. The complementary generators must be run to get all the keyboards.
3. The Peirce triplet is ubiquitous in the Scale-Tree, the Lambdoma & the Triangle

(~~imbue~~) substance

~~The nuclear~~ stuff

(quinary)
A secondary genera may be constructed thus;

a	e	11	13
b	f	8	9

where $b \cdot e - a \cdot f = 5$ $\qquad 8 \cdot 13 - 11 \cdot 9 = 5$

$a + e = c$ $\qquad 11 + 13 = 24$

and $b + f = d$ $\qquad 8 + 9 = 17$

Place $\frac{c}{d}$ in between

a	c	e	11	24	13
b	d	f	8	17	9

invert these

now $b \cdot c - a \cdot d = 5$ $\qquad 8 \cdot 24 - 11 \cdot 17 = 5$

and

$d \cdot e - c \cdot f = 5$ $\qquad 17 \cdot 13 - 24 \cdot 9 = 5$

Keyboard application invalid

$\frac{a}{b}$	$\frac{c}{d}$	$\frac{e}{f}$	$\frac{c}{d}$ dec.	Root	Generator	Octave
				0N, 0y	aN, ey	bN, fy
$\frac{8}{11}$	$\frac{17}{24}$	$\frac{9}{13}$	.708333	0N, 0y	~~8N, 9y~~	~~11N, 13y~~

invalid Keyboard

16 OCT99-EW

Wilson

SUMS-CAP 8 LAMBDA

0 0 (0)

0 1 (1) — 1 0 (1)

0 2 (2) — 1 1 (2) — 2 0 (2)

0 3 (3) — 1 2 (3) — 2 1 (3) — 3 0 (3)

0 4 (4) — 1 3 (4) — 2 2 (4) — 3 1 (4) — 4 0 (4)

0 5 (5) — 1 4 (5) — 2 3 (5) — 3 2 (5) — 4 1 (5) — 5 0 (5)

0 6 (6) — 1 5 (6) — 2 4 (6) — 3 3 (6) — 4 2 (6) — 5 1 (6) — 6 0 (6)

0 7 (7) — 1 6 (7) — 2 5 (7) — 3 4 (7) — 4 3 (7) — 5 2 (7) — 6 1 (7) — 7 0 (7)

0 8 (8) — 1 7 (8) — 2 6 (8) — 3 5 (8) — 4 4 (8) — 5 3 (8) — 6 2 (8) — 7 1 (8) — 8 0 (8)

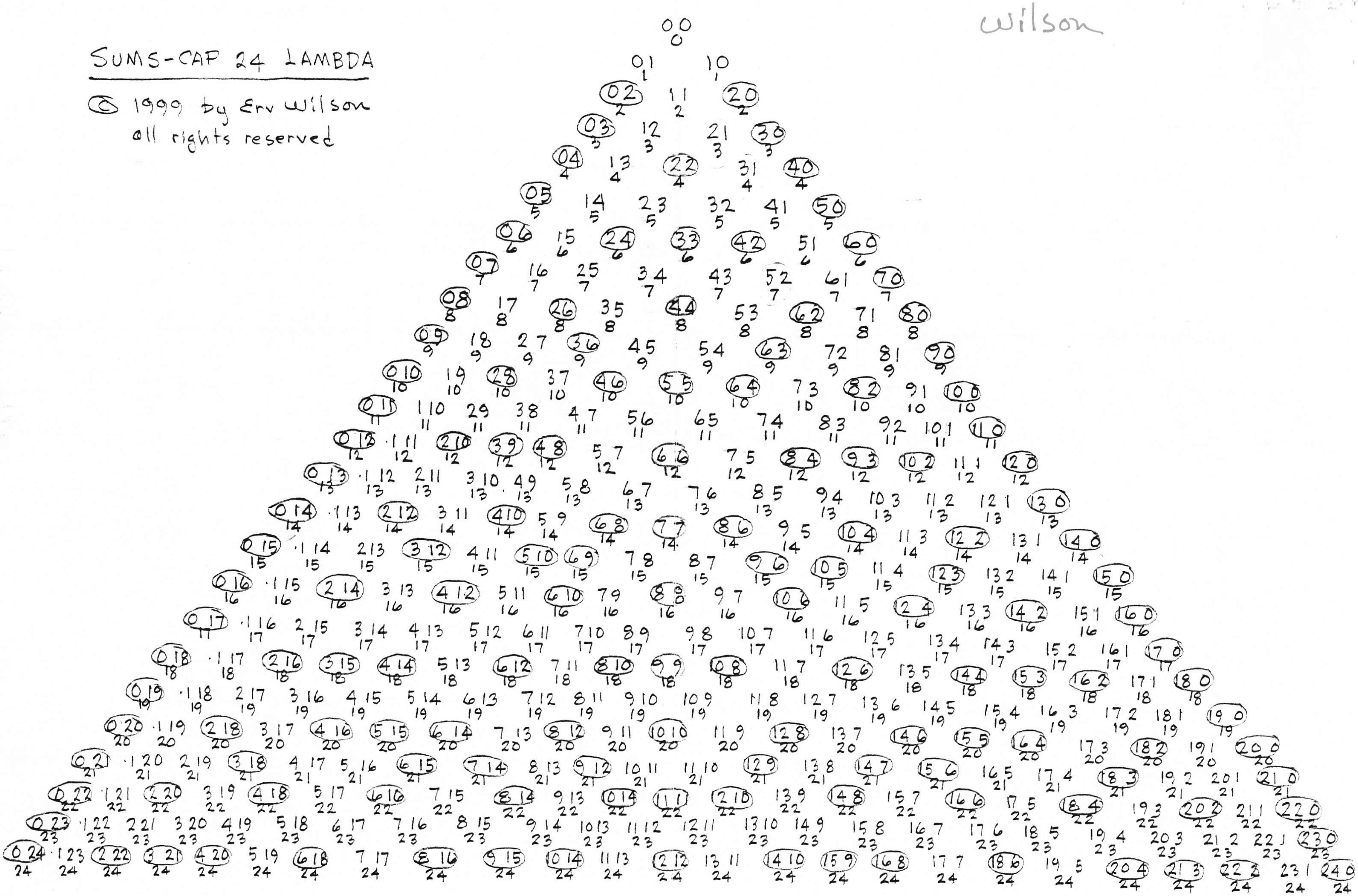
0 1 1 1 1 1 2 1 3 2 3 1 4 3 5 2 5 3 4 5 6 7 1

1 7 6 5 4 3 5 2 5 3 4 1 3 2 3 1 2 1 1 1 1 1 0

$\frac{1}{0}$ $\frac{7}{6}$ $\frac{6}{5}$ $\frac{5}{4}$ $\frac{4}{3}$ $\frac{6}{5}$ $\frac{5}{4}$ $\frac{6}{5}$ $\frac{10}{9}$ $\frac{9}{8}$ $\frac{4}{3}$ $\frac{4}{3}$ $\frac{9}{8}$ $\frac{10}{9}$ $\frac{6}{5}$ $\frac{5}{4}$ $\frac{6}{5}$ $\frac{4}{3}$ $\frac{5}{4}$ $\frac{6}{5}$ $\frac{7}{6}$ $\frac{1}{0}$

Wilson

SUMS-CAP 24 LAMBDA



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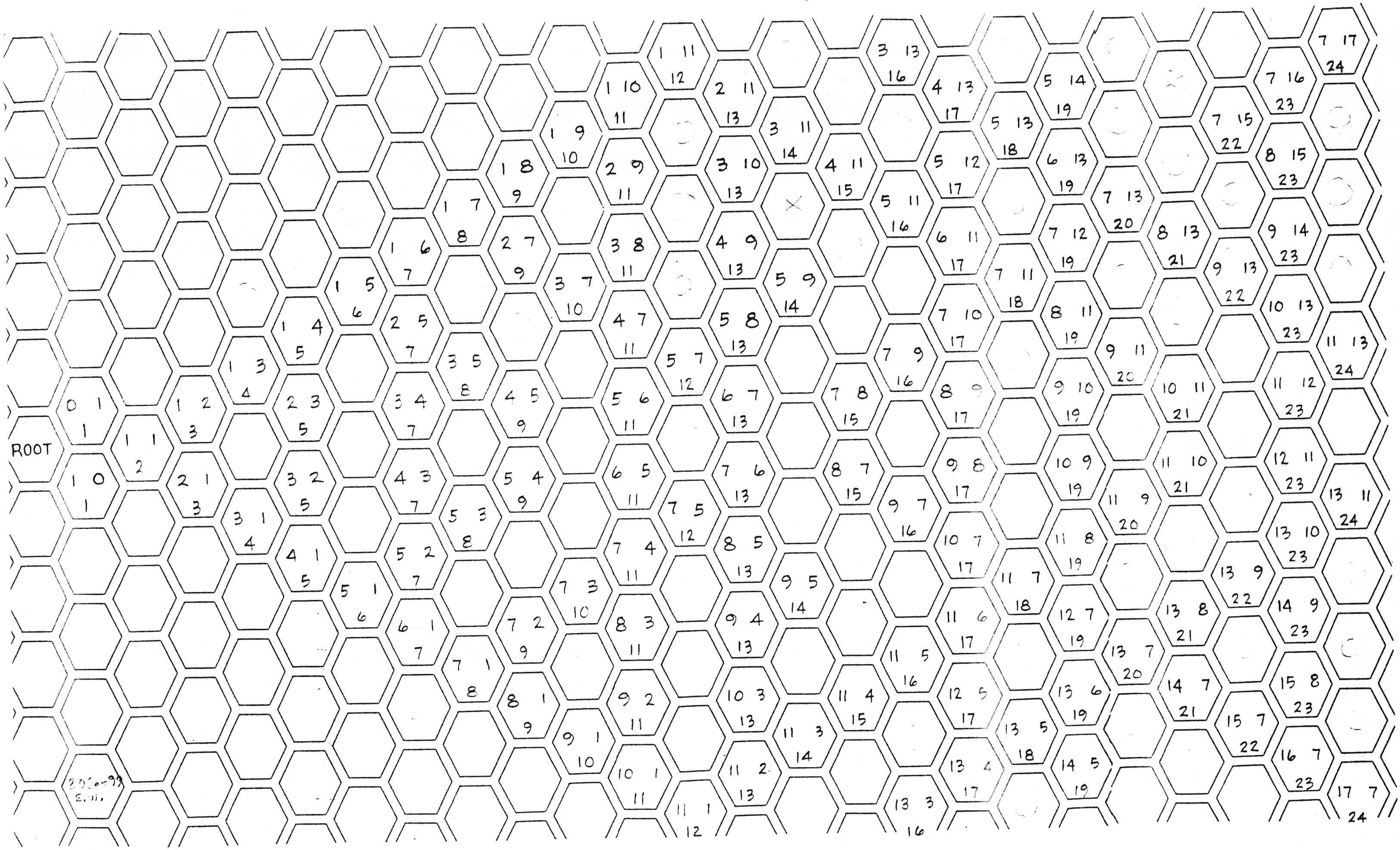
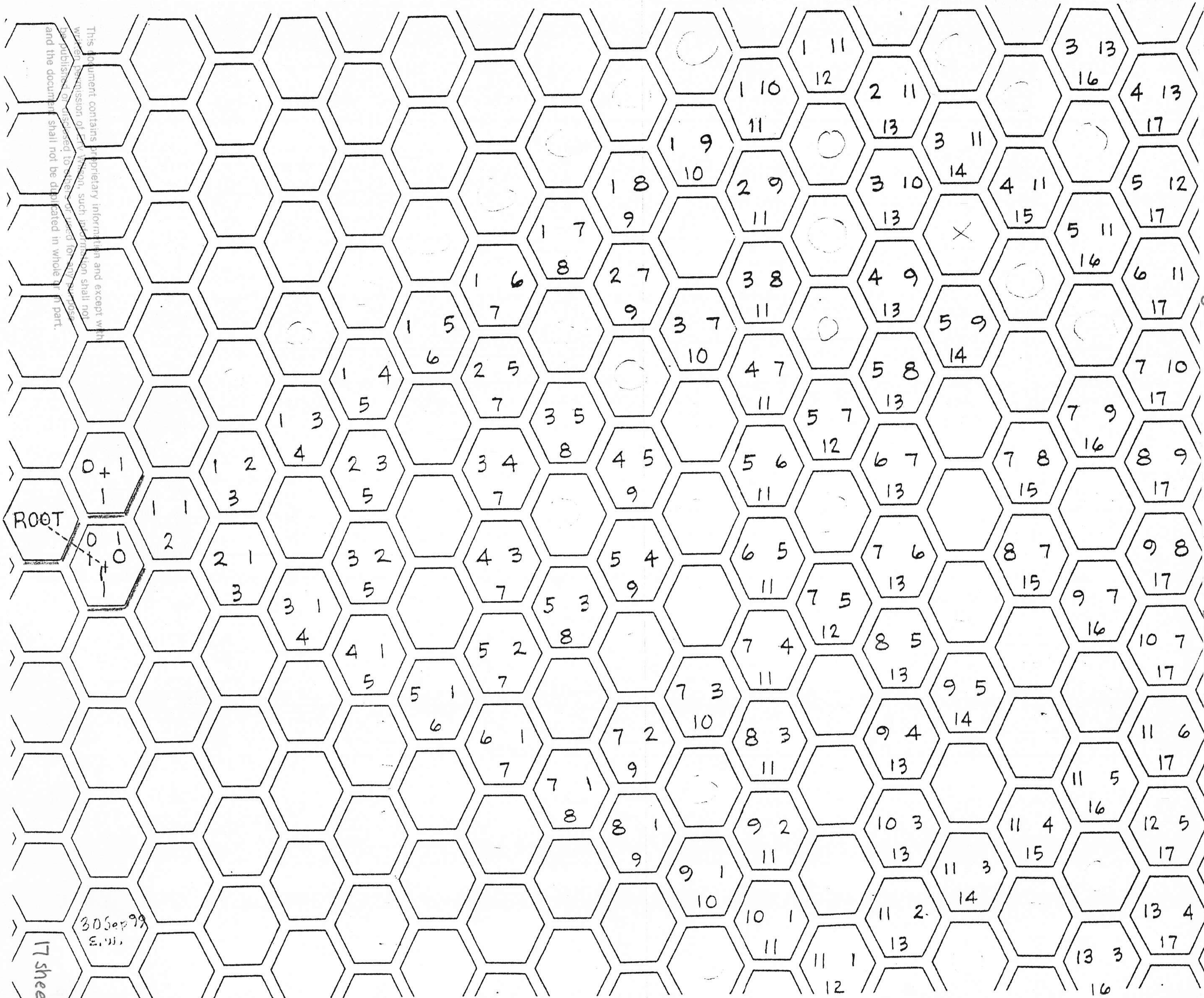
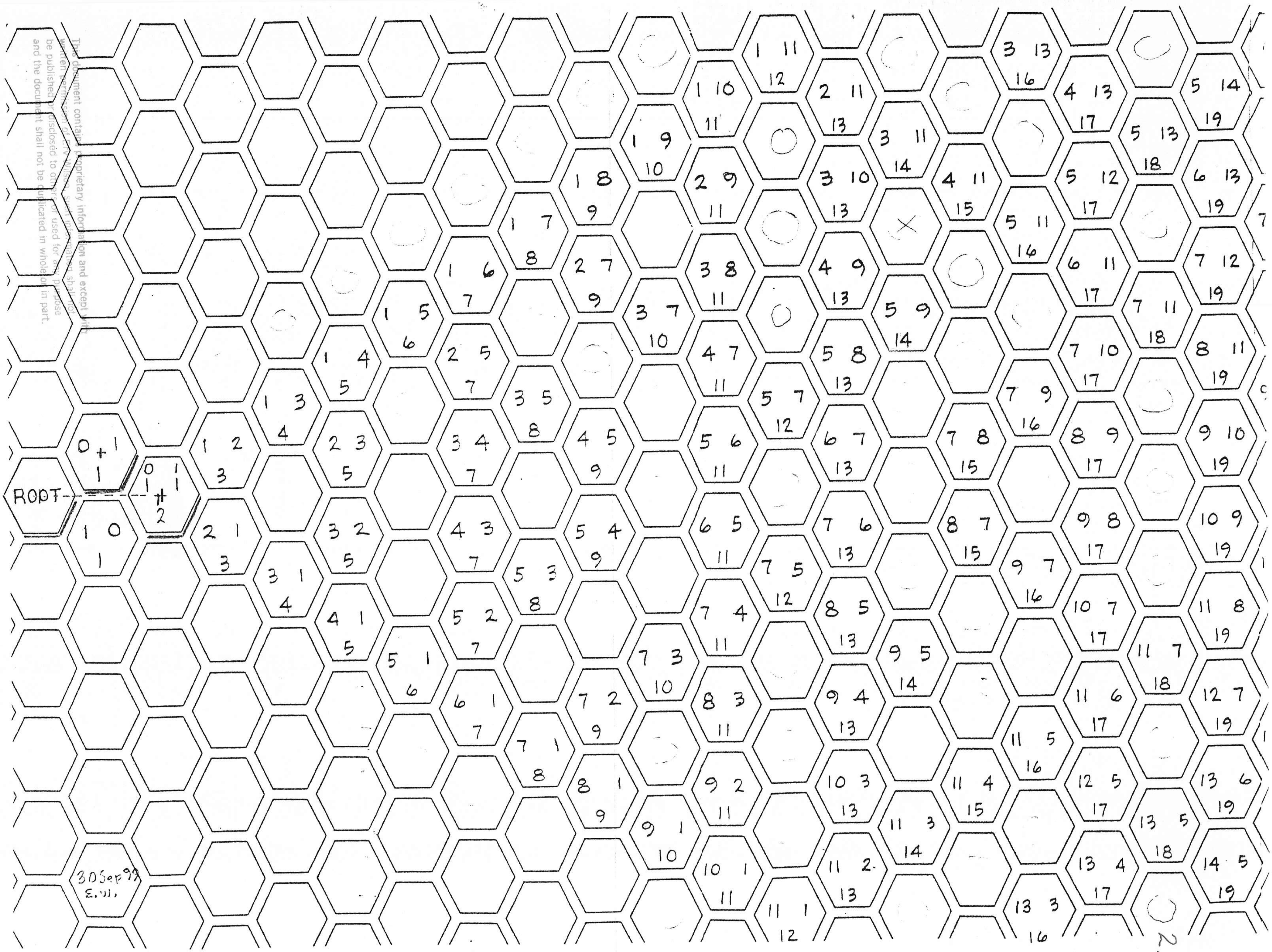
24 OCT 99 - E.W.
Sheet 1


ROOT

Keyboards on the Incipient Keyboard Guide

To Peirce State 6 on the Scale-Tree

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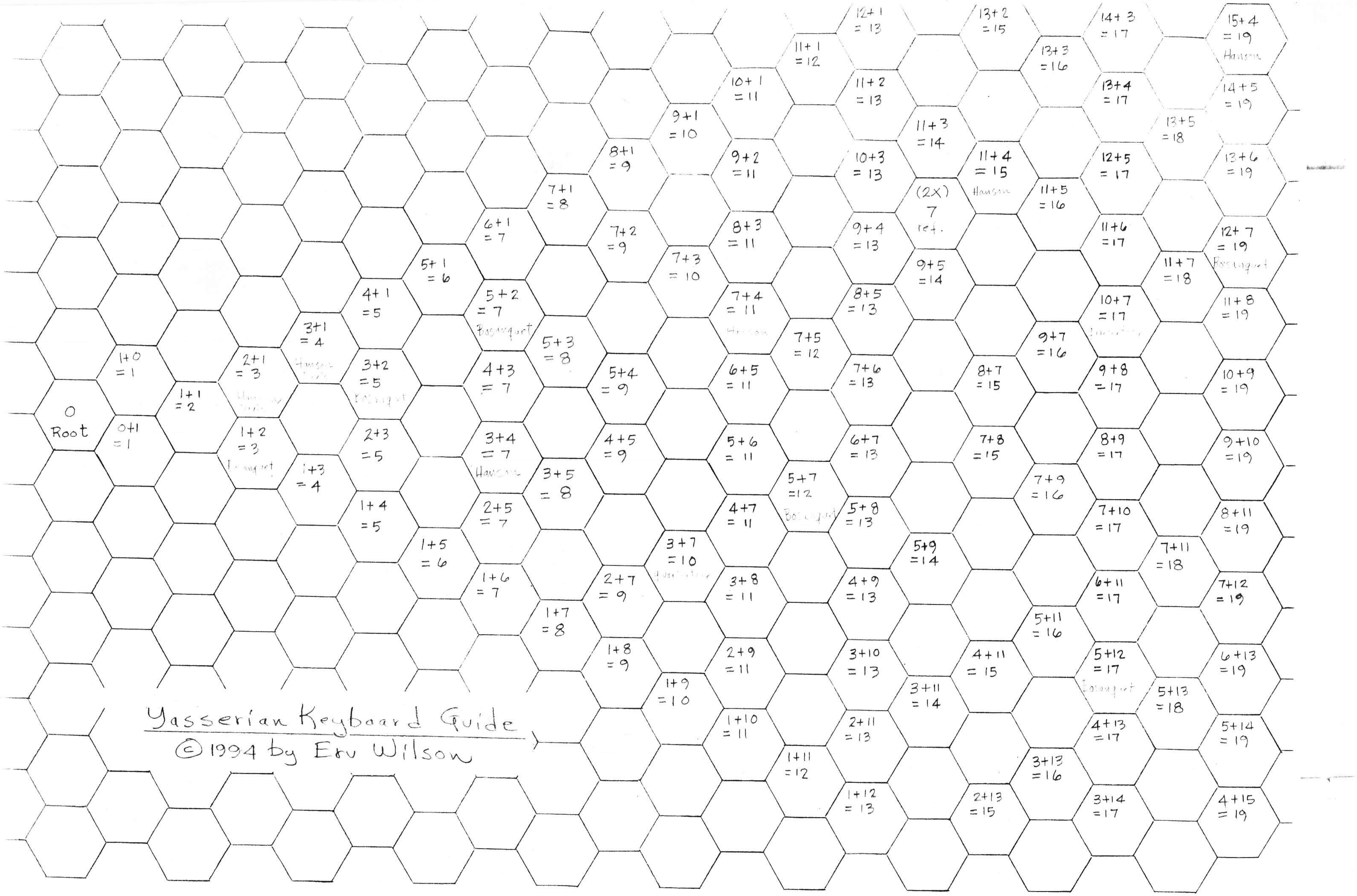
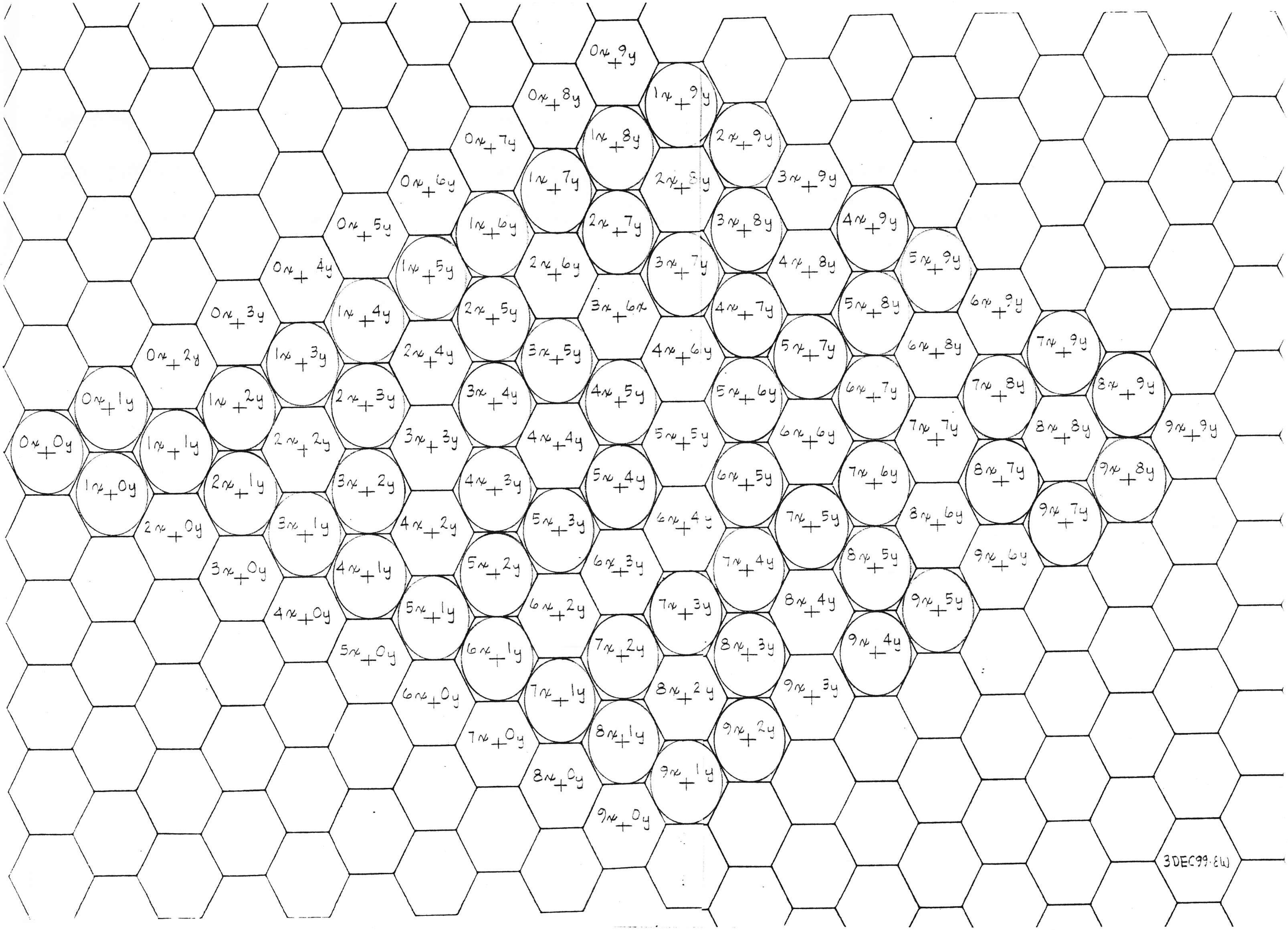


Yasserian Keyboard Guide


0x + 0y
0x + 1y
0x + 2y
0x + 3y
0x + 4y
0x + 5y
0x + 6y
0x + 7y
0x + 8y
0x + 9y
1x + 0y
1x + 1y
1x + 2y
1x + 3y
1x + 4y
1x + 5y
1x + 6y
1x + 7y
1x + 8y
1x + 9y
2x + 0y
2x + 1y
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2x + 4y
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2x + 7y
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2x + 9y
3x + 0y
3x + 1y
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3x + 6x
3x + 7y
3x + 8y
3x + 9y
4x + 0y
4x + 1y
4x + 2y
4x + 3y
4x + 4y
4x + 5y
4x + 6y
4x + 7y
4x + 8y
4x + 9y
5x + 0y
5x + 1y
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7x + 0y
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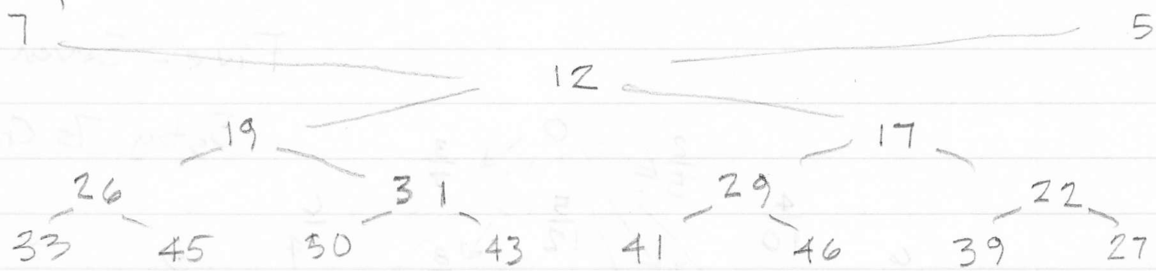
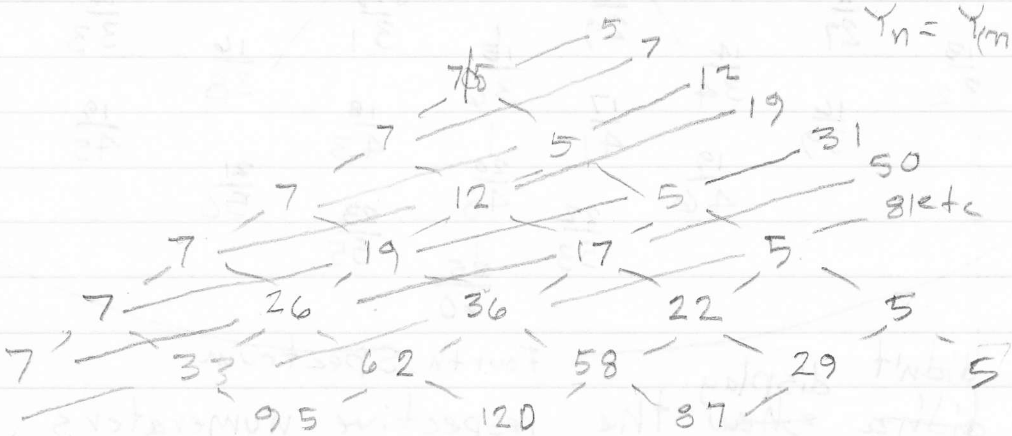
8x + 8y
8x + 9y
9x + 0y
9x + 1y
9x + 2y
9x + 3y
9x + 4y
9x + 5y
9x + 6y
9x + 7y
9x + 8y
9x + 9y
3DEC99·EW

$\frac{5}{4} > \frac{6}{5}$ $\frac{4}{5} < \frac{5}{6}$ The 5 × 7 grid as shown

Plethorists
Col-de-Sacists

					0	5	10	15	20	25	30	35
				7	12	17	22	27	32	37		
			14	19	24	29	34	39	44	49		
		21	26	31	36	41	46	51	56	61		
	28	33	38	43	48	53	58	63	68	73		
35	40	45	50	55	60	65	70	75	80	85		





$Y_n = Y_{(n-1)} + Y_{(n-2)}$

0	5	10	15	20	25
7	12	17	22	27	32
14	19	24	29	34	39
21	26	31	36	41	46
28	33	38	43	48	53
35	40	45	50	55	60

2 1 3 4 7 11 18

3 2 5 7 12 19 31

1262
6th Photo Tech Sq
flight 1262
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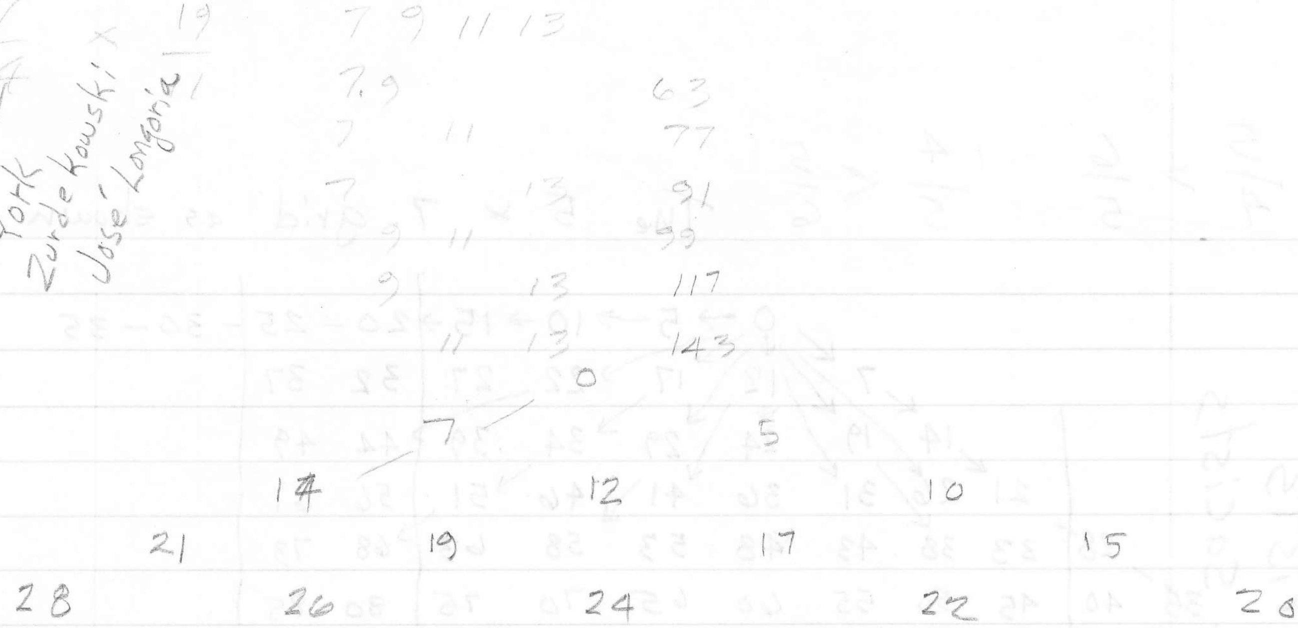
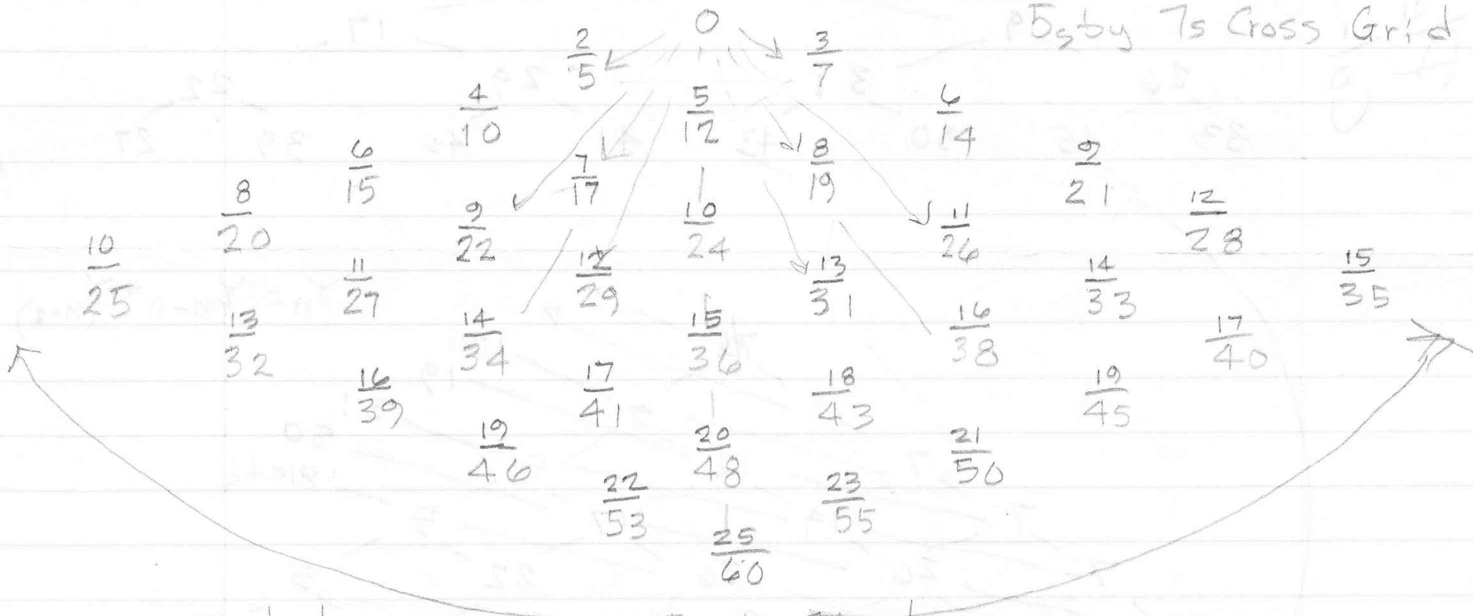


Five - Seven Crossgrid

5s by 7s Cross Grid



Fourth Spectrum

but I ~~didna~~ didn't ~~shew~~ display the respective numeraters defining the Fourths. ~~If~~ One will notice a gradual increase in the magnitude of the Fourth swinging cc-wise about point zero.