

Iannis Xenakis and Sieve Theory
An Analysis of the Late Music (1984-1993)

A Dissertation
Presented in Fulfilment of the Requirements for the Degree of
Doctor of Philosophy

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Volume 2 of 2: Figures and Appendices

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1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	41	42	43	44	45	46	47	48	49	50
1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	41	42	43	44	45	46	47	48	49	50

Figure 3.1: The Sieve of Eratosthenes, with $n = 50$.

	4_i			
	0	1	2	3
3_j	0	9	6	3
	1	4	1	10
	2	8	5	2
				11

Figure 3.2: Matrix for Moduli 4 and 3.

	4_i			
	0	1	2	3
3_j	0	9	6	3
	1	4	1	10
	2	8	5	2
				11

Figure 3.3: $(3, 0) + (4, 0)$.

	4_i			
	0	1	2	3
3_j	0	9	6	3
	1	4	1	10
	2	8	5	2
				11

Figure 3.4: Major Diatonic Scale.

	12_j												
	0	1	2	3	4	5	6	7	8	9	10	11	
5_i	0	0	25	50	15	40	5	30	55	20	45	10	35
	1	36	1	26	51	16	41	6	31	56	21	46	11
	2	12	37	2	27	52	17	42	7	32	57	22	47
	3	48	13	38	3	28	53	18	43	8	33	58	23
	4	24	49	14	39	4	29	54	19	44	9	34	59

Figure 3.5: Matrix for moduli 5 and 12.

	4_i			
	0	1	2	3
0	0	9	6	3
1	4	1	10	7
2	8	5	2	11
3_j				

Figure 3.6: $(3, 0) + (4, 3)$.

	4_i			
	0	1	2	3
0	0	9	6	3
1	4	1	10	7
2	8	5	2	11
3_j				

Figure 3.7: $(3, 0) + (4, 1)$.

	4_i			
	0	1	2	3
0	0	9	6	3
1	4	1	10	7
2	8	5	2	11
3_j				

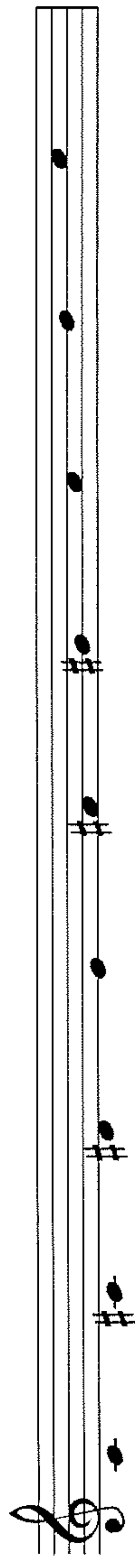


Figure 3.8: $(3, 0) + (4, 0) + (3, 1) \cdot (4, 1) + (3, 2) \cdot (4, 2)$.

	4_i			
	0	1	2	3
0	0	9	6	3
1	4	1	10	7
2	8	5	2	11
	3_j			

Figure 3.9: $(4, 0) + (3, 0) \cdot (4, 2)$.

	4_i					4_i			
	0	1	2	3		0	1	2	3
0	0	9	6	3		0	9	6	3
1	4	1	10	7		1	4	1	10
2	8	5	2	11		2	8	5	2
	3_j					0	1	2	3
	Mode of D.					Major diatonic.			

Figure 3.10: Matrices for the Mode of D and the Major Diatonic Scale.

4_i

	0	1	2	3
0	0	9	6	3
1	4	1	10	7
2	8	5	2	11

3_j

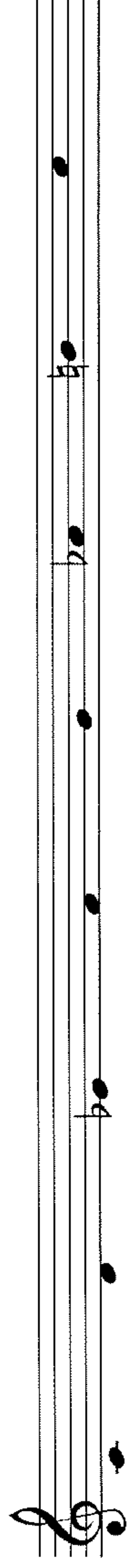
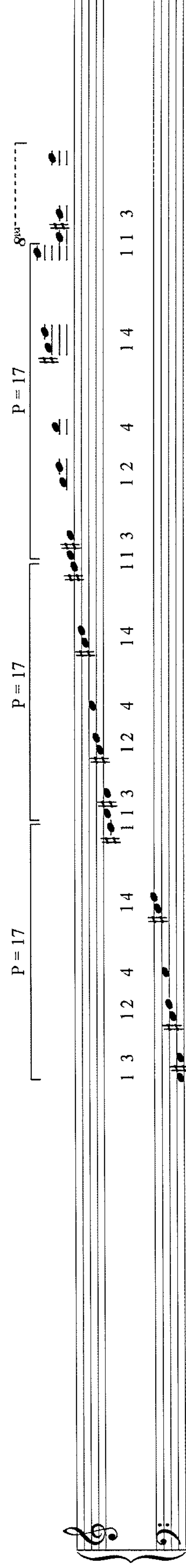


Figure 3.11: Harmonic minor.



3.12: Sieve of *Jonchaies*.

	Prime	Composite
Symmetric	palindromic structure prime period example: $\{0\ 2\ 5\ 6\ 9\}$, $P = 11$	palindromic structure composite period example: major diatonic
	non-palindromic structure prime period example: <i>Jonchaies</i>	non-palindromic structure composite period example: harmonic minor
Asymmetric		

Figure 3.13: Types of Sieves according to their Symmetry and Periodicity.

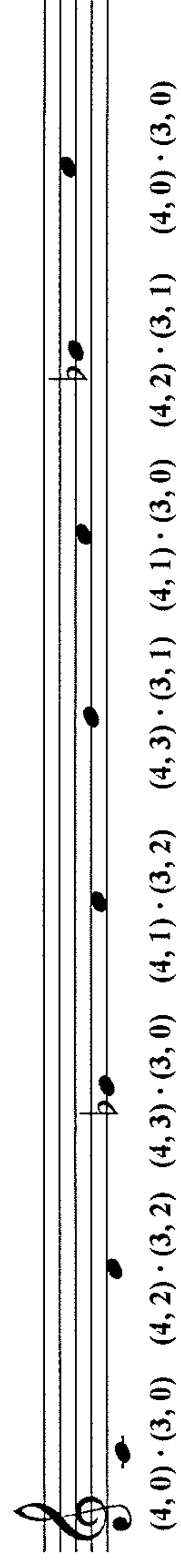


Figure 3.14: Cyclic Transposition of the Major Diatonic Scale, $T_{+10}(\text{mod}12)$, that results in the Mode of D.

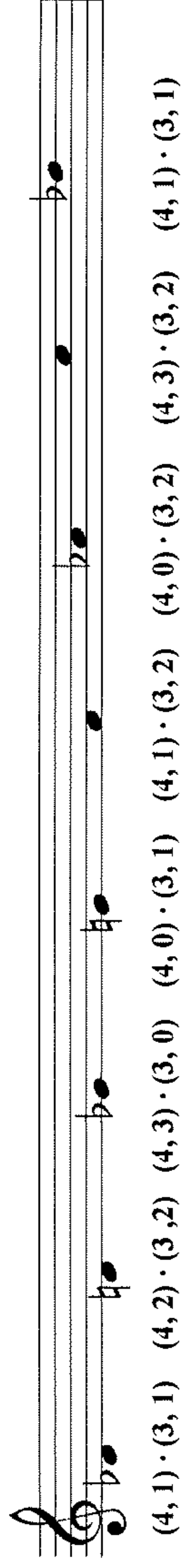


Figure 3.15: $r_2 = r_1 + r_2 + 1$

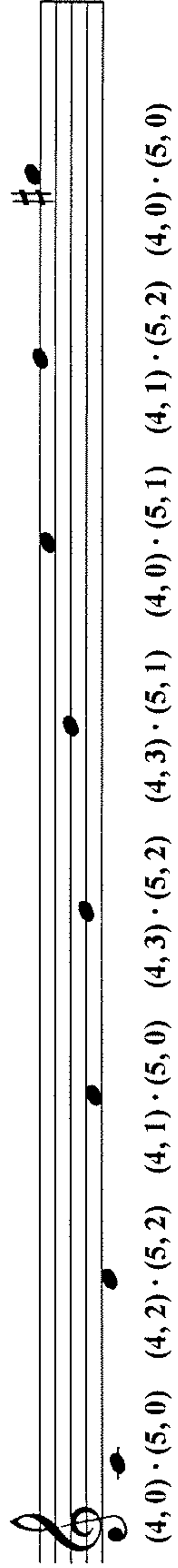


Figure 3.16: $m_2 = m_2 + 2$

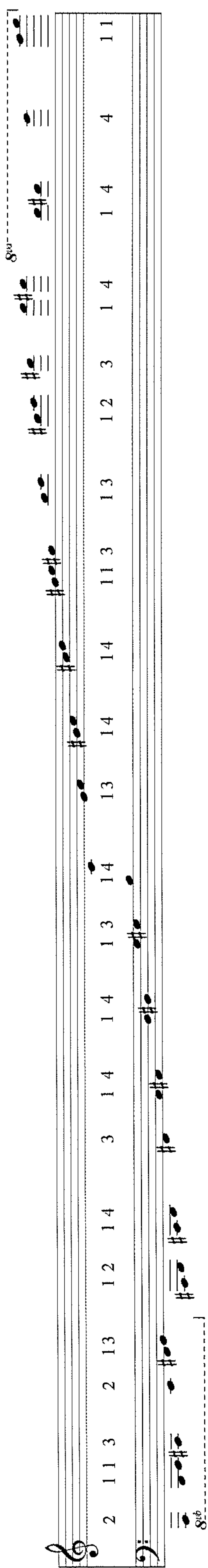


Figure 4.1: Sieve of *Nekuia*.

11_j

	0	1	2	3	4	5	6	7	8	9	10
0	0	56	24	80	48	16	72	40	8	64	32
1	33	1	57	25	81	49	17	73	41	9	65
2	66	34	2	58	26	82	50	18	74	42	10
3	11	67	35	3	59	27	83	51	19	75	43
4	44	12	68	36	4	60	28	84	52	20	76
5	77	45	13	69	37	5	61	29	85	53	21
6	22	78	46	14	70	38	6	62	30	86	54
7	55	23	79	47	15	71	39	7	63	31	87

8_i

Figure 4.2: Decomposed Matrix of the Sieve of *Nekuia*.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
M, I, R	0	2	3	4	7	9	10	13	14	16	17	21	24	25	29	30	34	35	38	39	43	
24, 0, 3	+												+									
14, 2, 6		+								+						+						
22, 3, 3			+											+								
31, 4, 2				+														+				
28, 7, 2					+													+				
29, 9, 2						+													+			
19, 10, 4							+								+							
25, 13, 2								+											+			
24, 14, 3									+										+			
26, 17, 2											+											+
23, 21, 2												+										
24, 10, 3																	+					
30, 9, 2						+															+	
35, 17, 2											+											
29, 24, 2													+									
32, 25, 1														+								
30, 29, 1															+							
26, 21, 2												+										
30, 17, 2											+											
31, 16, 2										+												

Figure 5.1: Simplified Matrix of the sieve of *Nekutiä*.

	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
M,I,R	44	47	48	52	53	57	58	59	62	63	66	67	69	72	73	77	78	82	86	87	88
24, 0, 3	3	1	-	1									3	1	4	1	-	4	1	1	
14, 2, 6	+						+							+					+		
22, 3, 3		+											+								
31, 4, 2											+										
28, 7, 2										+											
29, 9, 2												+									
19, 10, 4			+									+							+		
25, 13, 2										+											+
24, 14, 3									+										+		
26, 17, 2													+								
23, 21, 2	+											+									
24, 10, 3																					
30, 9, 2																					
35, 17, 2																					
29, 24, 2																	+				
32, 25, 1																					
30, 29, 1								+													
26, 21, 2		+																			
30, 17, 2		+																			
31, 16, 2		+																			+

Figure 5.1: Simplified Matrix of the sieve of *Nekutiä*, cont.

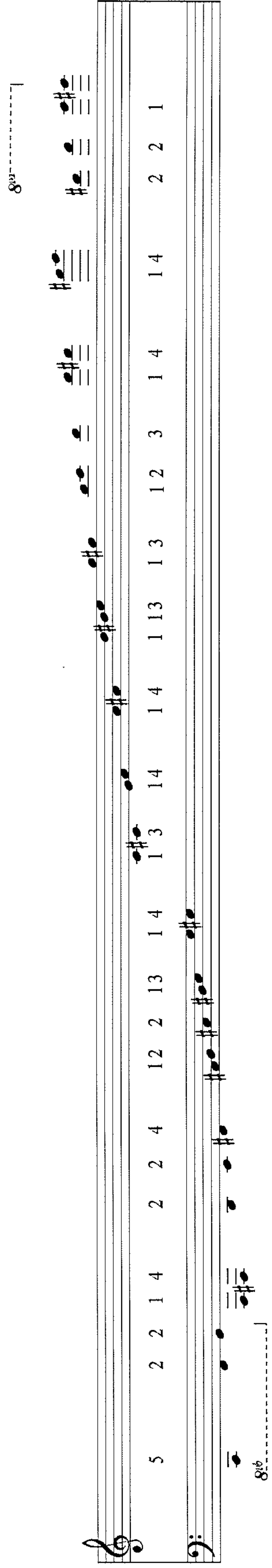


Figure 5.2: Sieve of *Akea*.

16j

0	0	65	50	35	20	5	70	40	25	10	75	60	45	30	15
1	16	1	66	51	36	21	6	71	41	26	11	76	61	46	31
2	32	17	2	67	52	37	22	7	57	42	27	12	77	62	47
3	48	33	18	3	68	53	38	8	73	58	43	28	13	78	63
4	64	49	34	19	4	69	54	9	74	59	44	29	14	79	

Figure 5.3: Decomposed matrix for the sieve of *Akea*.

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
5	5, 40, 8	4 th
2·7	14, 9, 5 14, 52, 2	8 ^{ve} + tone
3·5	15, 10, 4 15, 36, 2	8 ^{ve} + m3 rd
5	17, 17, 28, 3	8 ^{ve} + 4 th
	2·3 ² 18, 5, 4	8 ^{ve} + tritone
	19, 18, 3	
	19, 22, 3	
10	19, 19, 27, 2	8 ^{ve} + 5 th
	19, 32, 2	
	19, 46, 1	
	2 ² ·5 20, 31, 2	8 ^{ve} + m6 th
	23 23, 14, 2	8 ^{ve} + M7 th
15	2 ³ ·3 24, 7, 3	2·8 ^{ve}
	5 ² 25, 0, 3	2·8 ^{ve} + semitone
	25, 16, 2	

Figure 5.4: Sketches of *Akeq*, Simplified Formula of the Sieve.

<i>Final Choice</i>	<i>M, I, R</i>	<i>Points Covered</i>	<i>Final Choice</i>	<i>M, I, R</i>	<i>Points Covered</i>
1	25, 0, 3	0 25 50 75	(5, 40)	5, 45, 7	45 50 55 60 65 70 75 80
2	18, 5, 4	5 23 41 59 77	16	19, 46, 1	46 65
3	24, 7, 3	7 31 55 79	(5, 40)	5, 50, 6	50 55 60 65 70 75 80
4	14, 9, 5	9 23 37 51 65 79	(14, 9)	14, 51, 2	51 65 79
5	15, 10, 4	10 25 40 55 70	17	14, 52, 2	52 66 80
6	23, 14, 2	14 37 60	(5, 40)	5, 55, 5	55 60 65 70 75 80
7	25, 16, 2	16 41 66		14, 56, 1	56 70
8	19, 18, 3	18 37 56 75		6, 59, 3	59 65 71 77
9	19, 22, 3	22 41 60 79	(5, 40)	5, 60, 4	60 65 70 75 80
(14, 9)	14, 23, 4	23 37 51 65 79		9, 62, 2	62 71 80
(15, 10)	15, 25, 3	25 40 55 70	(5, 40)	5, 65, 3	65 70 75 80
10	19, 27, 2	27 46 65		9, 66, 1	66 75
11	17, 28, 3	28 45 62 79	(5, 40)	5, 70, 2	70 75 80
12	20, 31, 2	31 51 71		4, 71, 2	71 75 79
13	19, 32, 2	32 51 70		2, 75, 2	75 77 79
14	15, 36, 2	36 51 66	(2, 75)	2, 77, 1	77 79
(14, 9)	14, 37, 3	37 51 65 79	(2, 75)	2, 79, 0	79
15	5, 40, 8	40 45 50 55 60 65 70 75 80		2, 80, 0	80
	15, 41, 2	41 56 71			

Figure 5.5: Xenakis's Calculation of the Simplified Formula for the sieve of *Akea*.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
M, I, R	0	5	7	9	10	14	16	18	22	23	25	27	28	31	32	36	37	40	41	45
25, 0, 3	+	2	2	1	4	2	2	4	1	2	+	1	3	1	4	1	3	1	1	1
18, 5, 4		+								+										+
24, 7, 3			+											+						
14, 9, 5				+						+							+			
15, 10, 4					+						+						+			
23, 14, 2						+											+			
25, 16, 2							+												+	
19, 18, 3								+												+
19, 22, 3									+											+
19, 27, 2												+								
17, 28, 3													+							+
20, 31, 2														+						
19, 32, 2															+					
15, 36, 2																+				
5, 40, 8																		+		
14, 52, 2																				+

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
M, I, R	46	50	51	52	55	56	59	60	62	65	66	70	71	75	77	79	80
25, 0, 3	4	1	1	3	1	3	1	2	3	1	4	1	4	2	2	1	
18, 5, 4		+					+							+			
24, 7, 3					+											+	
14, 9, 5			+							+						+	
15, 10, 4					+							+					
23, 14, 2								+									
25, 16, 2											+						
19, 18, 3														+			
19, 22, 3																	
19, 27, 2										+							
17, 28, 3													+				
20, 31, 2																	
19, 32, 2																	
15, 36, 2																	
5, 40, 8		+			+						+						
14, 52, 2				+													+

Figure 5.6: Simplified Matrix of the Sieve of *Akea* from the Formula as found in the Pre-compositional Sketches.

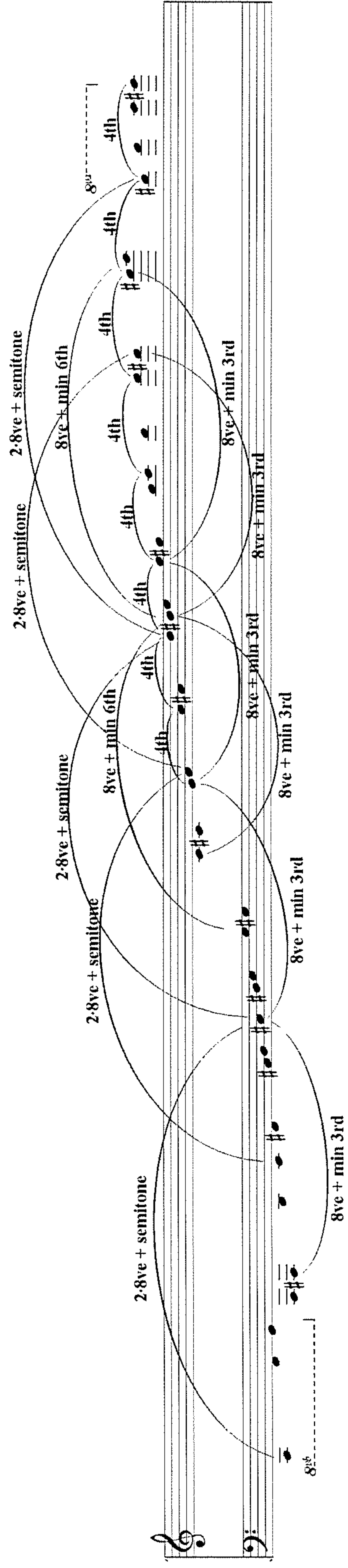


Figure 5.9: Sieve of *Akeq* and its Moduli Congruent Modulo the Perfect 4th.

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
2·7	14, 9, 5	8 ^{ve} + tone
3·5	15, 10, 4	8 ^{ve} + m3 rd
2·3 ²	18, 5, 4	8 ^{ve} + tritone
19	19, 18, 3	8 ^{ve} + 5 th
2 ² ·5	20, 5, 3	8 ^{ve} + m6 th
23	23, 14, 2	8 ^{ve} + M7 th
2 ³ ·3	24, 7, 3 24, 22, 2	2·8 ^{ve}
5 ²	25, 0, 3 25, 16, 2	2·8 ^{ve} + semitone
2·13	26, 10, 2	2·8 ^{ve} + tone
3 ³	27, 5, 2 27, 25, 2	2·8 ^{ve} + m3 rd
2 ² ·7	28, 0, 2 28, 27, 1	2·8 ^{ve} + M3 rd
29	29, 22, 2	2·8 ^{ve} + 4 th
31	31, 9, 2	2·8 ^{ve} + 5 th

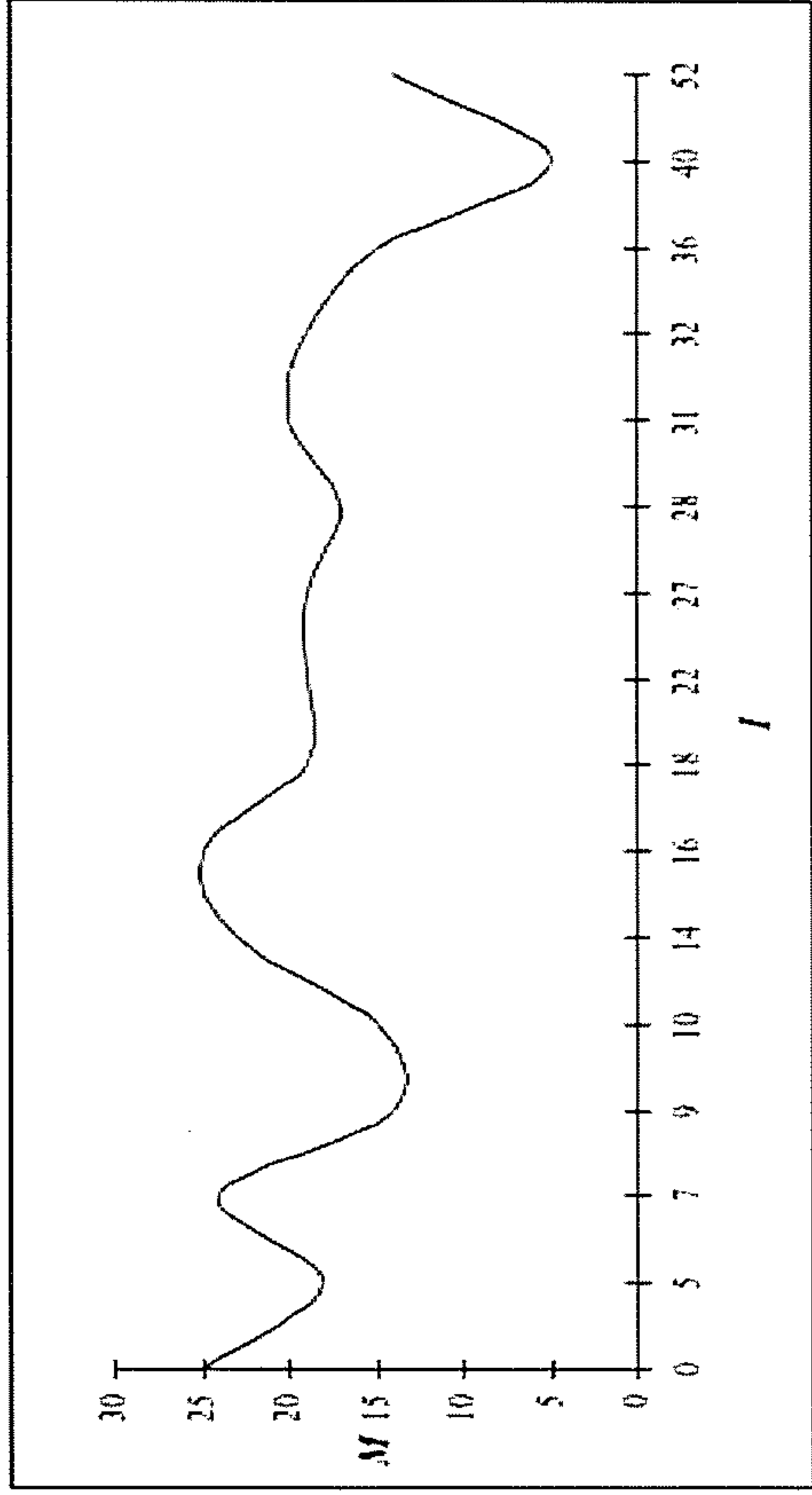
Figure 5.10: Simplified Formula of the Sieve of Akea, suggested by Program B.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
M,I,R	0	5	7	9	10	14	16	18	22	23	25	27	28	31	32	36	37	40	41	45
25, 0, 3	+	2	2	1	4	2	2	4	1	2	+	1	3	1	4	1	3	1	4	1
18, 5, 4		+								+				+					+	
24, 7, 3			+																	
14, 9, 5				+						+							+			
15, 10, 4					+												+			
23, 14, 2						+											+			
25, 16, 2							+										+			
19, 18, 3								+									+			
24, 22, 2									+											
28, 27, 1												+								
28, 0, 2	+												+							
27, 5, 2		+													+					
26, 10, 2					+											+				
20, 5, 3											+									+
27, 25, 2																				
31, 9, 2				+																
29, 22, 2									+											
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
M,I,R	46	50	51	52	55	56	59	60	62	65	66	70	71	75	77	79	80			
25, 0, 3	4	1	1	3	1	3	1	2	3	1	4	1	4	2	2	1				
18, 5, 4		+					+							+						
24, 7, 3																				
14, 9, 5			+							+										
15, 10, 4					+							+								
23, 14, 2								+												
25, 16, 2											+									
19, 18, 3														+						
24, 22, 2	+											+								
28, 27, 1																				
28, 0, 2																				
27, 5, 2																				
26, 10, 2																				
20, 5, 3																				
27, 25, 2																				
31, 9, 2				+																
29, 22, 2													+							

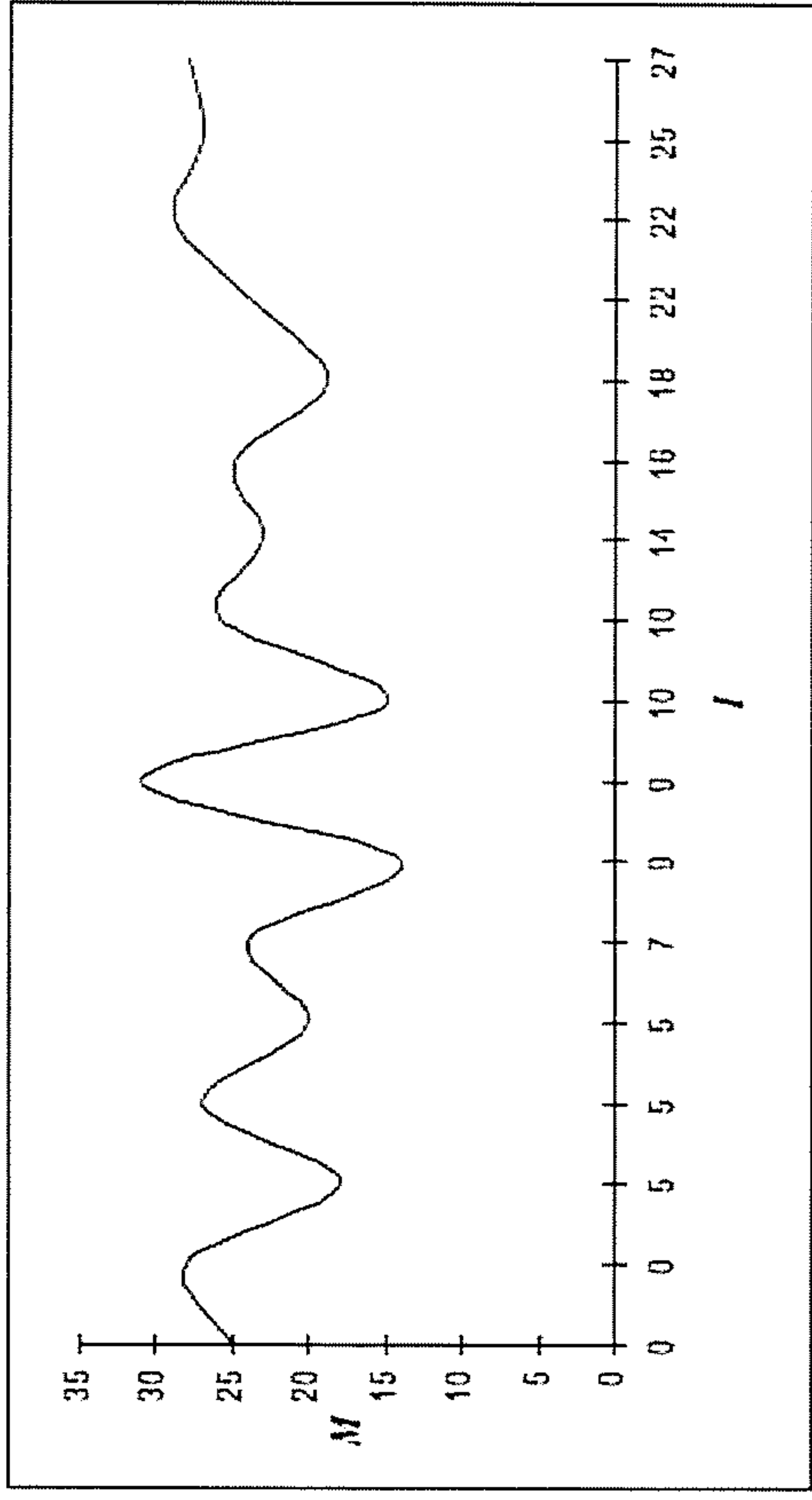
Figure 5.11: Simplified Matrix of the Sieve of *Akea*, from the Formula suggested by Program B.

	Point	1986	1990	Point	1986	1990	Point	1986	1990
1	0	25, 0, 3	25, 0, 3 28, 0, 2	14	31	24, 7, 3 20, 31, 2	27	59	18, 5, 4 27, 5, 2
2	5	18, 5, 4	18, 5, 4 27, 5, 2 20, 5, 3	15	32	19, 32, 2	28	60	23, 14, 2 19, 22, 3 5, 40, 8
3	7	24, 7, 3	24, 7, 3	16	36	15, 36, 2	29	62	17, 28, 3 14, 9, 5
4	9	14, 9, 5	14, 9, 5 31, 9, 2	17	37	23, 14, 2 19, 18, 3	30	65	19, 27, 2 5, 40, 8
5	10	15, 10, 4	15, 10, 4 26, 10, 2	18	40	15, 10, 4 5, 40, 8	31	66	25, 16, 2 15, 36, 2 14, 52, 2
6	14	23, 14, 2	23, 14, 2	19	41	18, 5, 4 25, 16, 2 19, 22, 3	32	70	15, 10, 4 19, 32, 2 5, 40, 8
7	16	25, 16, 2	25, 16, 2	20	45	17, 28, 3 5, 40, 8	33	71	20, 31, 2 25, 0, 3 19, 18, 3 5, 40, 8
8	18	19, 18, 3	19, 18, 3	21	46	19, 27, 2	34	75	18, 5, 4 24, 7, 3 14, 9, 5 19, 22, 3 17, 28, 3
9	22	19, 22, 3	24, 22, 2 29, 22, 2	22	50	25, 0, 3 5, 40, 8	35	77	18, 5, 4 18, 5, 4
10	23	18, 5, 4 14, 9, 5	18, 5, 4 14, 9, 5	23	51	14, 9, 5 20, 31, 2 19, 32, 2 15, 36, 2	36	79	24, 7, 3 14, 9, 5 19, 22, 3 17, 28, 3
11	25	25, 0, 3 15, 10, 4	25, 0, 3 15, 10, 4 20, 5, 3 27, 25, 2	24	52	14, 52, 2	37	80	5, 40, 8 29, 22, 2
12	27	19, 27, 2	28, 27, 1	25	55	24, 7, 3 15, 10, 4 5, 40, 8			
13	28	17, 28, 3	28, 0, 2	26	56	19, 18, 3			

Figure 5.12: The Sieve of *Akeq* and the two versions of the Algorithm (1986 and 1990).



1986



1990

Figure 5.13: The size of M as I increases, in the Formulae of the Sieve of *Akea* by the two versions of the Algorithm.

	<u>Original</u>	<u>Inversion</u>
	14, 9, 5	14, 1, 5
	15, 10, 4	15, 10, 4
	18, 5, 4	18, 3, 4
	19, 18, 3	19, 5, 3
5	20, 5, 3	20, 15, 3
	23, 14, 2	23, 20, 2
	24, 7, 3	24, 1, 3
	24, 22, 2	24, 10, 2
	25, 0, 3	25, 5, 3
10	25, 16, 2	25, 14, 2
	26, 10, 2	26, 18, 2
	27, 25, 2	27, 1, 2
	27, 5, 2	27, 21, 2
	28, 0, 2	28, 24, 2
15	28, 27, 1	28, 25, 1
	29, 22, 2	29, 0, 2
	31, 9, 2	31, 9, 2

Figure 5.14: The Simplified Formula of the Sieve of *Akea* and its Inversion.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
M, I, R	0	1	3	5	9	10	14	15	18	20	21	24	25	28	29	30	34	35	39	40
25, 5, 3	/	2	2	4	/		/	3	2	/	3	/	3	/	/	4	/	/	/	3
18, 3, 4			+							+						+				
24, 1, 3		+											+							
14, 1, 5		+						+							+					
15, 10, 4						+				+										
23, 20, 2																				
25, 14, 2							+													
19, 5, 3				+								+								
24, 10, 2						+											+			
28, 25, 1													+							
28, 24, 2												+								
27, 21, 2										+										
26, 18, 2								+												
20, 15, 3									+									+		
27, 1, 2		+												+						
31, 9, 2					+															
29, 0, 2		+													+					
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
M, I, R	43	44	48	49	52	53	55	57	58	62	64	66	70	71	73	75	80			
25, 5, 3	/	4	/	3	/	2	2	/	4	2	2	3	/	2	2	5				
18, 3, 4							+													
24, 1, 3				+											+					
14, 1, 5								+						+						
15, 10, 4							+						+							
23, 20, 2												+								
25, 14, 2											+									
19, 5, 3										+										
24, 10, 2									+											
28, 25, 1																				
28, 24, 2																				
27, 21, 2																				
26, 18, 2																				
20, 15, 3																				
27, 21, 2			+																	
26, 18, 2		+											+							
20, 15, 3							+													
27, 1, 2																				
31, 9, 2																				
29, 0, 2									+											

Figure 5.15: Simplified Matrix of the Inversion of the Sieve of Akea.

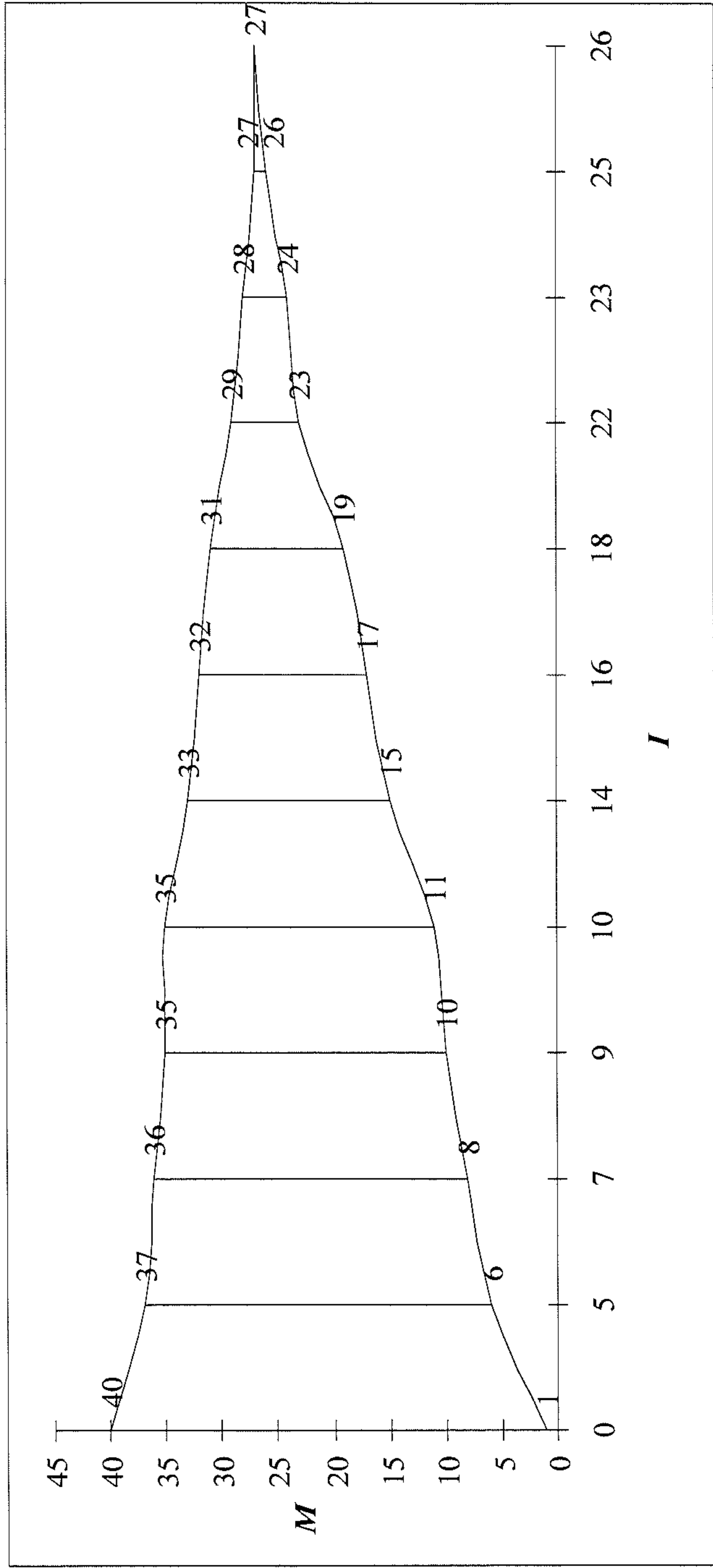


Figure 5.16: The Minimum and Maximum Values of M , according to the Condition of Inner Symmetry, as I Increases in the Sieve of $Akea$.

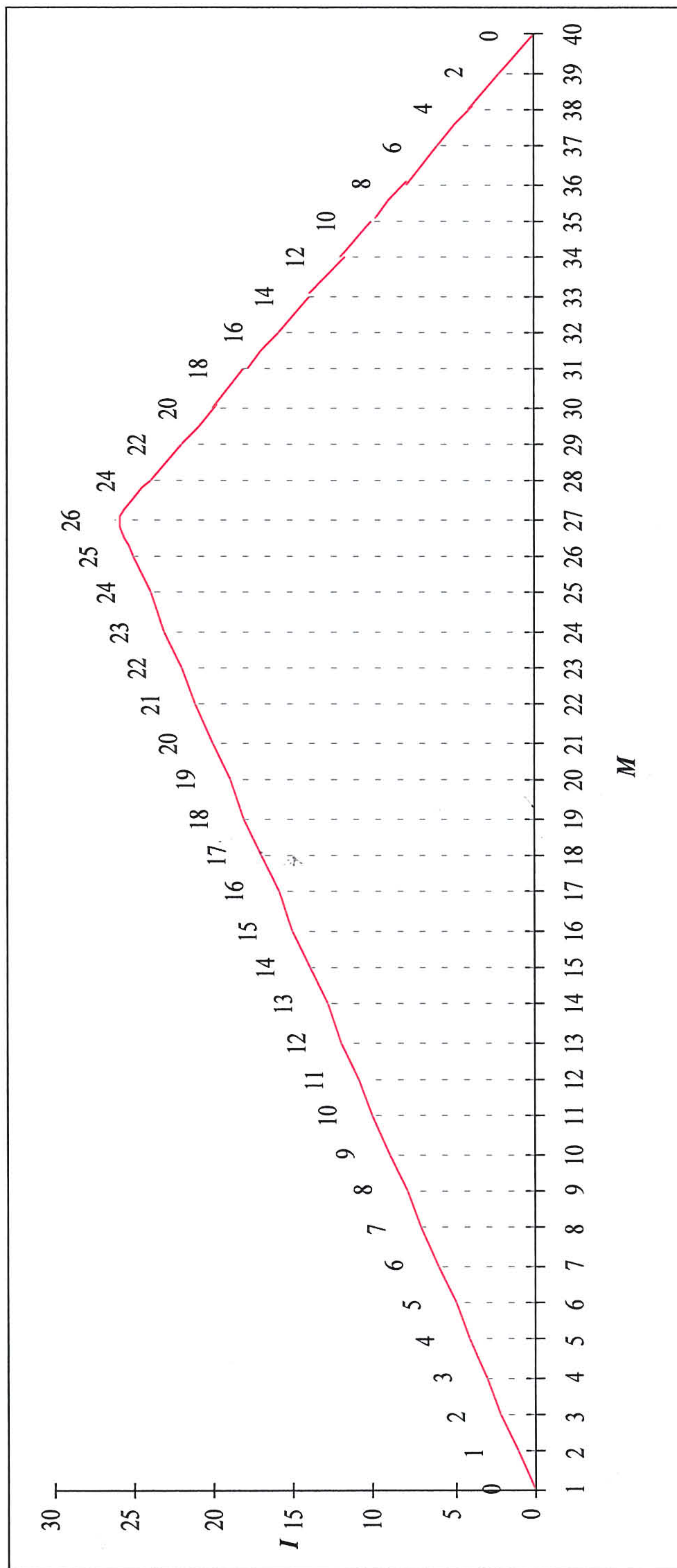


Figure 5.17: The Maximum Values of I as M Increases, when $n = 80$.

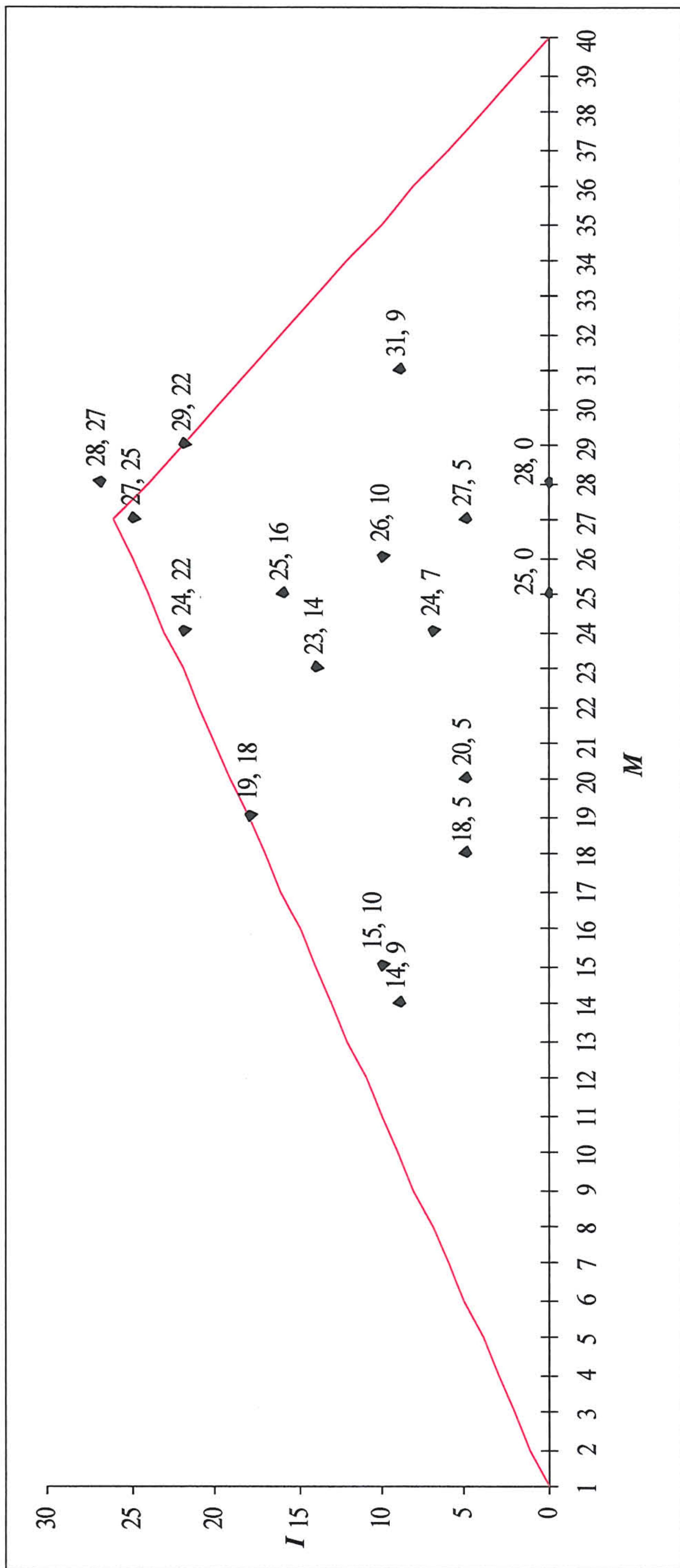


Figure 5.18: The Condition of Inner Symmetry and the Sieve of Akea.

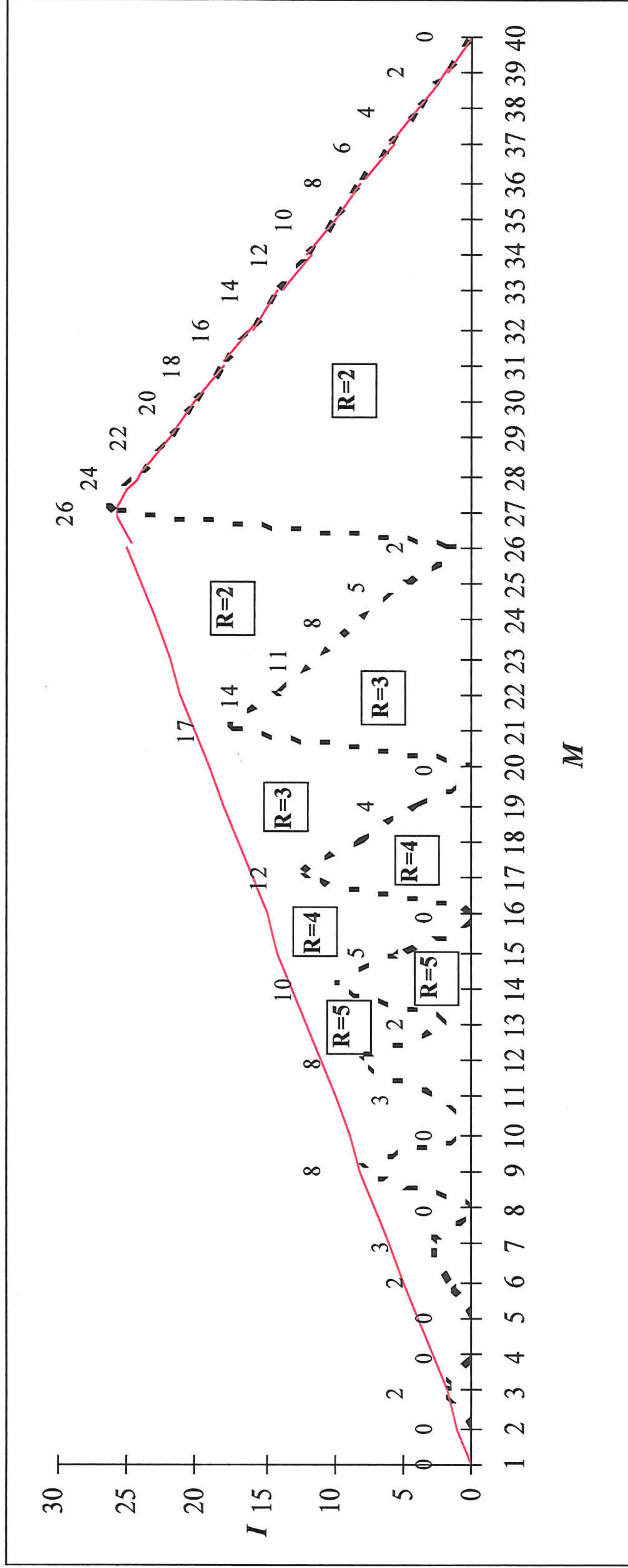


Figure 5.19: The values of R and $n(\text{mod}M)$ as M increases, when $n = 80$.

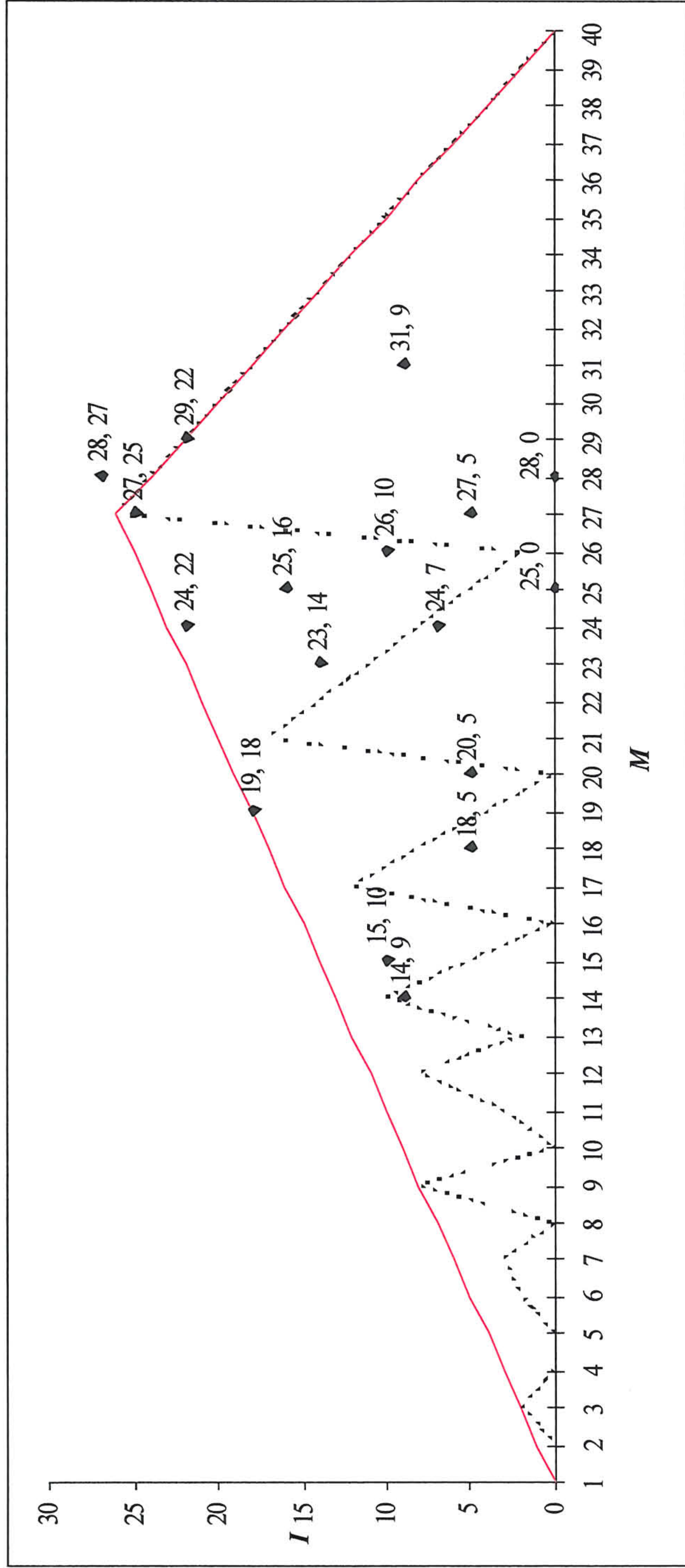


Figure 5.20: Inner Symmetry Chart for the Sieve of Akea.

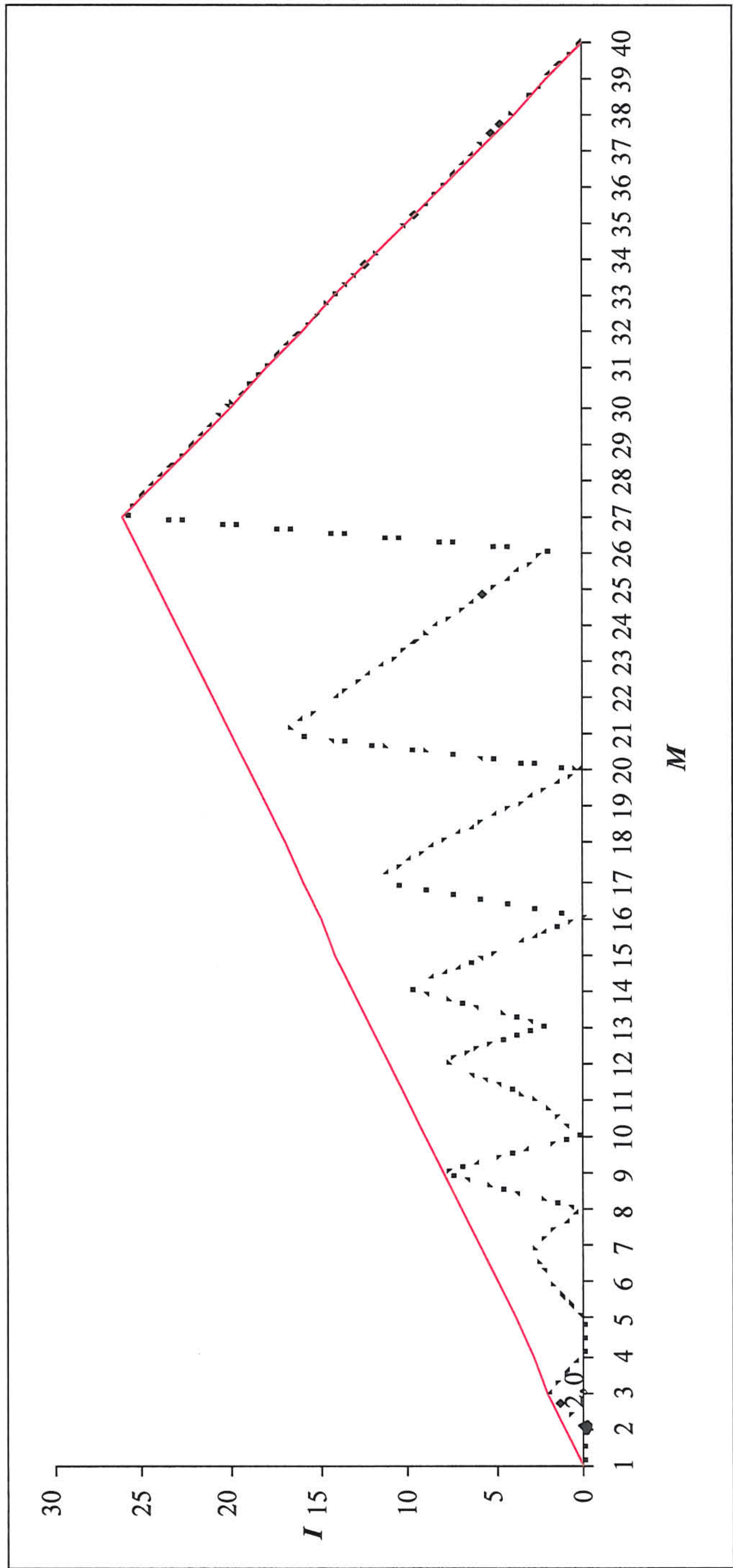


Figure 5.21: Inner Symmetry Chart for (2, 0), with $n = 80$.

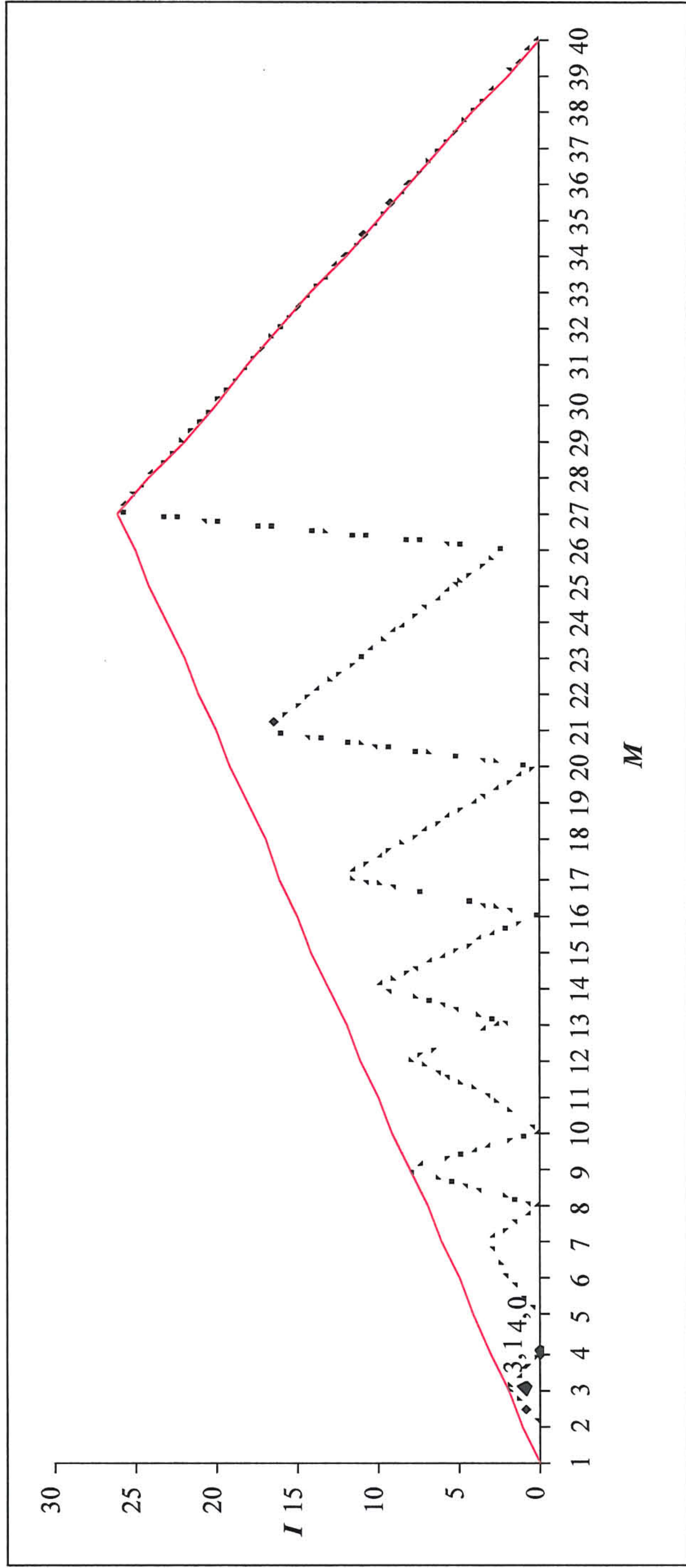


Figure 5.22: Inner Symmetry Chart for $(3, 1) + (4, 0)$, with $n = 80$.

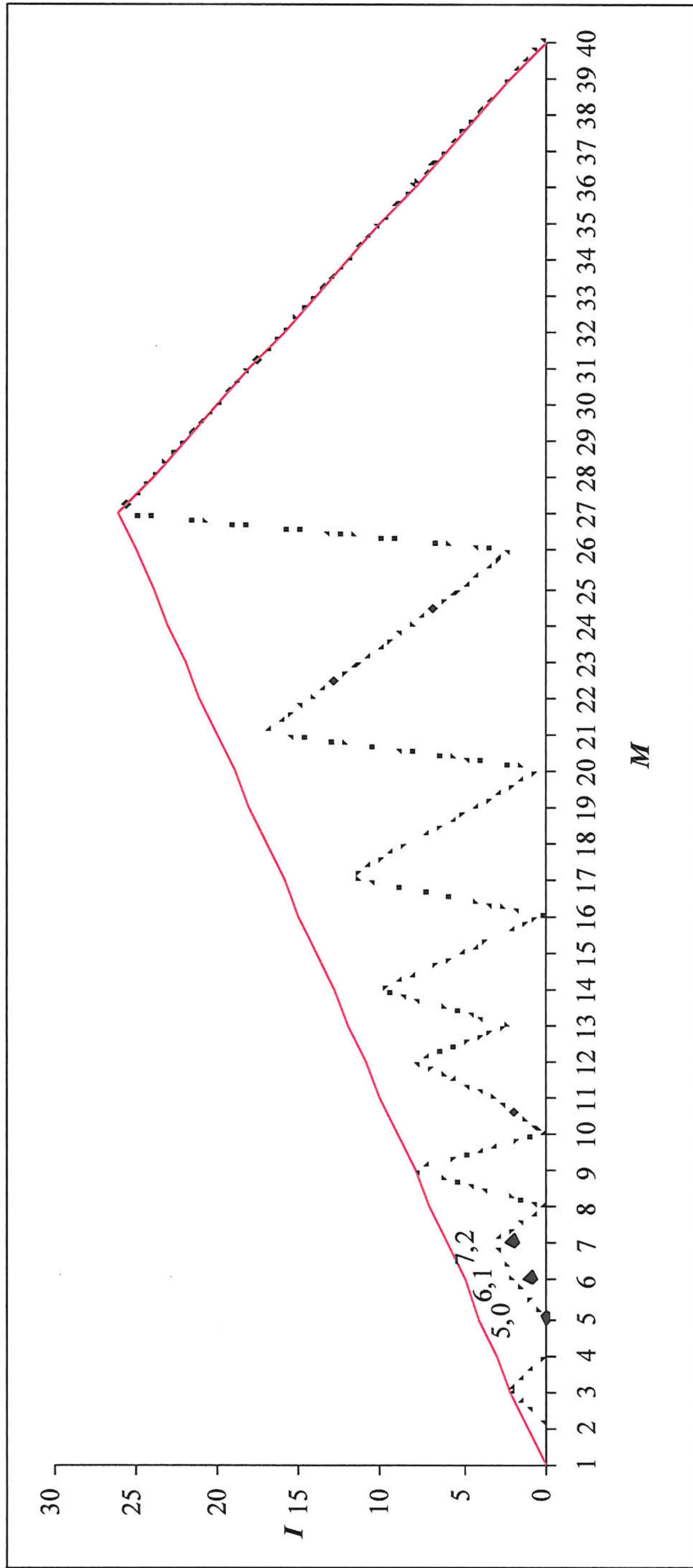


Figure 5.23: Inner Symmetry Chart for $(5, 0) + (6, 1) + (7, 2)$, with $n = 80$.

Figure 6.1 shows a musical sketch for Jonchaies T₋₁. It consists of a grand staff with two staves. The right-hand staff contains a sequence of notes with fingerings indicated by numbers 1, 2, 3, and 4. The sequence of fingerings is: 4, 1 1 3, 1 2 4, 1 4, 1 1 3, 1 2 4, 1 4, 1 1 3, 1 2 4, 1 4, 1 1 3, 1 2 4, 1 4, 1 1 3, 1 2 4, 1 4, 1 1 3, 1 2 4, 1. The left-hand staff contains a few notes, with an 8va marking below it. A dashed line indicates a continuation of the piece.

Figure 6.1: Sketches of *Palimpsest*, sieve of *Jonchaies* T₋₁

Figure 6.2 shows a musical sketch for Jonchaies T₋₇. It consists of a grand staff with two staves. The right-hand staff contains a sequence of notes with fingerings indicated by numbers 1, 2, 3, 4, and 5. The sequence of fingerings is: 5, 1 2 4, 1 4, 1 1 5, 1 2 4, 1 4, 1 1 5, 1 2 4, 1 4, 1 1 5, 1 2 4, 1 4, 1 1 5, 1 2 4, 1 4, 1 1 5, 1 2 4, 1 4, 1 1 5, 1 2 4. The left-hand staff contains a few notes, with an 8va marking below it. A dashed line indicates a continuation of the piece.

Figure 6.2: Sketches of *Palimpsest*, Sieve of *Jonchaies* T₋₇ and with perfect 4th instead of m3rd.

Figure 6.3 shows a musical sketch for Jonchaies T₊₁. It consists of a grand staff with two staves. The right-hand staff contains a sequence of notes with fingerings indicated by numbers 1, 2, 3, 4, and 5. The sequence of fingerings is: 2 4, 1 4, 1 3, 1 2 4, 1 4, 1 3, 1 2 4, 1 4, 1 3, 1 2 4, 1 4, 1 3, 1 2 4, 1 4, 1 3, 1 2 4, 1 4, 1 3, 1 2 4, 1. The left-hand staff contains a few notes, with an 8va marking below it. A dashed line indicates a continuation of the piece.

Figure 6.3: Sketches of *Palimpsest*, Sieve of *Jonchaies* T₊₁ and omitting the last element.

Figure 6.4: Original Sieve of Mists.

Figure 6.5: Final Version of the Sieve of Mists.

	10_j									
	0	1	2	3	4	5	6	7	8	9
0	0	81	72	63	54	45	36	27	18	9
1	10	1	82	73	64	55	46	37	28	19
2	20	11	2	83	74	65	56	47	38	29
3	30	21	12	3	84	75	66	57	48	39
4	40	31	22	13	4	85	76	67	58	49
5	50	41	32	23	14	5	86	77	68	59
6	60	51	42	33	24	15	6	87	78	69
7	70	61	52	43	34	25	16	7	88	79
8	80	71	62	53	44	35	26	17	8	89
9_k										

Figure 6.6: Decomposed Matrix for the Sieve of *Mists*.

	5_j				
	0	1	2	3	4
0	0	6	2	8	4
1	5	1	7	3	9
2_i					

Figure 6.7: Sub-matrix for the Sieve of *Mists*.

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
5^2	25, 16, 2	2·8ve + semitone
	28, 10, 2	
$2^2·7$	28, 16, 2	2·8ve + M3rd
	28, 23, 2	
5	29, 23, 2	2·8ve + 4th
	30, 8, 2	
$2·3·5$	30, 21, 2	2·8ve + tritone
	30, 27, 2	
2^5	32, 30, 1	2·8ve + m6th
10	33, 10, 2	2·8ve + M6th
	5·7	35, 23, 1
	$2^2·3^2$	36, 0, 2
		36, 13, 2
	41	41, 8, 2
15	41, 30, 1	3·8ve + 4th
	47	47, 2, 1
		3·8ve + M7th

Figure 6.8: Simplified Formula of the Sieve of *Mists*.

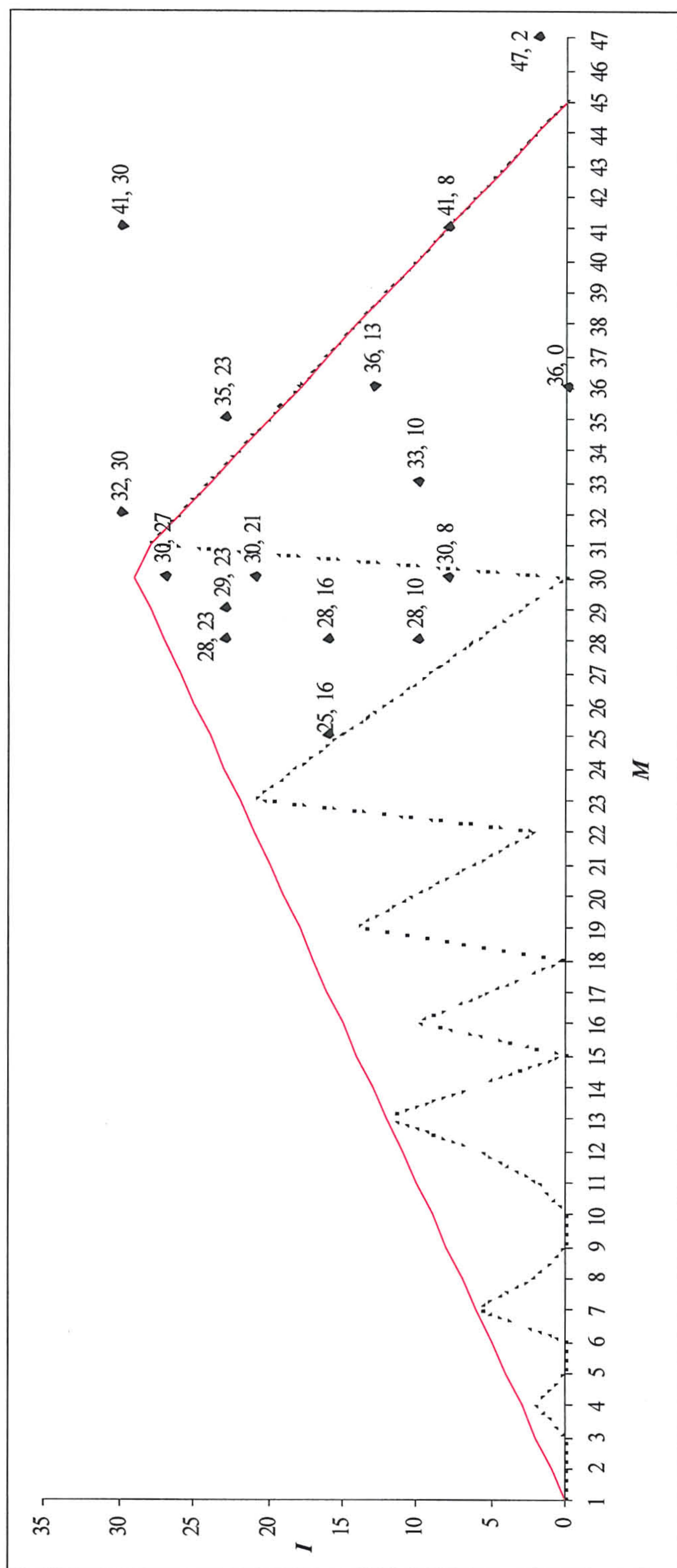


Figure 6.9: Inner Symmetry Chart for the Final Sieve of Mists.

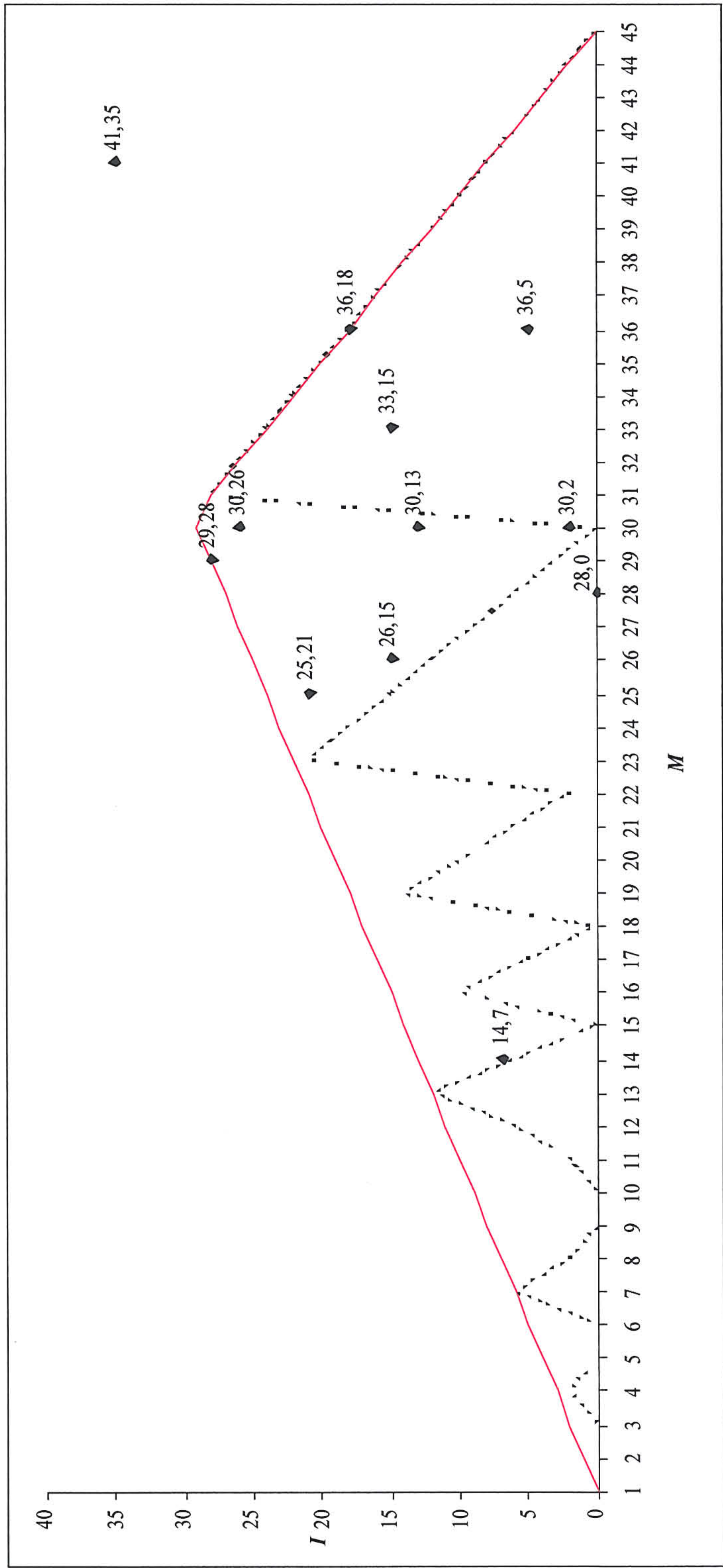


Figure 6.10: Sieve of Mists, $T_7(\text{mod } 90)$.

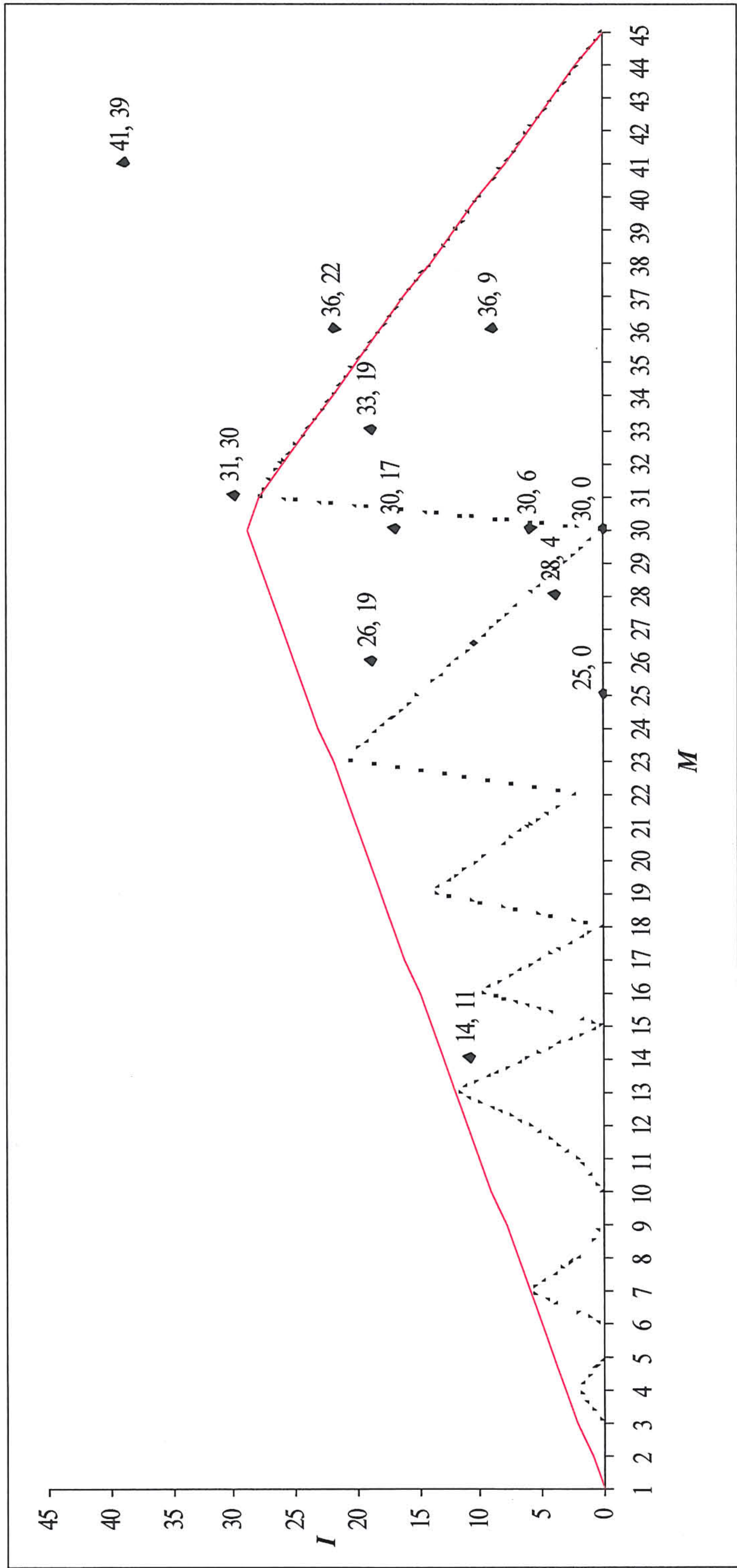


Figure 6.11: Sieve of Mists, $T_8(\text{mod } 90)$.

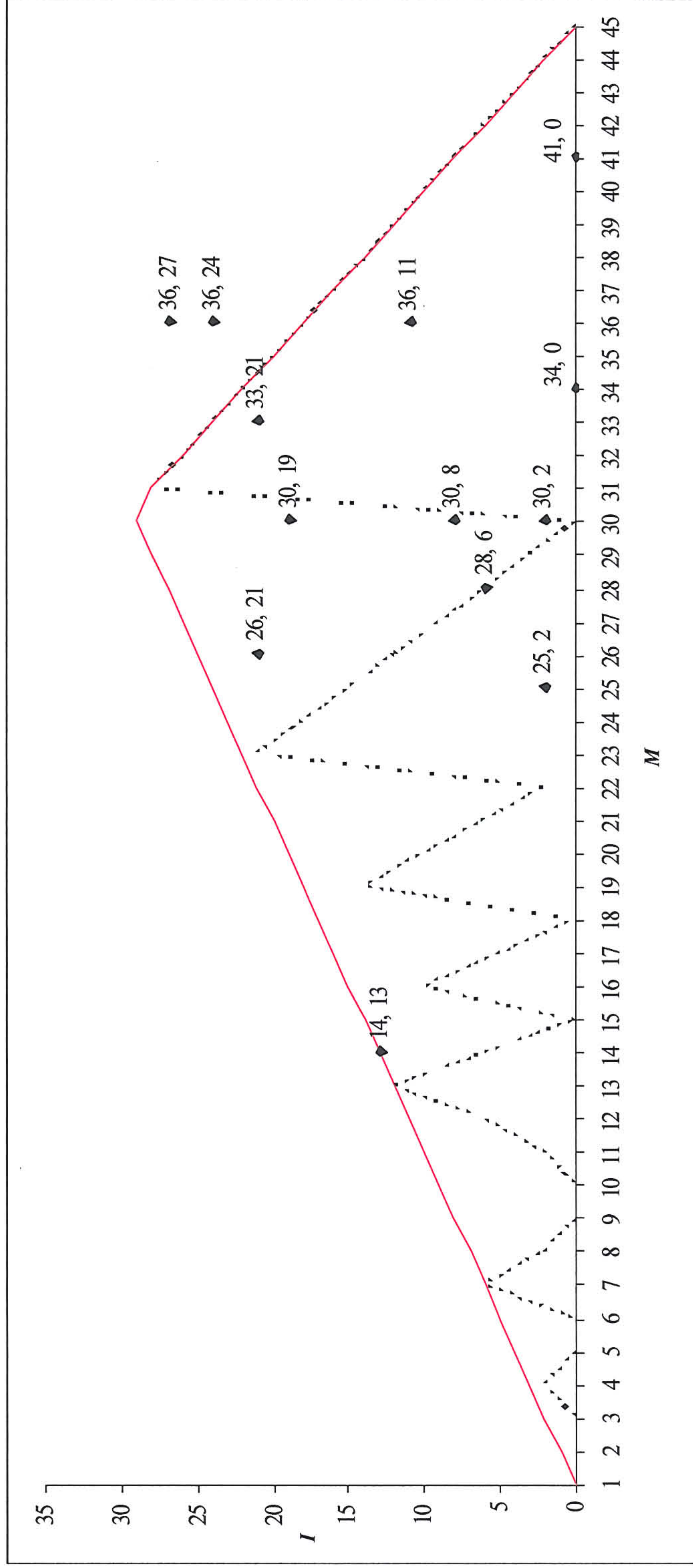


Figure 6.12: Sieve of Mists, $T_{10}(\text{mod}90)$.

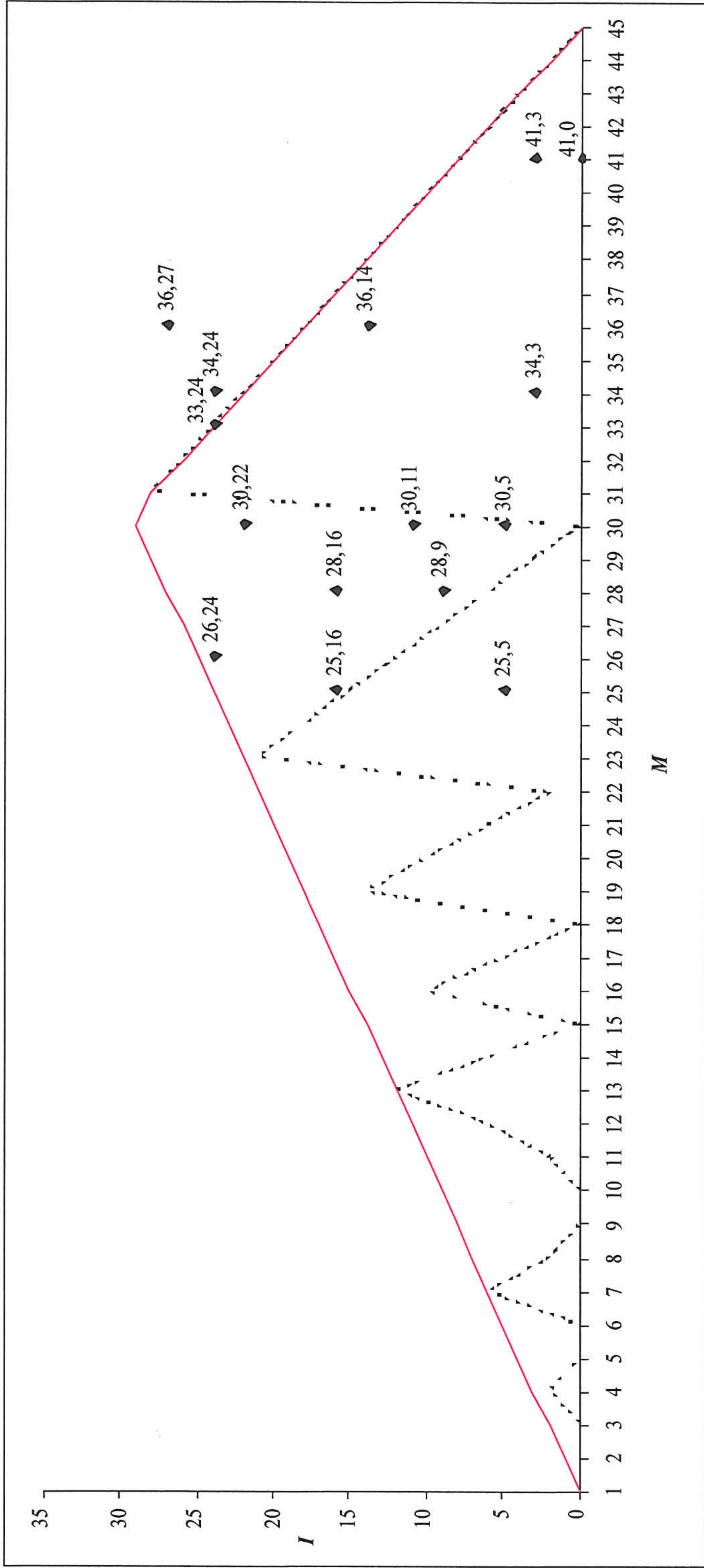


Figure 6.13: Sieve of $Mists$, $T_{15}(\text{mod}90)$.

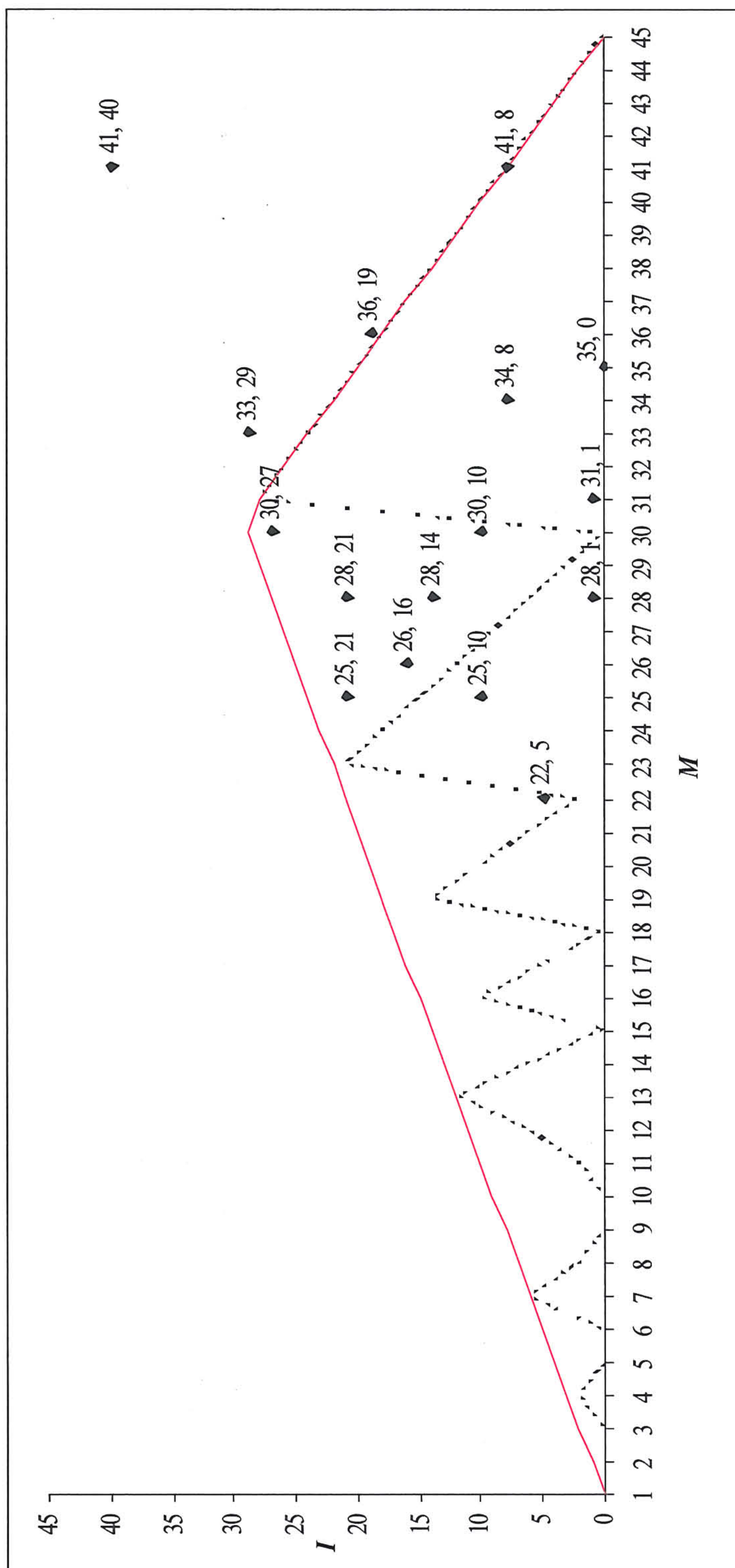


Figure 6.14: Sieve of Mists, $T_{20}(\text{mod } 90)$.

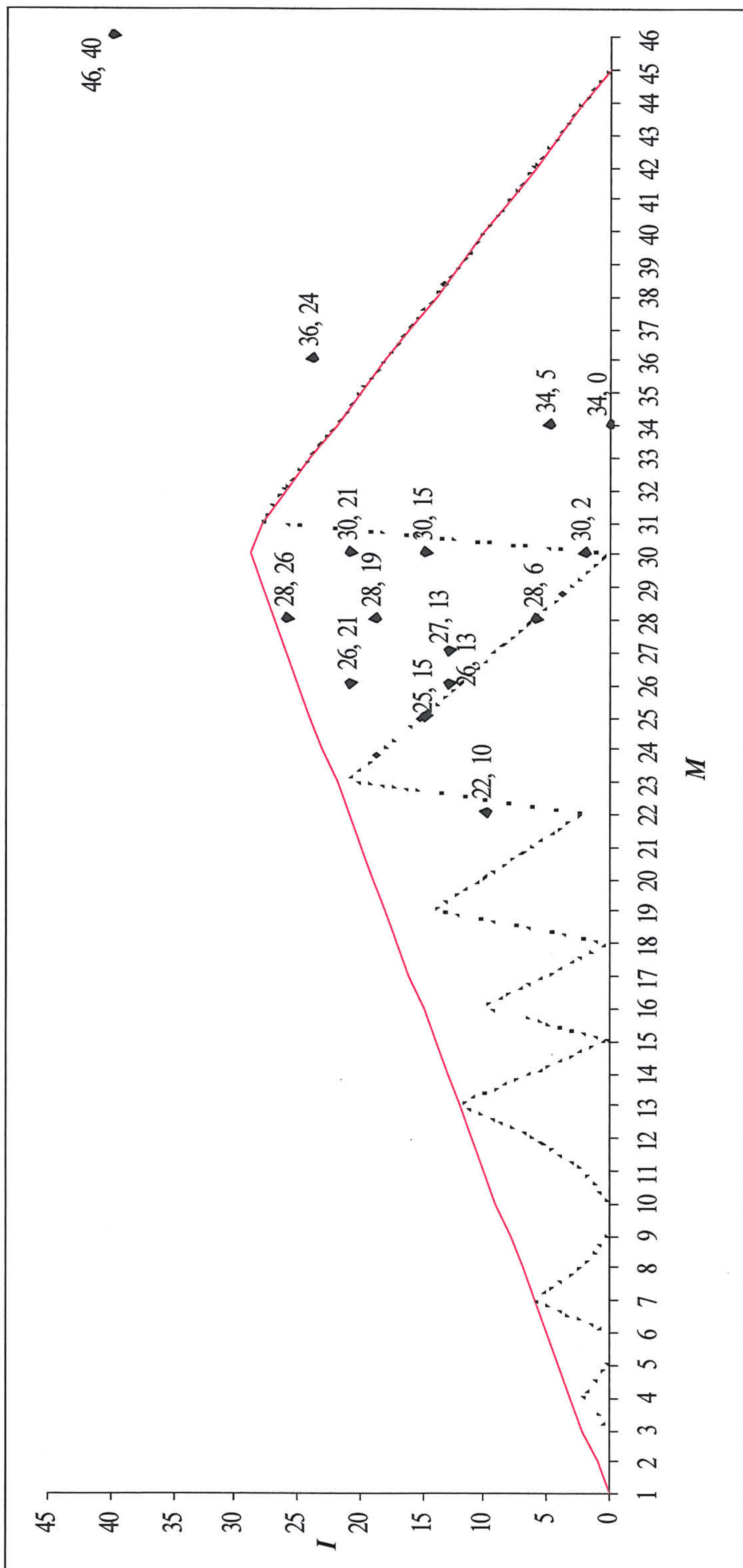


Figure 6.15: Sieve of Mists, $T_{24}(\text{mod } 90)$.

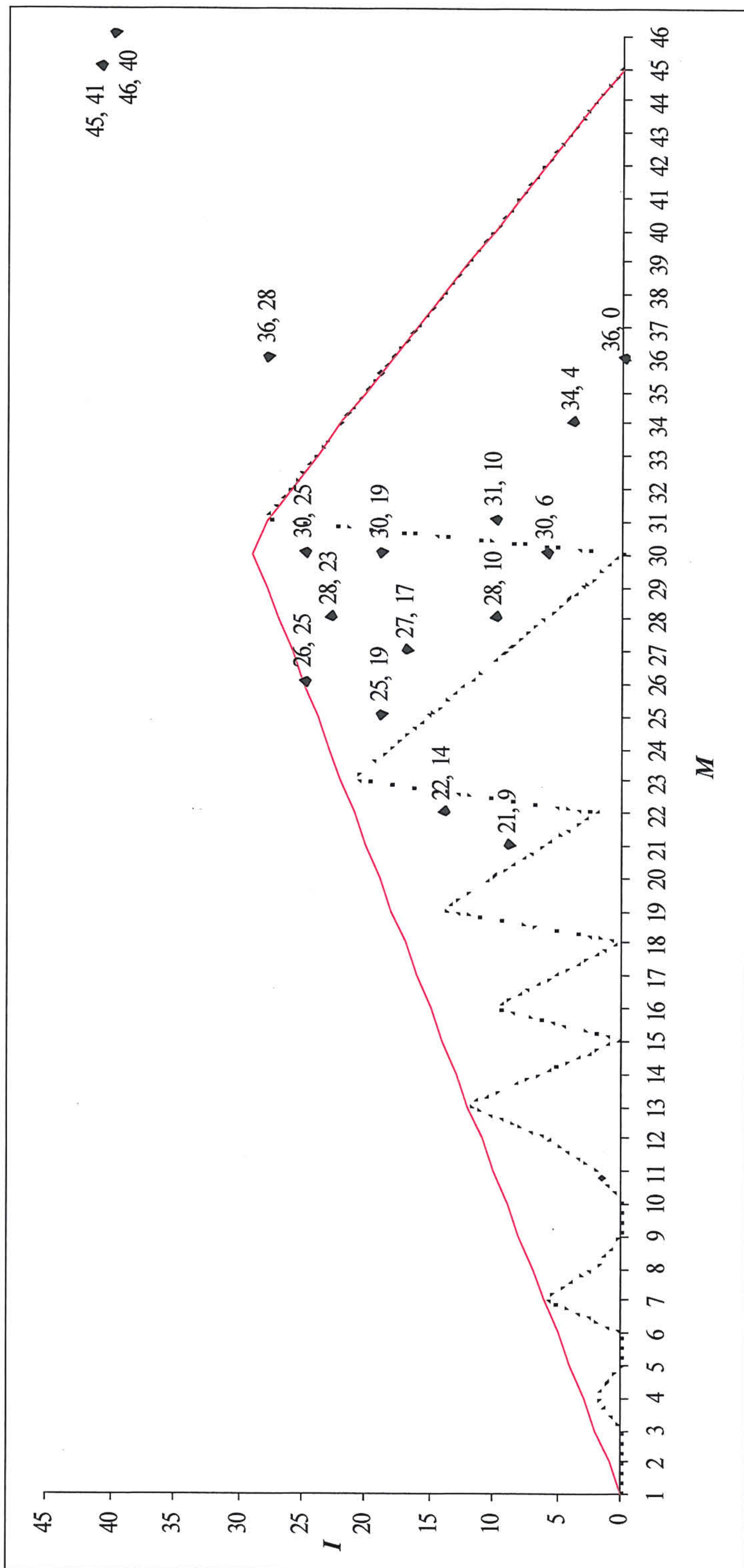


Figure 6.16: Sieve of Mists, $T_{29}(\text{mod } 90)$.

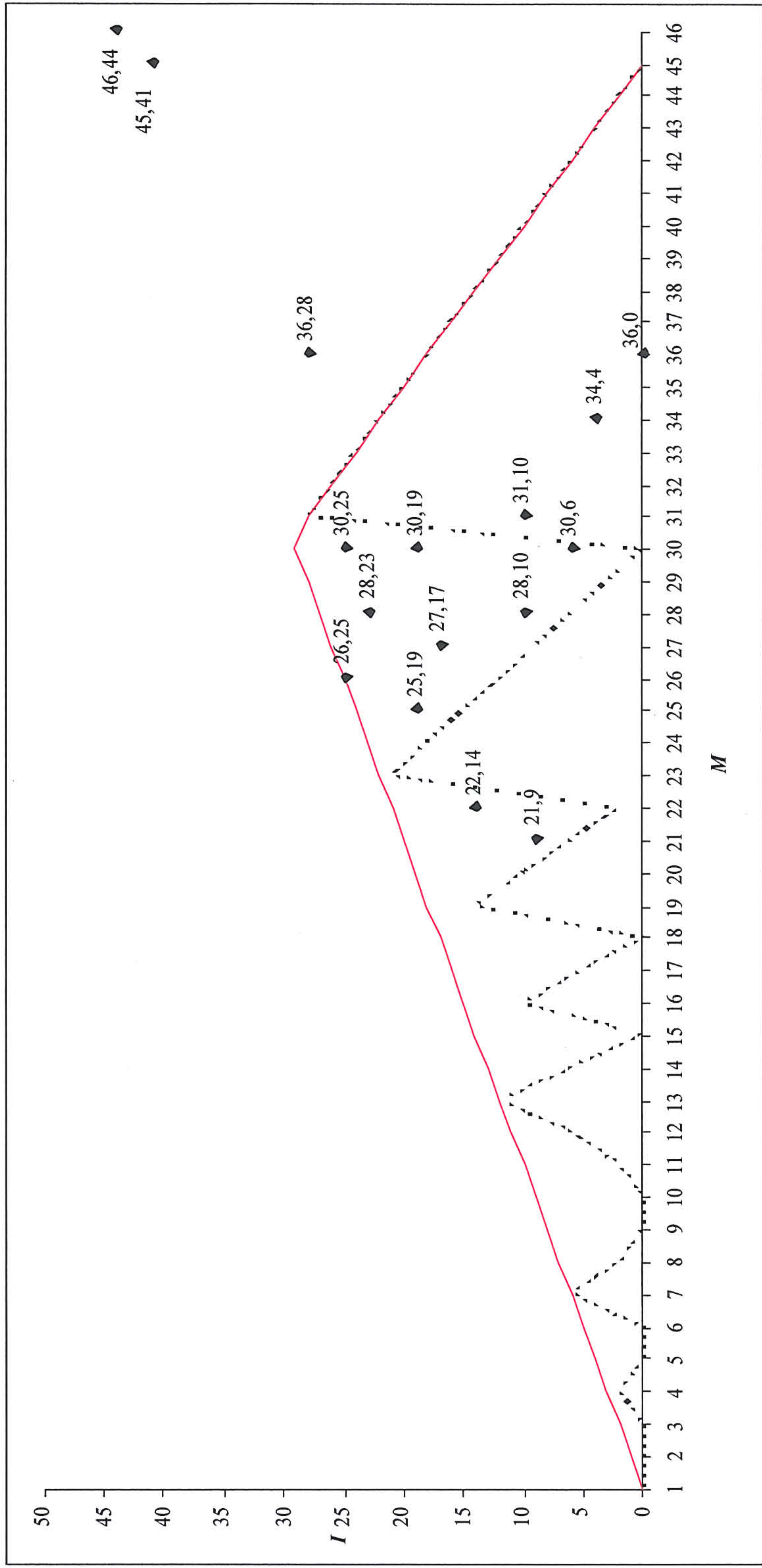


Figure 6.17: Sieve of Mists, $T_{30}(\text{mod}90)$.

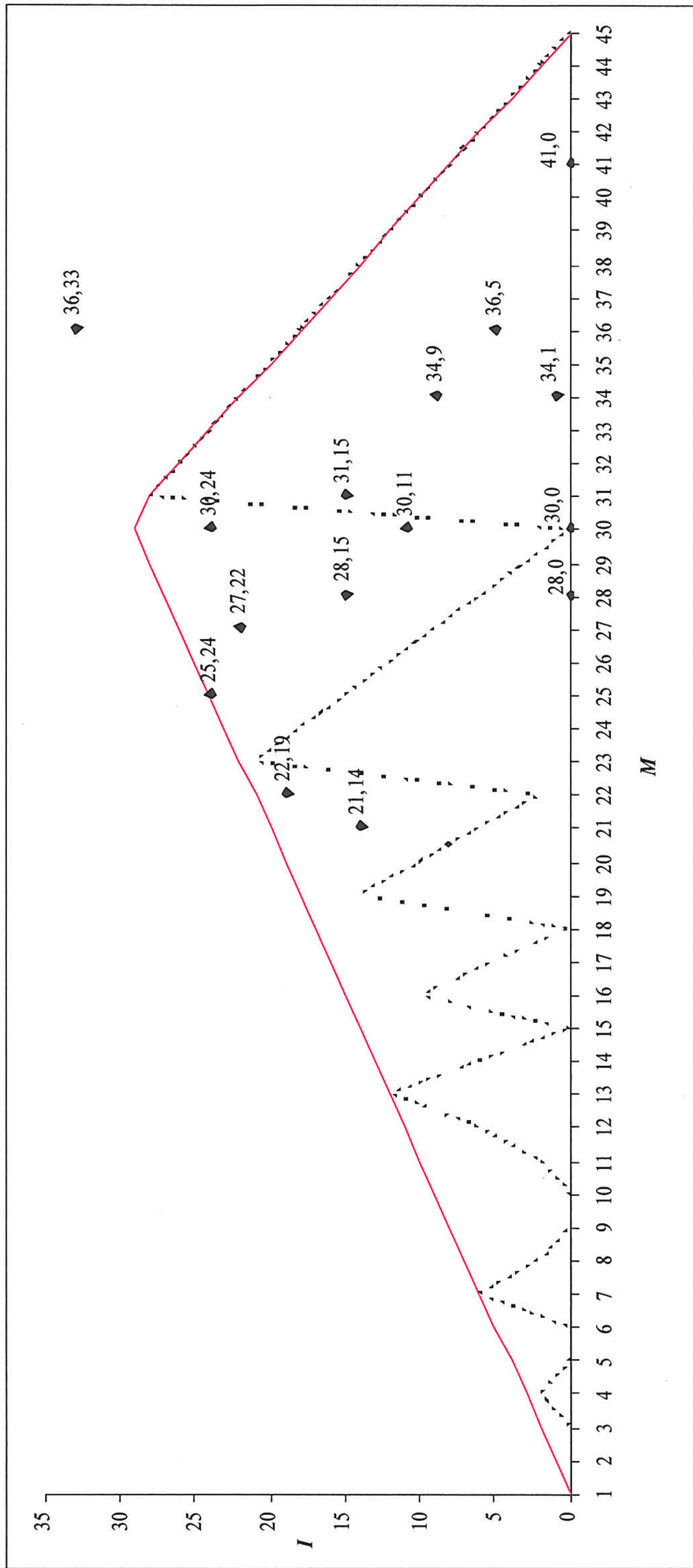


Figure 6.18: Sieve of Mists, $T_{36}(\text{mod } 90)$.

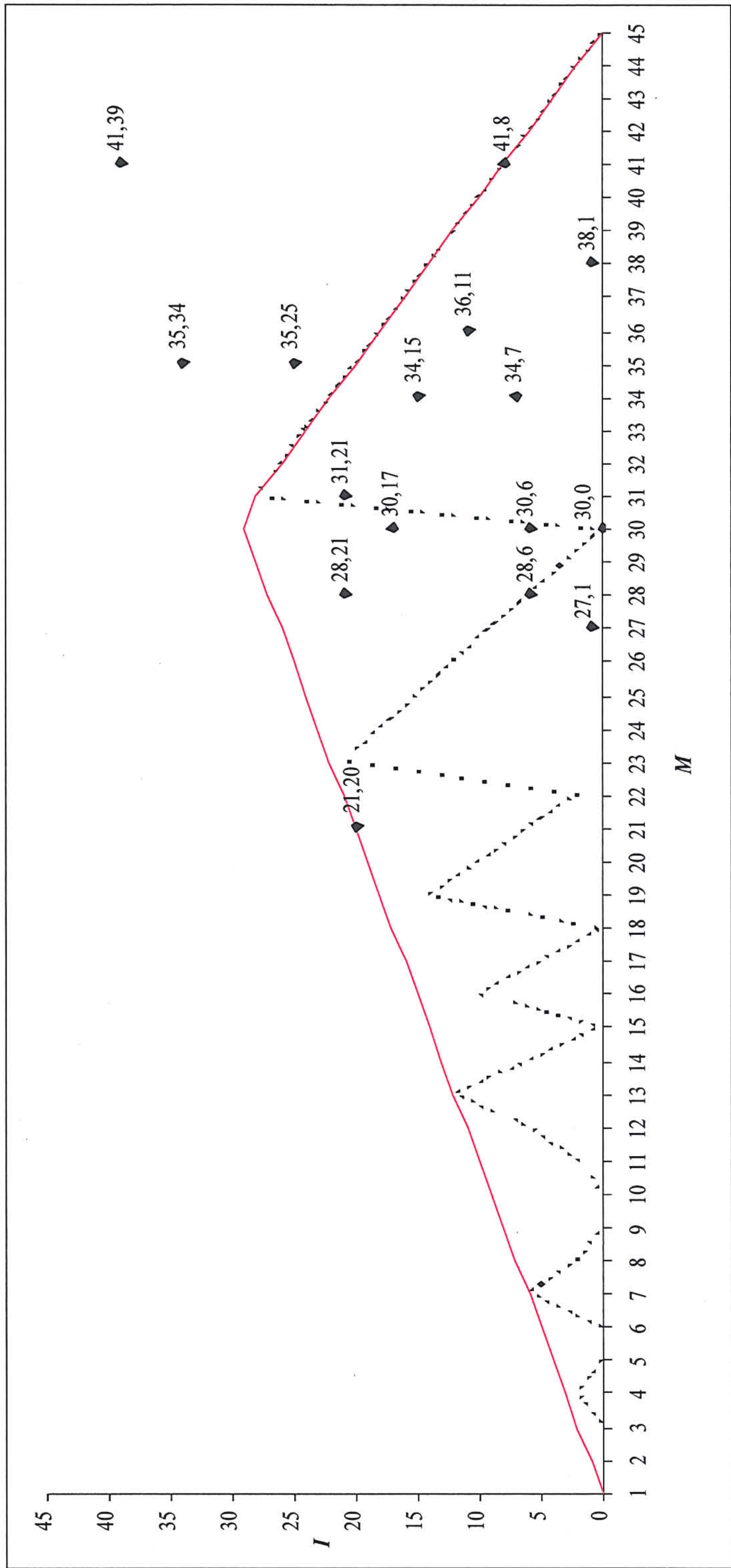


Figure 6.19: Sieve of *Mists*, $T_{38}(\text{mod}90)$.

Figure 6.20: Sieve in the sketches of *Ais* that was not finally used.

Figure 6.21: Original Sieve of *Ais* (not finally used).

Figure 6.22: Sieve of *Ais* (T_{+7} of the Original).

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
3·7	21, 9, 3 21, 19, 3	8ve + M6th
2·11	22, 20, 3	8ve + m7th
2 ³ ·3	24, 16, 2 24, 23, 2	2·8ve
5	25, 0, 3 25, 12, 2	2·8ve + semitone
2·13	26, 19, 2 26, 20, 2	2·8ve + tone
10	2 ² ·7 28, 6, 2	2·8ve + M3rd
	29 29, 0, 2	2·8ve + 4th
	2·3·5 30, 20, 2	2·8ve + tritone
	31 31, 16, 2	2·8ve + 5th
	2 ⁵ 32, 25, 1	2·8ve + m6th
15	3·11 33, 6, 2 33, 20, 2	2·8ve + M6th
	2·17 34, 3, 2	2·8ve + m7th
	2 ² ·3 ² 36, 0, 2	3·8ve
	37 37, 30, 1	3·8ve + semitone

Figure 6.23: Simplified Formula of the Final Sieve of *A*'s.

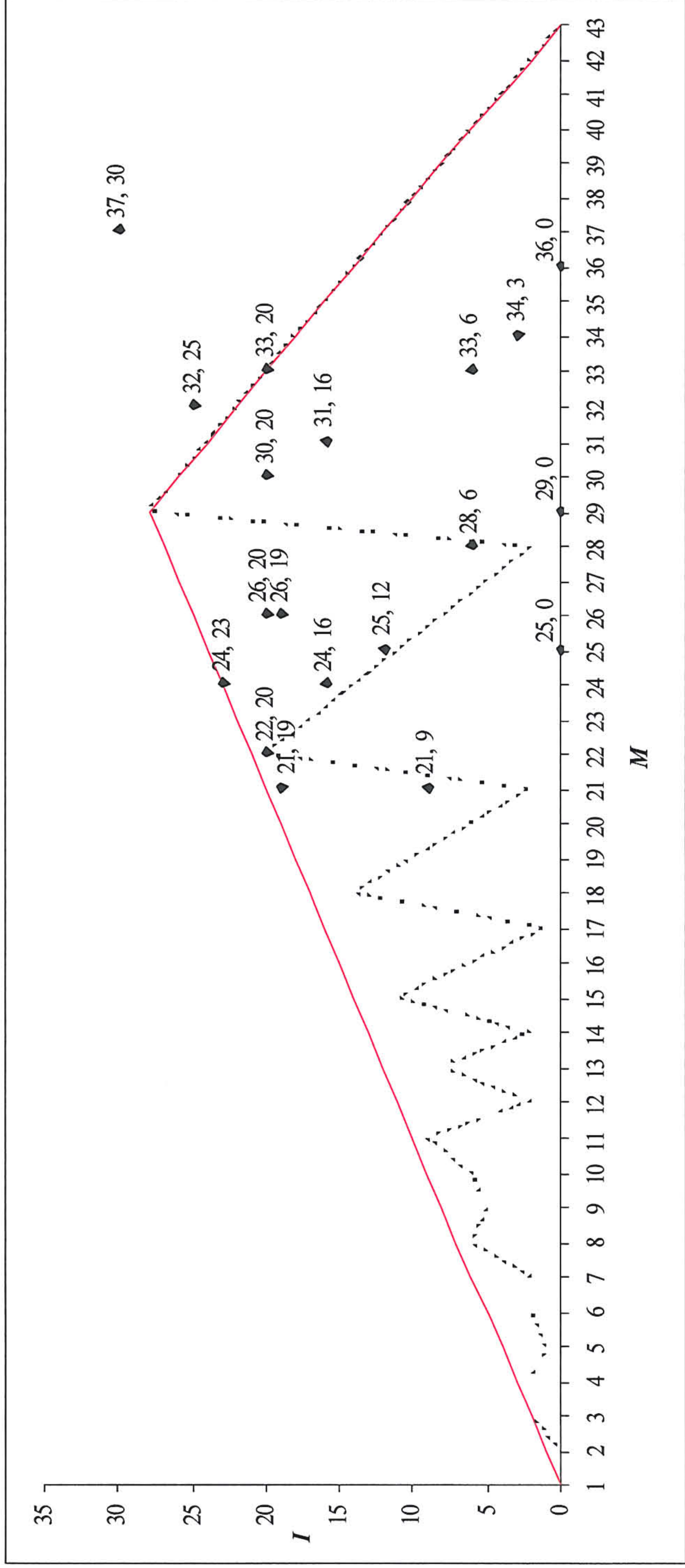


Figure 6.24: Inner Symmetry Chart for the Final Sieve of A_{15} .

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
3·7	21, 10, 3 21, 20, 3	8ve + M6th
2·11	22, 11, 3 22, 14, 3	8ve + m7th
5	23, 14, 3 5 ² 25, 16, 2	8ve + M7th 2·8ve + semitone
	28, 16, 2	
2 ² ·7	28, 21, 2 28, 27, 2	2·8ve + M3rd
10	30, 0, 2 2·3·5 30, 3, 2 30, 28, 1	2·8ve + tritone
	31, 7, 2	
15	31, 11, 2 31, 25, 1	2·8ve + 5th
	2 ⁵ 32, 16, 2	2·8ve + m6th
	3·11 33, 20, 2	2·8ve + M6th

Figure 6.25: Simplified Formula of the Original Sieve of A_i 's.

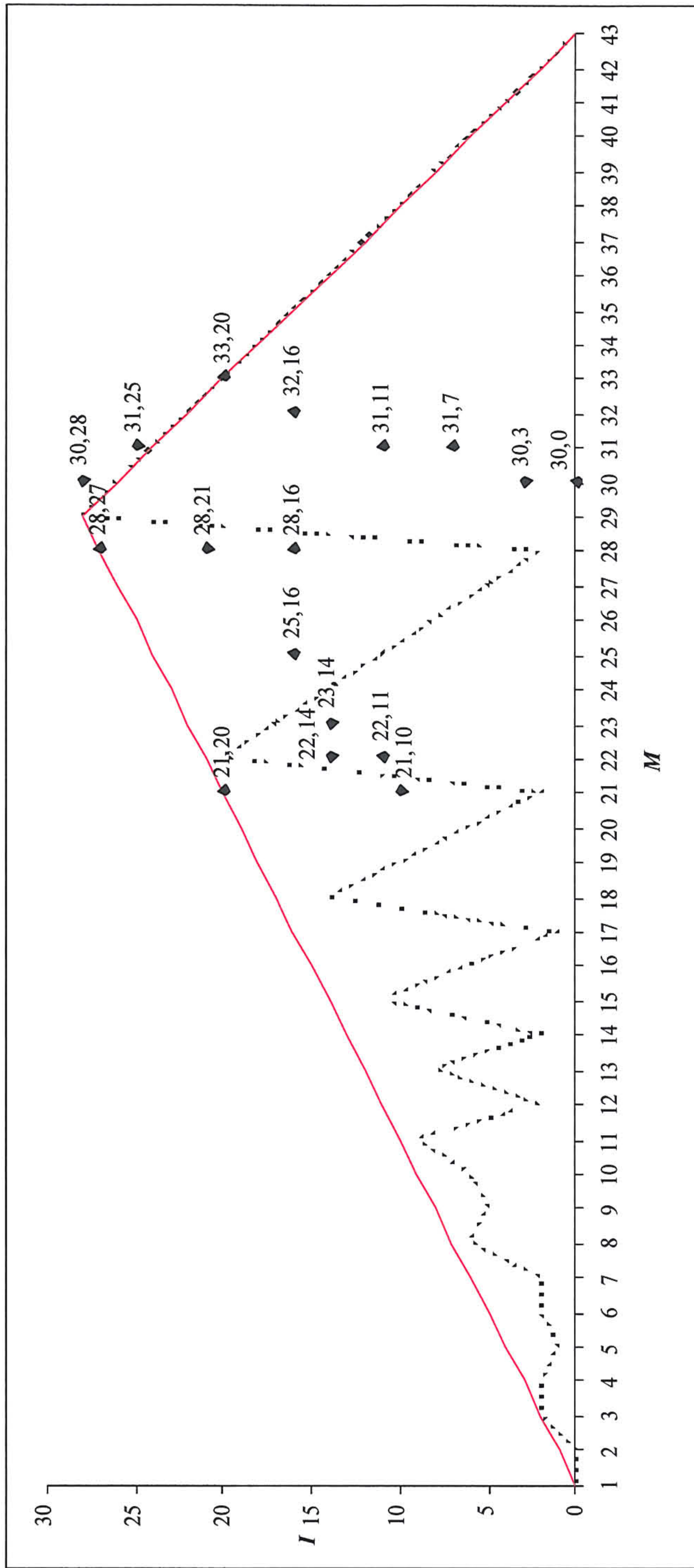


Figure 6.26: Inner Symmetry Chart for the original sieve of A_{15} .

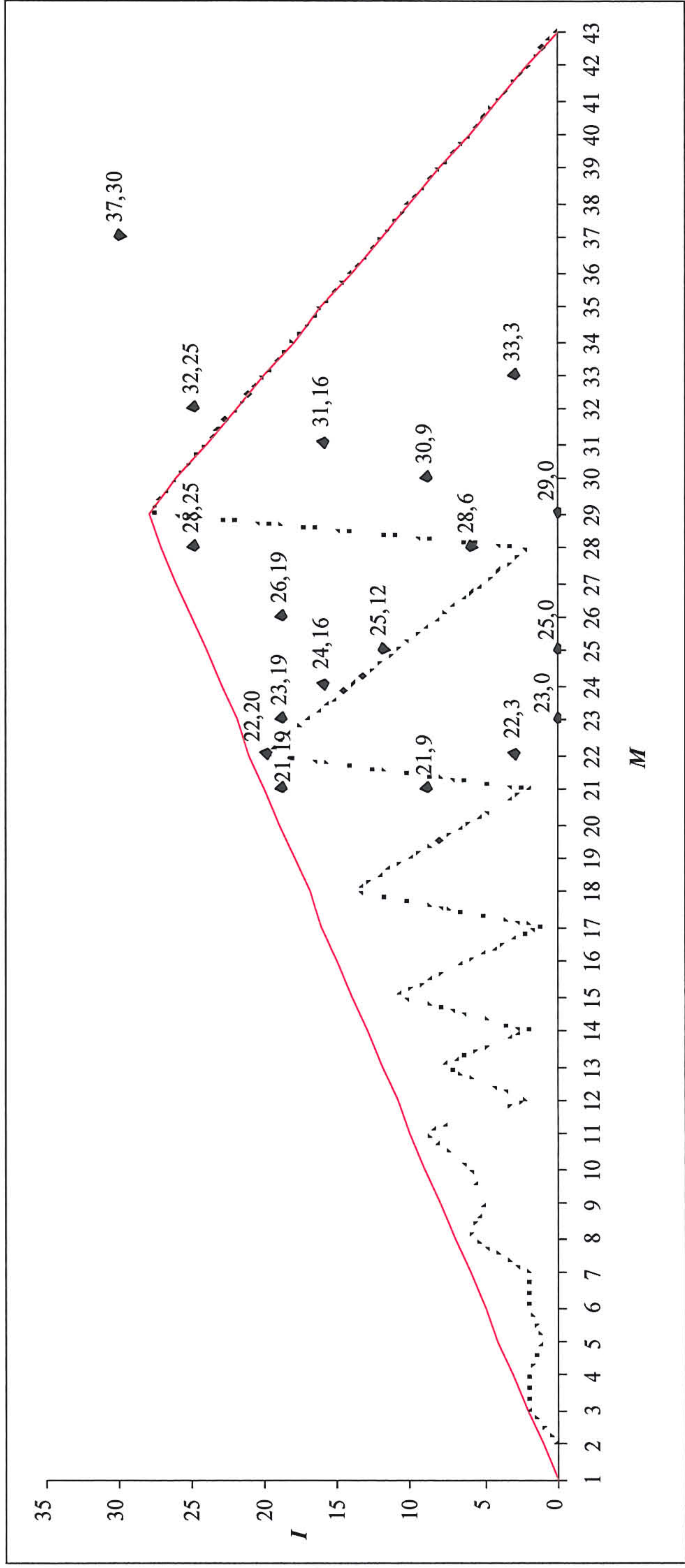


Figure 6.27: Inner Symmetry Chart of the $T_7(\text{mod}86)$ Transposition of the original sieve of A_{is} .

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
2·7	14, 2, 6	8ve + tone
19	19, 10, 4	8ve + 5th
2·11	22, 3, 3	8ve + m7th
23	23, 21, 2	8ve + M7th
5		
	24, 0, 3	
2 ³ ·3	24, 14, 3	2·8ve
	24, 10, 3	
5 ²	25, 13, 3	2·8ve + semitone
10		
2·13	26, 17, 2	2·8ve + tone
	26, 21, 2	
2 ² ·7	28, 7, 2	2·8ve + M3rd
29	29, 9, 2	2·8ve + 4th
	29, 24, 2	
	30, 9, 2	
15		
2·3·5	30, 17, 2	2·8ve + tritone
	30, 29, 1	
31	31, 4, 2	2·8ve + 5th
	31, 16, 2	
2 ⁵	32, 25, 1	2·8ve + m6th
20		
5·7	35, 17, 2	2·8ve + M7th

Figure 6.28: Simplified Formula of the Sieve of *Nekuia*.

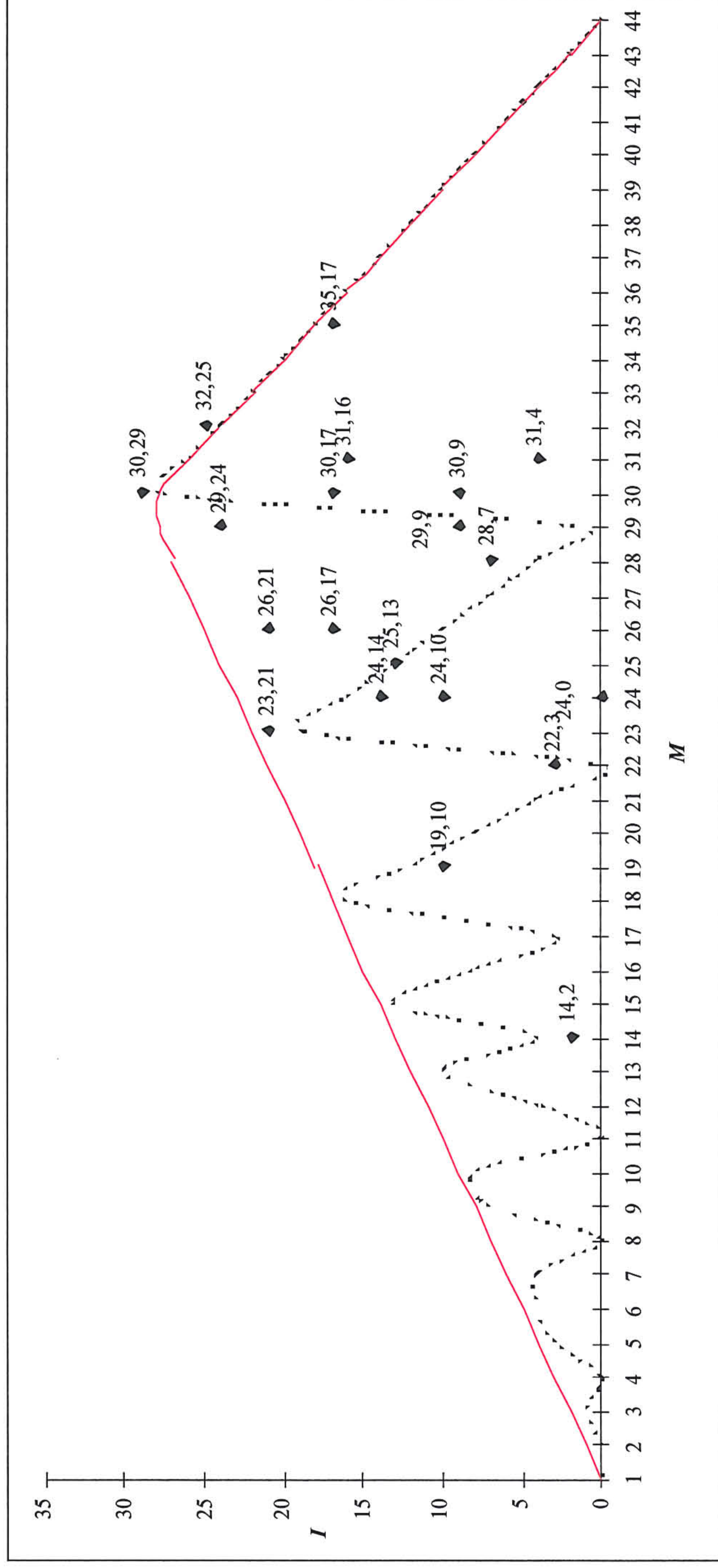


Figure 6.29: Inner Symmetry Chart for the Sieve of Nekuia.

Cyclic Transition	Effective Index mod88
$8_i + 11_j$	0
$8_i + 11_{j+8}$	8
$8_{i+1} + 11_j$	33
$8_i + 11_{j+7}$	40
$8_i + 11_{j+1}$	56
$8_{i+5} + 11_j$	77
$8_i + 11_{j+3}$	80

Figure 6.30: Cyclic Transpositions in *Nekuiā*.

	Canonical Form	M, I, R	Interval
	2·7	14, 8, 5	8ve + tone
	19	19, 16, 3	8ve + 5th
	2·11	22, 9, 3	8ve + m7th
5	23	23, 4, 3 23, 22, 2	8ve + M7th
	2 ³ ·3	24, 6, 3 24, 16, 2 24, 20, 2	2·8ve
10	5 ²	25, 15, 2 25, 19, 2	2·8ve + semitone
	2·13	26, 23, 2	2·8ve + tone
	3 ³	27, 9, 2	2·8ve + m3rd
	2 ² ·7	28, 13, 2	2·8ve + M3rd
15	2·3·5	30, 5, 2 30, 19, 2 30, 23, 2	2·8ve + tritone
	31	31, 10, 2 31, 22, 2 31, 27, 1	2·8ve + 5th
20	2 ⁵	32, 27, 1	2·8ve + m6th
	2 ² ·3 ²	36, 0, 2	3·8ve

	Canonical Form	M, I, R	Interval
	3·5	15, 0, 5	8ve + m3rd
	18, 2, 4		
	2·3 ²	18, 12, 4	8ve + tritone
	18, 16, 4		
5	2 ² ·5	20, 15, 3	8ve + m6th
	2·11	22, 12, 3	8ve + m7th
	23	23, 6, 3 23, 10, 3	8ve + M7th
10	2 ³ ·3	24, 21, 2	2·8ve
	5 ²	25, 15, 2 25, 16, 2	2·8ve + semitone
	27, 2, 3		
	3 ³	27, 20, 2	2·8ve + m3rd
	27, 25, 2		
15	2 ² ·7	28, 5, 2	2·8ve + M3rd
	2·3·5	30, 1, 2	2·8ve + tritone
	5·7	35, 9, 2	2·8ve + M7th

	Canonical Form	M, I, R	Interval
	2·5	10, 4, 8	m7th
	3·5	15, 4, 5 15, 9, 5	8ve + m3rd
	2·3 ²	18, 11, 4	8ve + tritone
5	2 ² ·5	20, 10, 3	8ve + m6th
	2·11	22, 21, 3	8ve + m7th
	23	23, 15, 3 23, 19, 3	8ve + M7th
10	5 ²	25, 0, 3	2·8ve + semitone
	2·13	26, 18, 2	2·8ve + tone
	31	31, 25, 2	2·8ve + 5th
	2 ⁵	32, 25, 1	2·8ve + m6th
	2·17	34, 10, 2 34, 19, 2	2·8ve + m7th
15	5·7	35, 5, 2	2·8ve + M7th

T_{8(mod88)}

T_{33(mod88)}

T_{40(mod88)}

Figure 6.31: Simplified Formulae of the Cyclic Transpositions of the Sieve of Nekuia.

Canonical Form	M, I, R	Interval
19	19, 14, 3	8ve + 5th
2 ² ·5	20, 4, 4	8ve + m6th
2·11	22, 13, 3	8ve + m7th
23	23, 10, 3	8ve + M7th
2 ³ ·3	24, 19, 2	2·8ve
	25, 4, 3	
5 ²	25, 13, 3	2·8ve + semitone
	25, 14, 2	
	25, 18, 2	
2·13	26, 18, 2	2·8ve + tone
3 ³	27, 25, 2	2·8ve + m3rd
2 ² ·7	28, 0, 3	2·8ve + M3rd
	28, 5, 2	
29	29, 9, 2	2·8ve + 4th
2·3·5	30, 18, 2	2·8ve + tritone
	30, 23, 2	
31	31, 1, 2	2·8ve + 5th
	31, 13, 2	

T₅₆(mod88)

Canonical Form	M, I, R	Interval
19	19, 12, 4	8ve + 5th
	19, 16, 3	
23	23, 8, 3	8ve + M7th
	24, 1, 3	
2 ³ ·3	24, 16, 3	2·8ve
	24, 21, 2	
5 ²	25, 0, 3	2·8ve + semitone
2·13	26, 4, 3	2·8ve + tone
	28, 17, 2	
2 ² ·7	28, 22, 2	2·8ve + M3rd
	28, 26, 2	
	29, 1, 3	
	29, 11, 2	
29	29, 17, 2	2·8ve + 4th
	29, 21, 2	
2·3·5	30, 0, 2	2·8ve + tritone
	31, 3, 2	
31	31, 22, 2	2·8ve + 5th
2 ⁵	32, 21, 2	2·8ve + m6th
3·11	33, 11, 2	2·8ve + M6th
5·7	35, 4, 2	2·8ve + M7th

T₇₇(mod88)

Canonical Form	M, I, R	Interval
2·7	14, 7, 5	8ve + tone
19	19, 1, 4	8ve + 5th
	19, 16, 3	
2·11	22, 16, 3	8ve + m7th
23	23, 12, 3	8ve + M7th
	24, 1, 3	
2 ³ ·3	24, 5, 3	2·8ve
	24, 20, 2	
5 ²	25, 4, 3	2·8ve + semitone
2·13	26, 8, 3	2·8ve + tone
	26, 12, 2	
2 ² ·7	28, 26, 2	2·8ve + M3rd
	29, 15, 2	
29	29, 21, 2	2·8ve + 4th
	29, 25, 2	
2·3·5	30, 0, 2	2·8ve + tritone
	31, 7, 2	
31	31, 26, 2	2·8ve + 5th
3·11	33, 15, 2	2·8ve + M6th
5·7	35, 8, 2	2·8ve + M7th

T₈₀(mod88)

Figure 6.31: Simplified Formulae of the Cyclic Transpositions of the Sieve of *Nekuia*, cont.

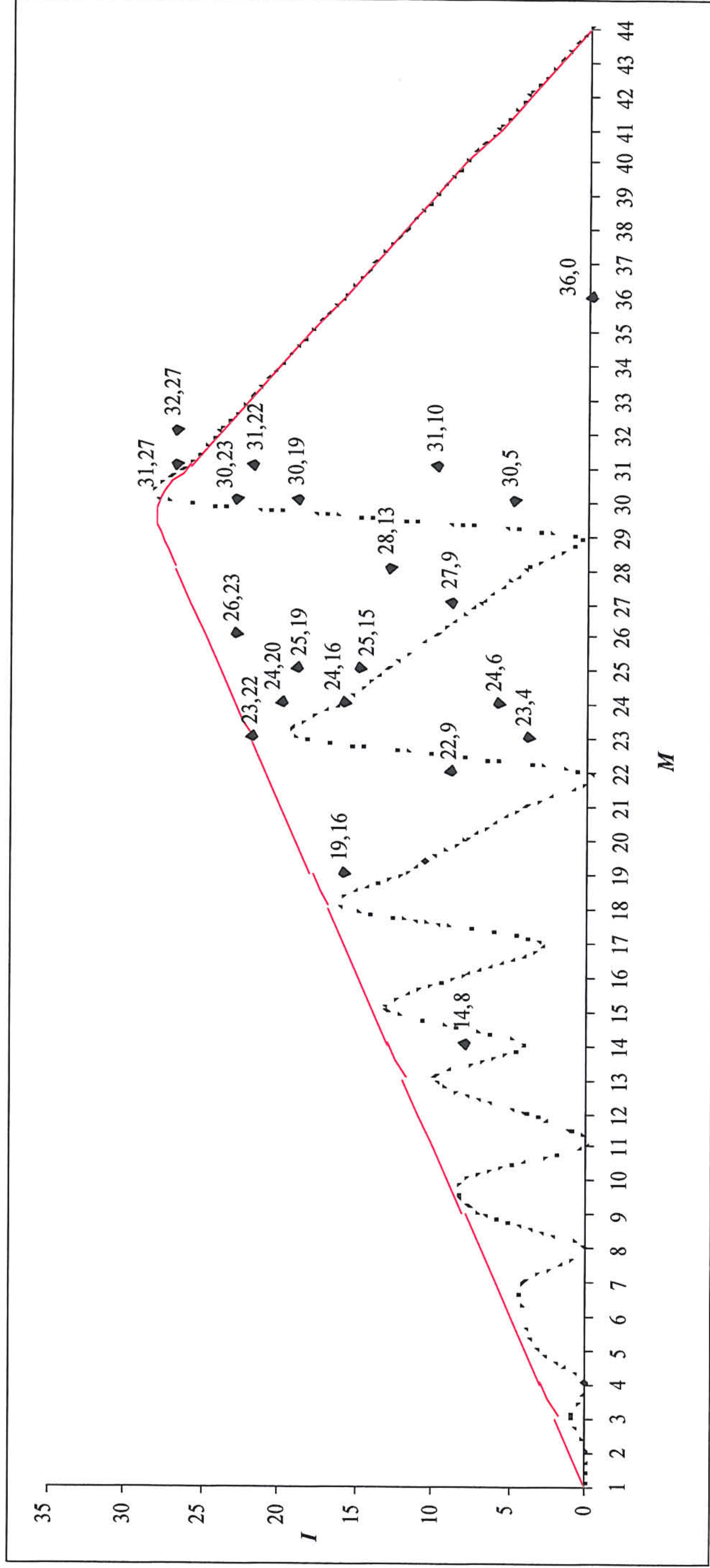


Figure 6.32: Sieve of *Nekuia*, $T_8(\text{mod}88)$.

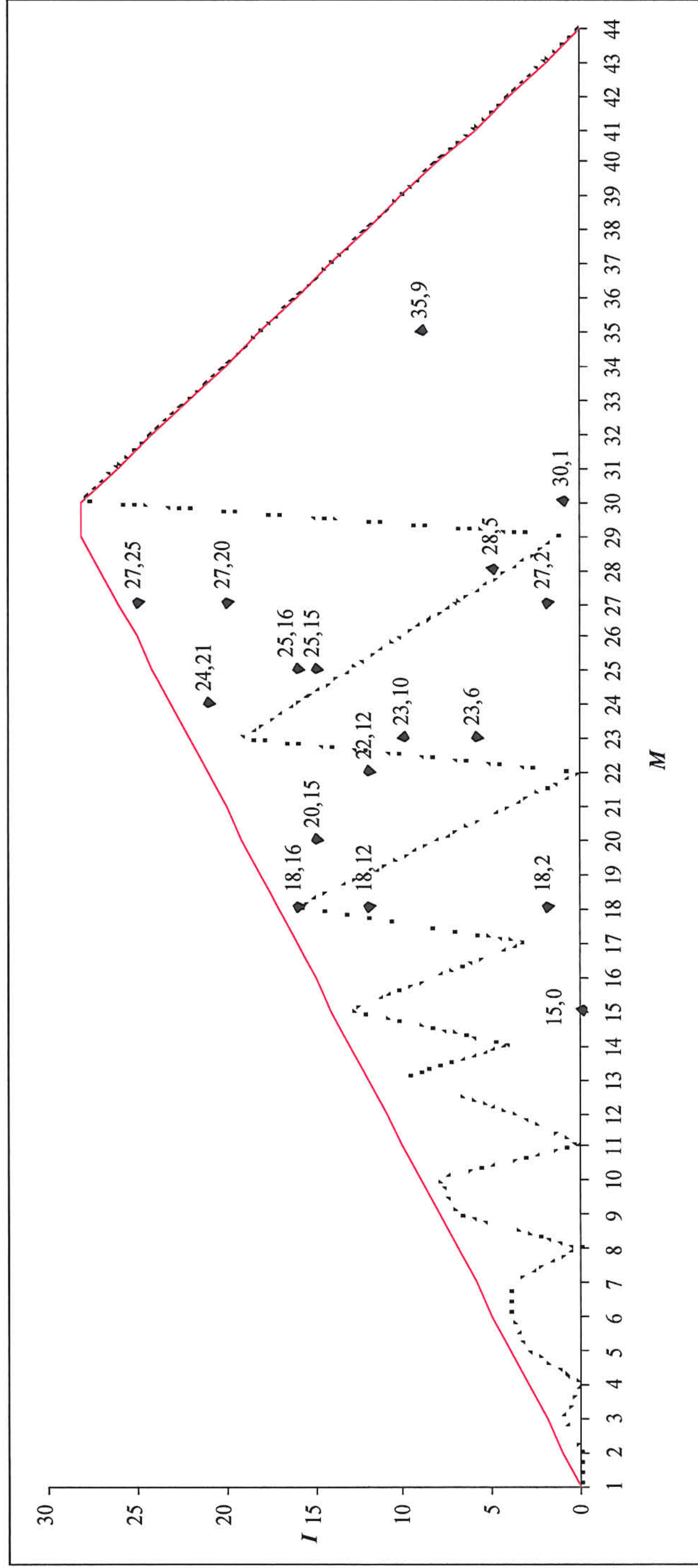


Figure 6.33: Sieve of *Nekuia*, $T_{33}(\text{mod } 88)$.

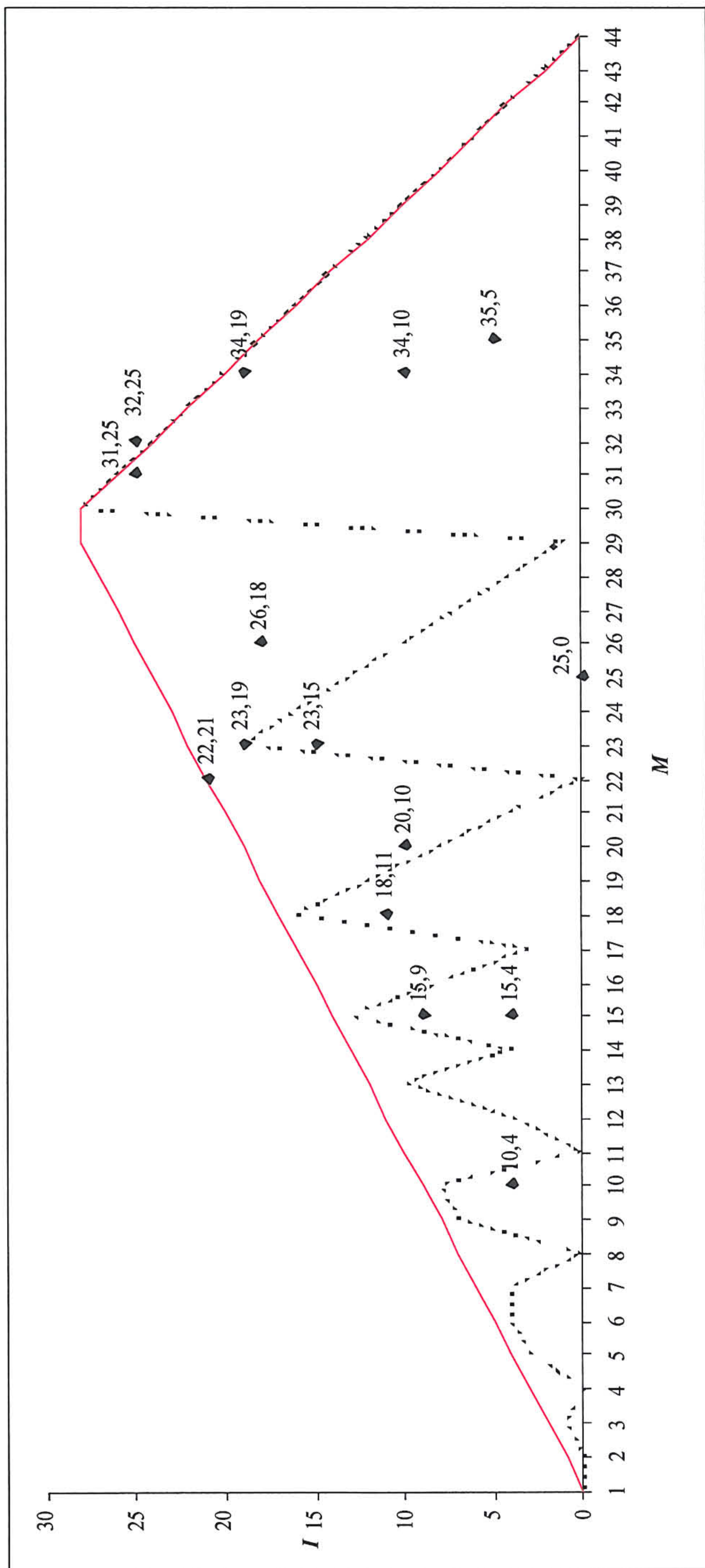


Figure 6.34: Sieve of *Nekuia*, $T_{40}(\text{mod } 88)$.

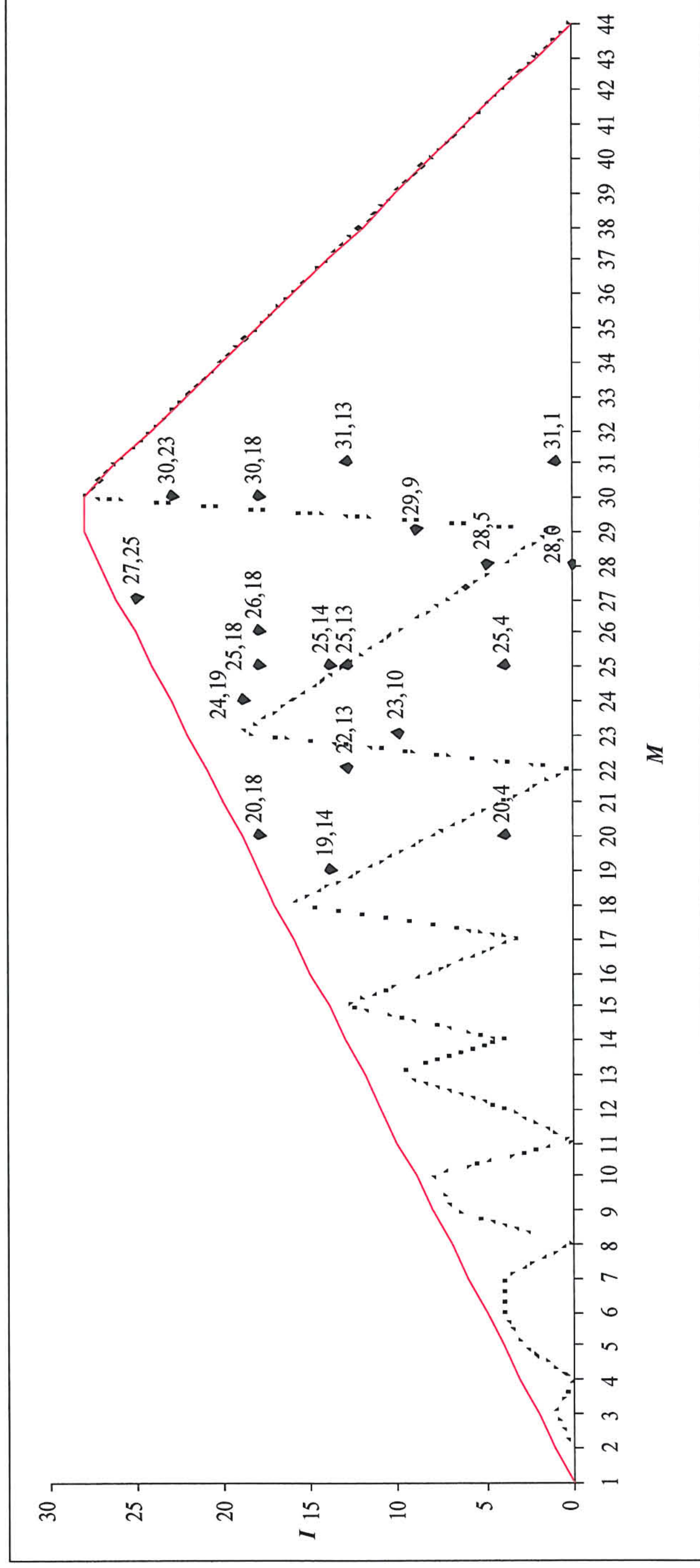


Figure 6.35: Sieve of *Nekuia*, $T_{56}(\text{mod}88)$.

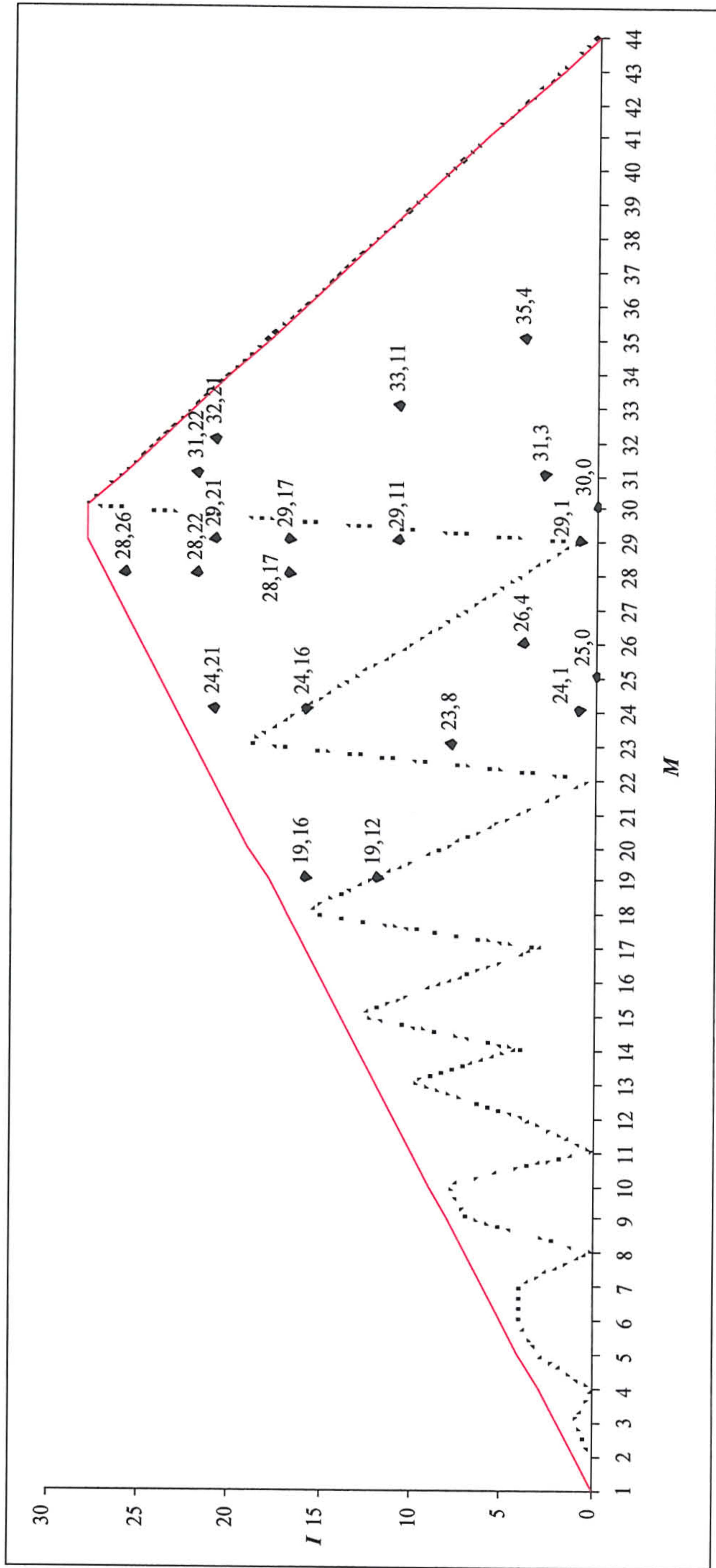


Figure 6.36: Sieve of Nekuia, $T_{77}(\text{mod } 88)$.

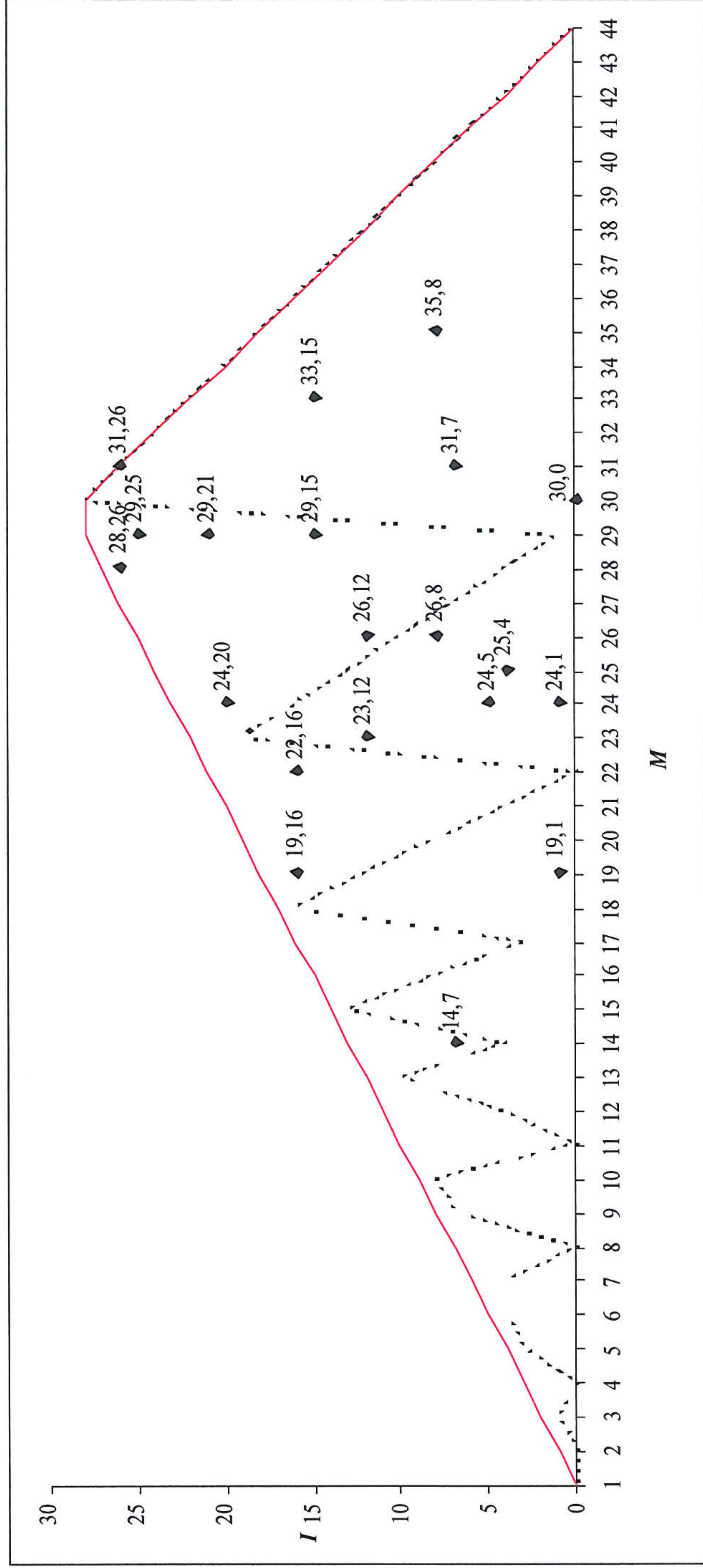


Figure 6.37: Sieve of *Nekuia*, $T_{80}(\text{mod}88)$.

The musical score consists of two staves: a treble clef staff on top and a bass clef staff on the bottom. A sequence of numbers is written between the staves, starting with '2' on the left and ending with '1 1 2' on the right. The numbers are: 2, 1 1 3, 2 13, 1 2 14, 2 2 4, 1 2 2 4, 1 2 2 1 3, 1 4, 1 3, 1 4, 1 4, 1 1 3, 1 3, 1 2 3, 1 4, 1 4, 1 4, 4, 1 1 2. Above the treble staff, there are musical notes and accidentals (sharps) corresponding to the numbers. Above the bass staff, there are musical notes and accidentals (sharps). At the far left, there is a treble clef and a bass clef. At the far right, there is a treble clef and a bass clef. The numbers are positioned between the staves, with some numbers having a vertical line extending upwards to the treble staff and some having a vertical line extending downwards to the bass staff. The numbers are: 2, 1 1 3, 2 13, 1 2 14, 2 2 4, 1 2 2 1 3, 1 4, 1 3, 1 4, 1 4, 1 1 3, 1 3, 1 2 3, 1 4, 1 4, 1 4, 4, 1 1 2.

Figure 6.38: First Version of the Sieve of *Nekuia*.

<i>Canonical Form</i>	<i>M, I, R</i>	<i>Interval</i>
2·7	14, 2, 6	8ve + tone
3·5	15, 2, 5	8ve + m3rd
19	19, 10, 4	8ve + 5th
2·11	22, 3, 3	8ve + m7th
23	23, 21, 2	8ve + M7th
2 ³ ·3	24, 10, 3 24, 14, 3	2·8ve
	25, 7, 3	
5 ²	25, 13, 3	2·8ve + semitone
	25, 23, 2	
10	2·13	26, 17, 2
	29, 0, 3	2·8ve + tone
	29, 9, 2	2·8ve + 4th
15	2·3·5	30, 9, 2
	30, 29, 1	2·8ve + tritone
	31, 4, 2	
	31, 16, 2	2·8ve + 5th
	5·7	35, 17, 2
	2 ² ·3 ²	36, 17, 1
		2·8ve + M7th
		3·8ve

Figure 6.39: Simplified Formula of the First Version of the sieve of *Nekutiā*.

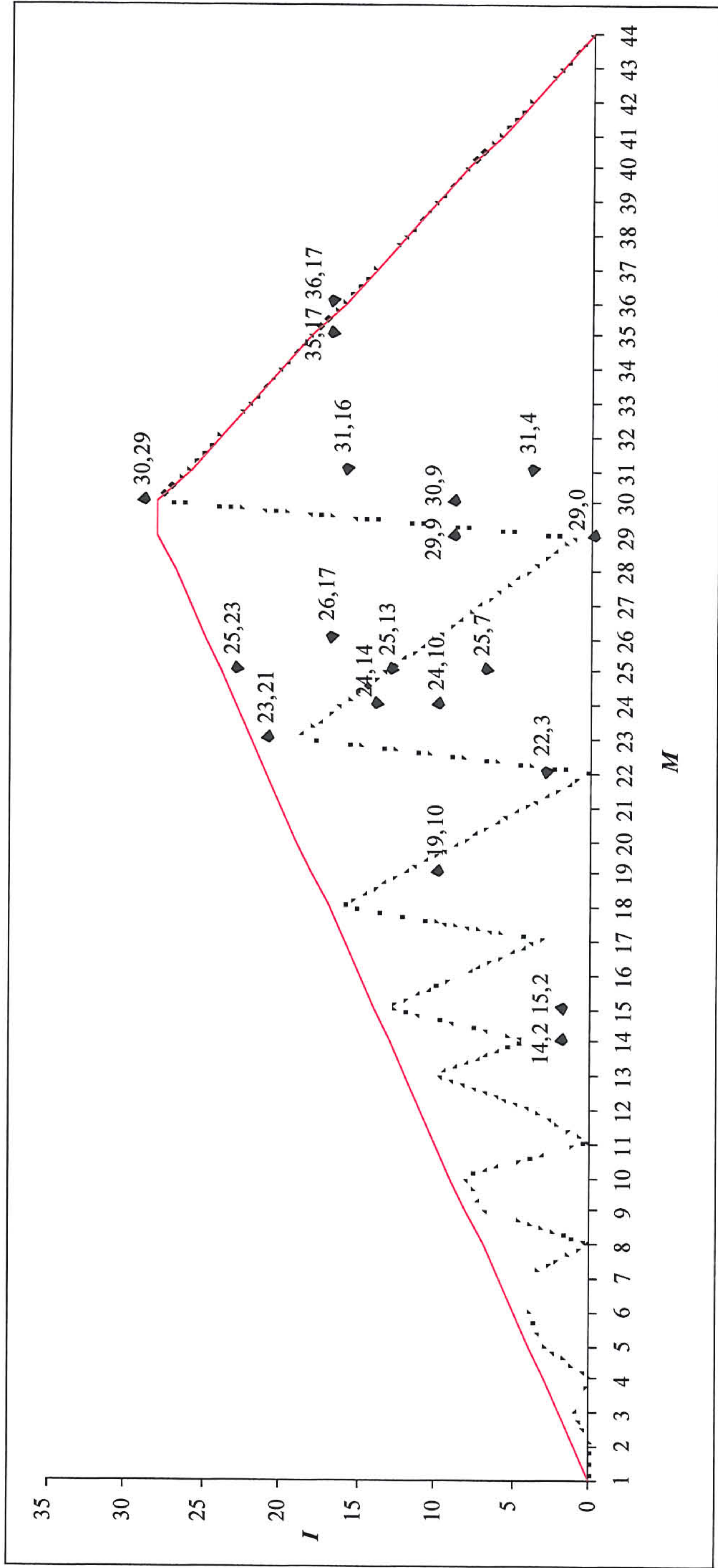


Figure 6.40: Inner Symmetry Chart of the First Version of the Sieve of *Nekuia*.

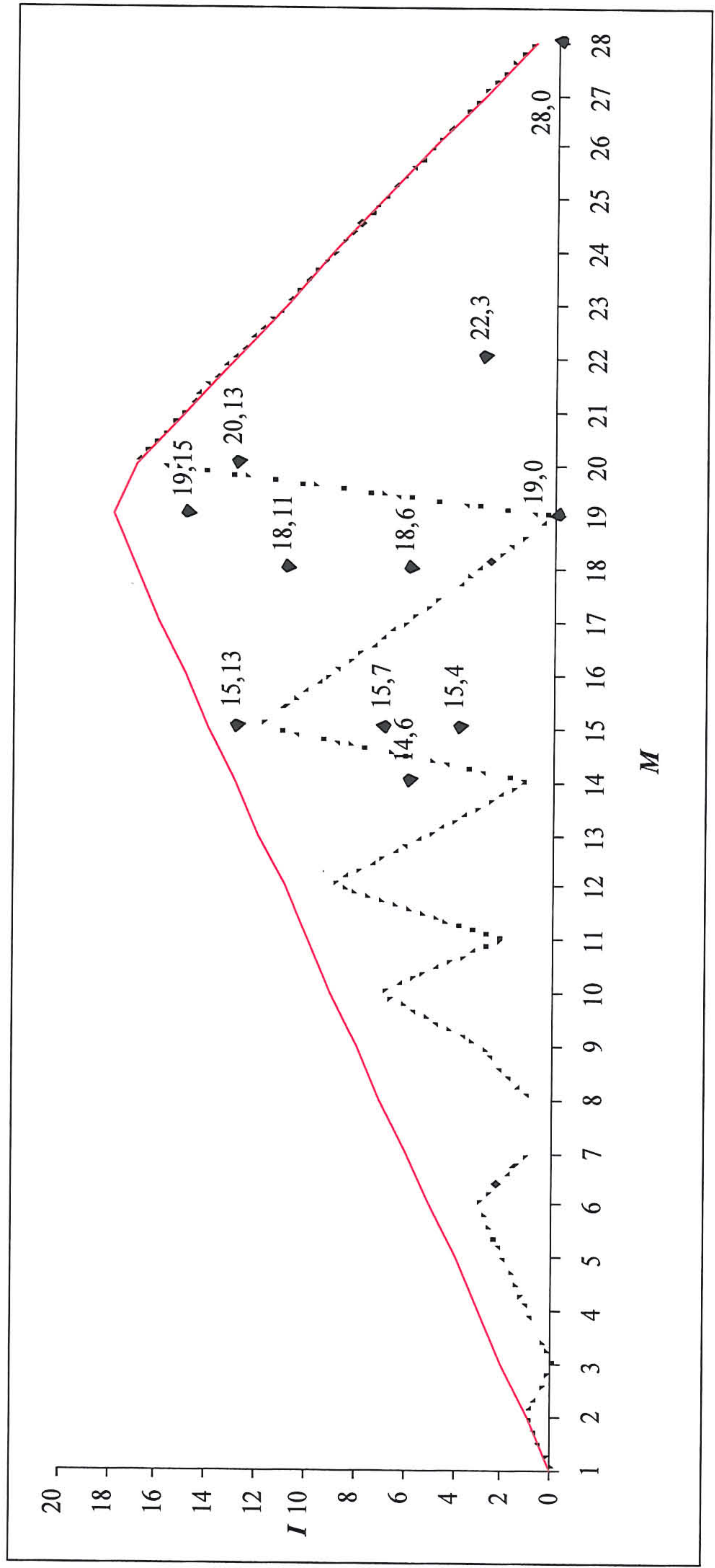


Figure 6.41: Inner Symmetry Chart of the sieve segment used in Naama.

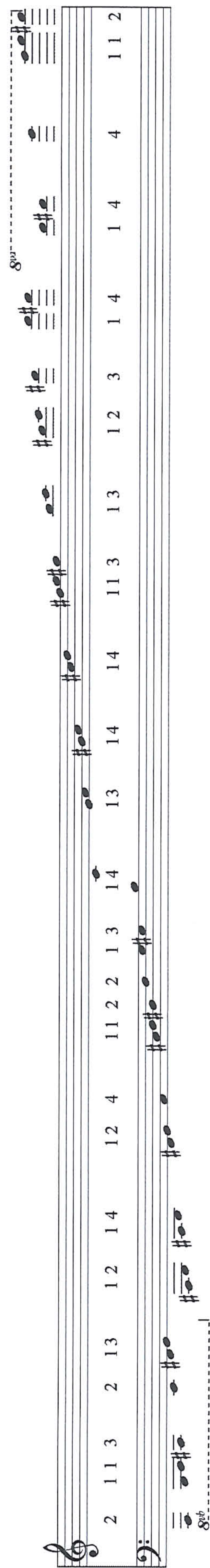
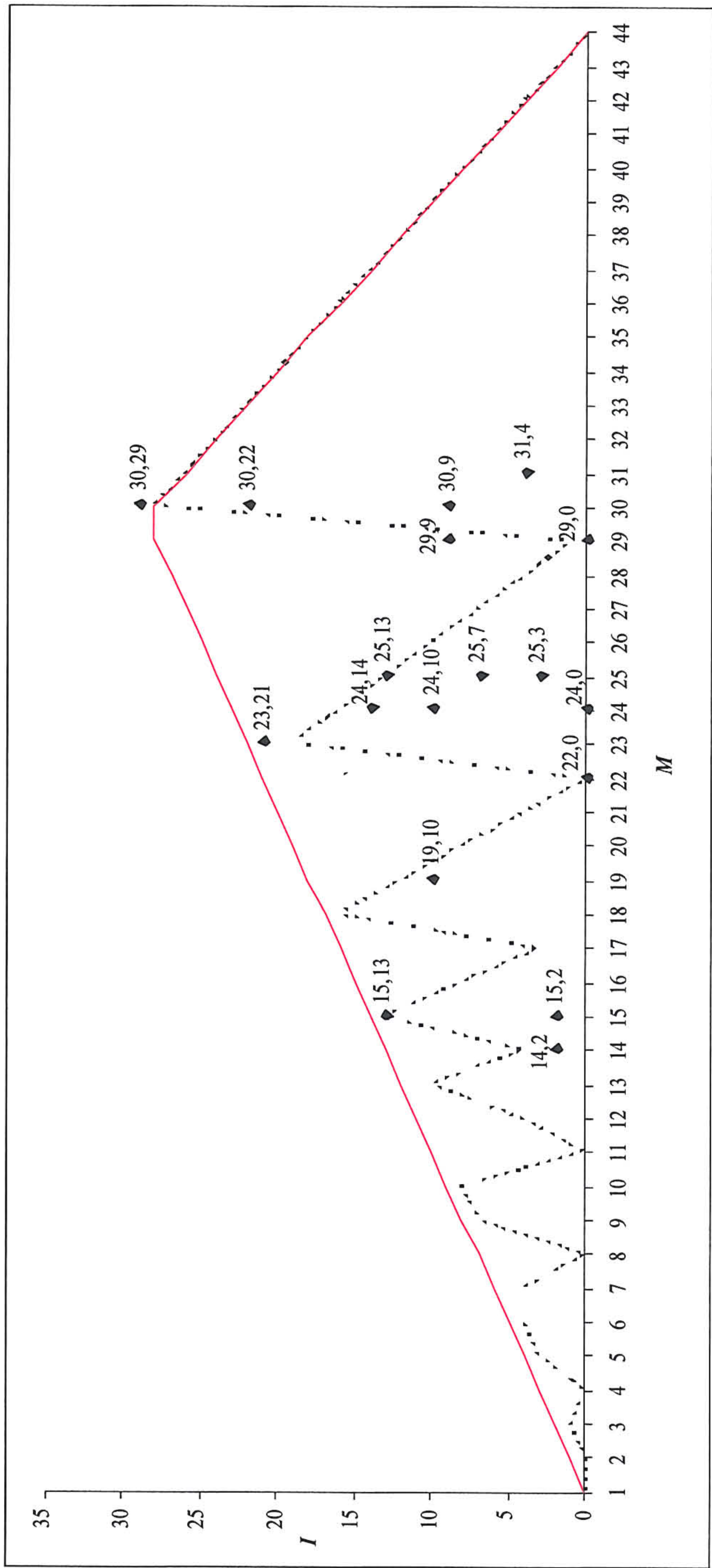


Figure 6.42: Second Version of the Sieve of Nekuia.

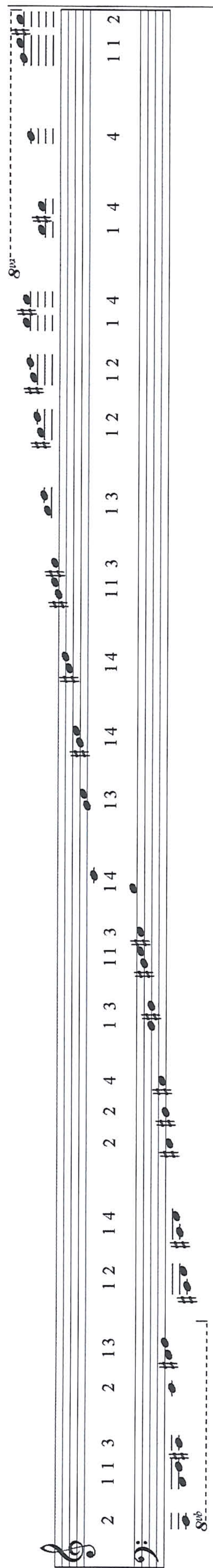
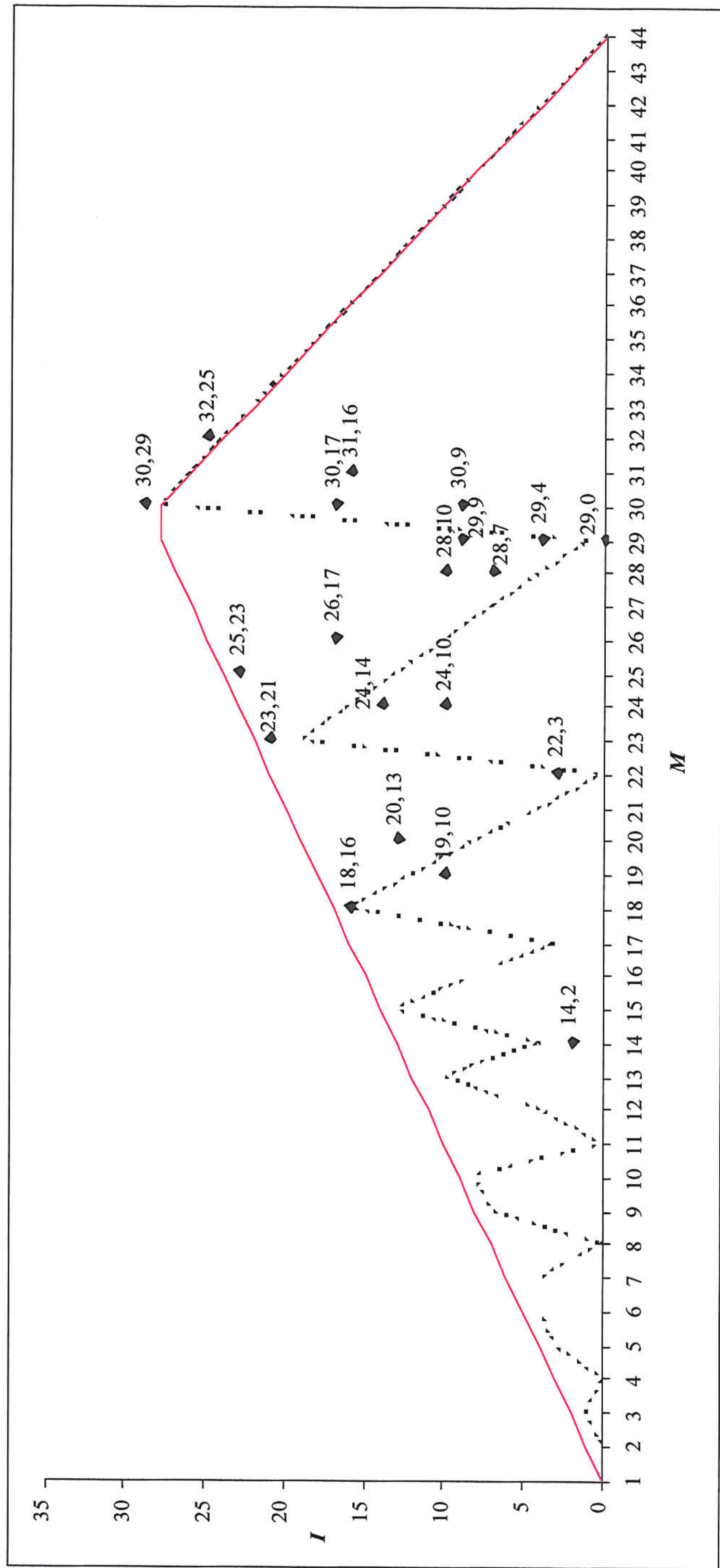


Figure 6.43: Third Version of the Sieve of Nekuia.

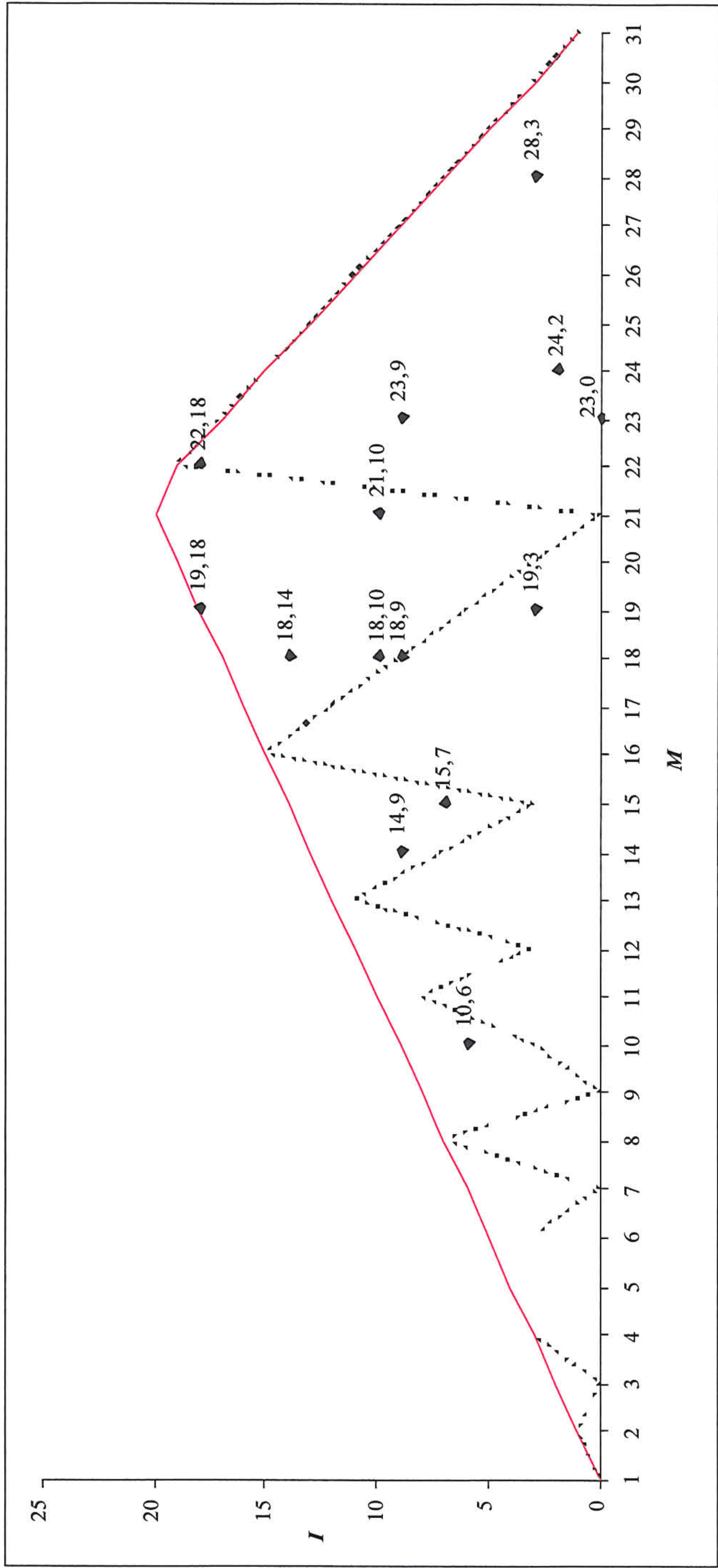


Figure 6.44: Inner Symmetry Chart of the segment of the sieve used in A l'île de Gorée.

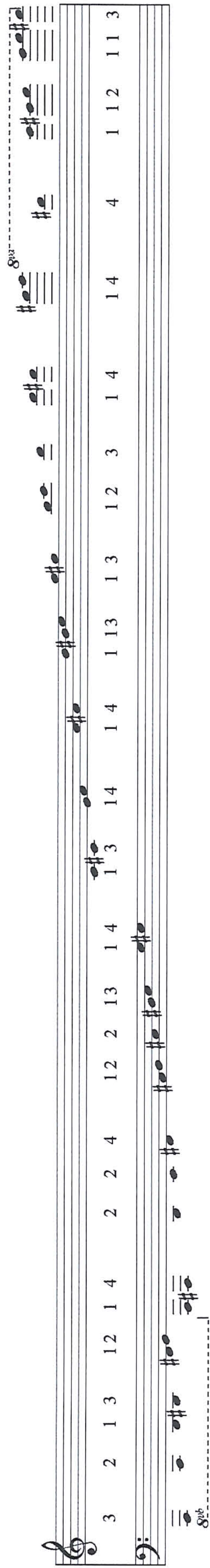
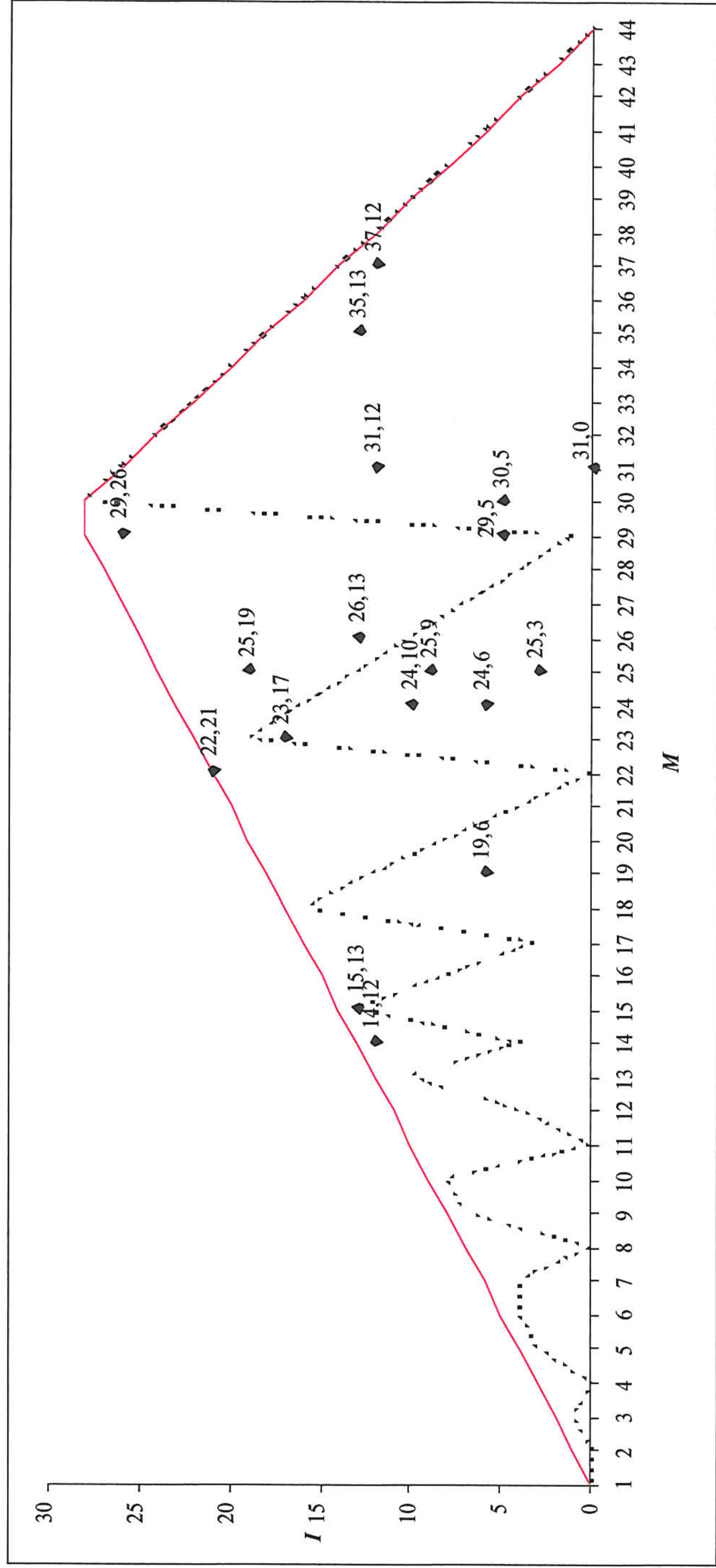


Figure 6.45: Fourth version of the sieve of *Nekuia*.

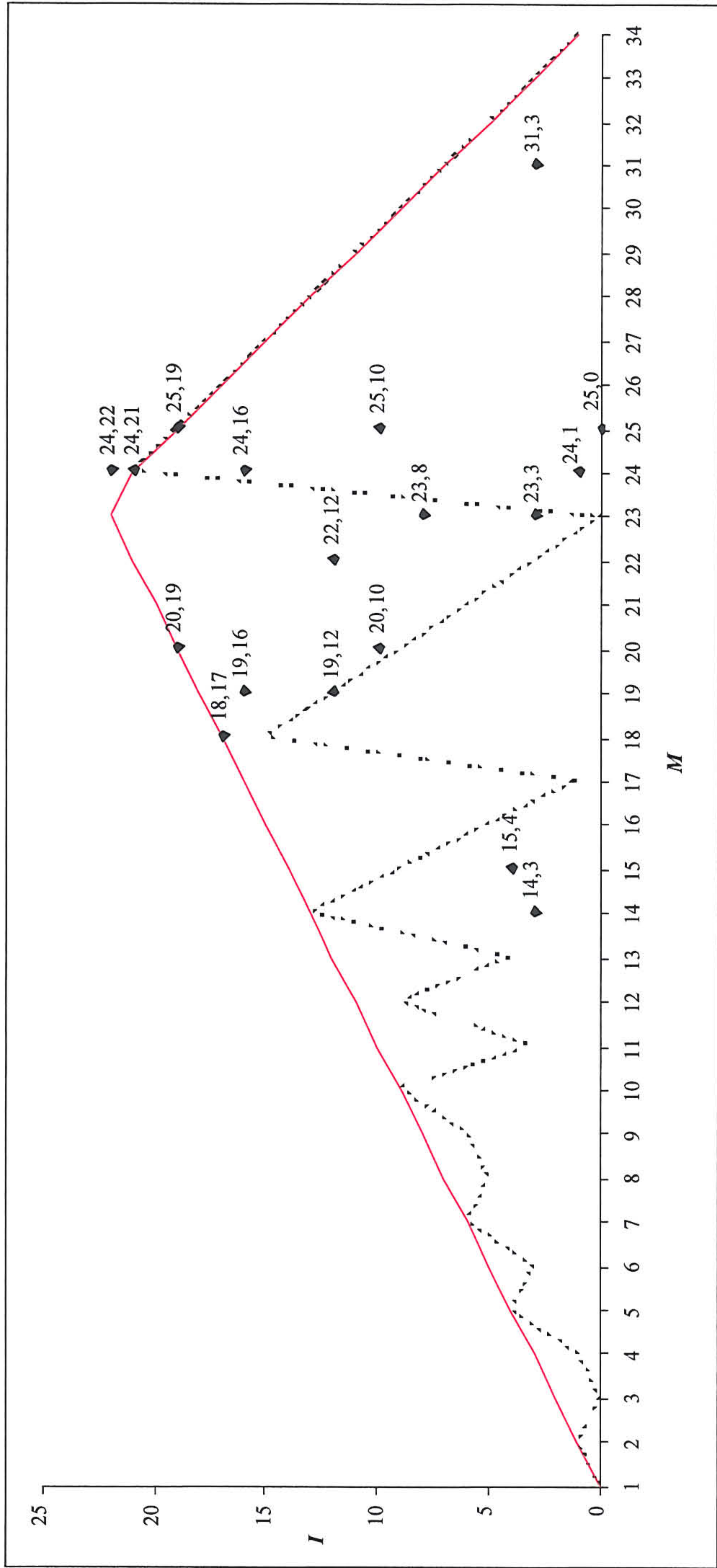
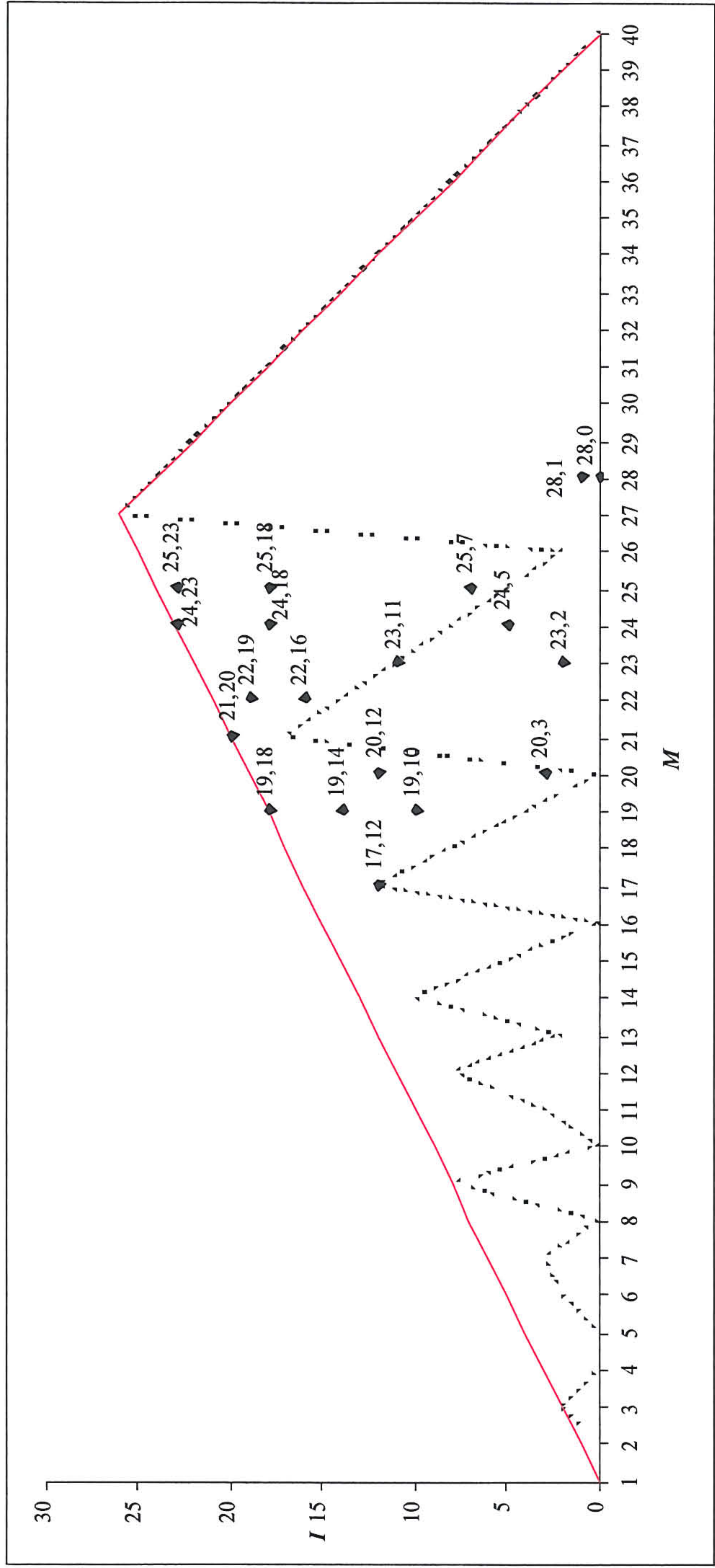


Figure 6.46: Inner Symmetry Chart for the Segment of the Sieve used in *Horos*.



8^{va}-----1

1 1 1 2 2 3 1 1 2 2 2 1 1 3 2 3 1 3 1 1 3 1 3 2 1 3 1 1 3 1 1 2 2 3

8^{vb}-----1

8^{va}-----1

Figure 6.47: Complement of the Sieve of Akeā.

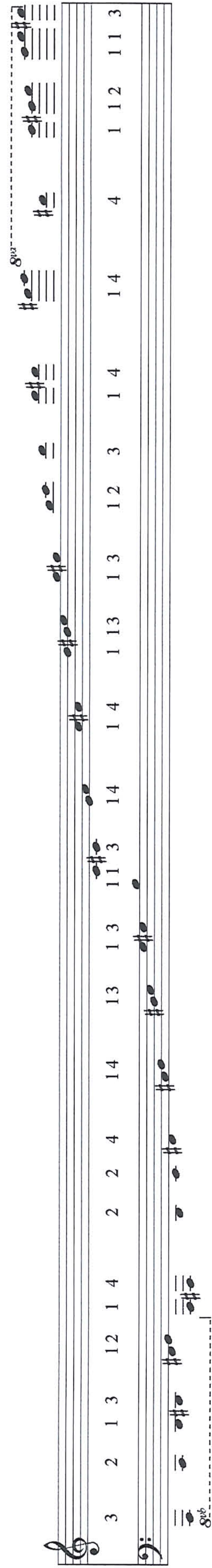
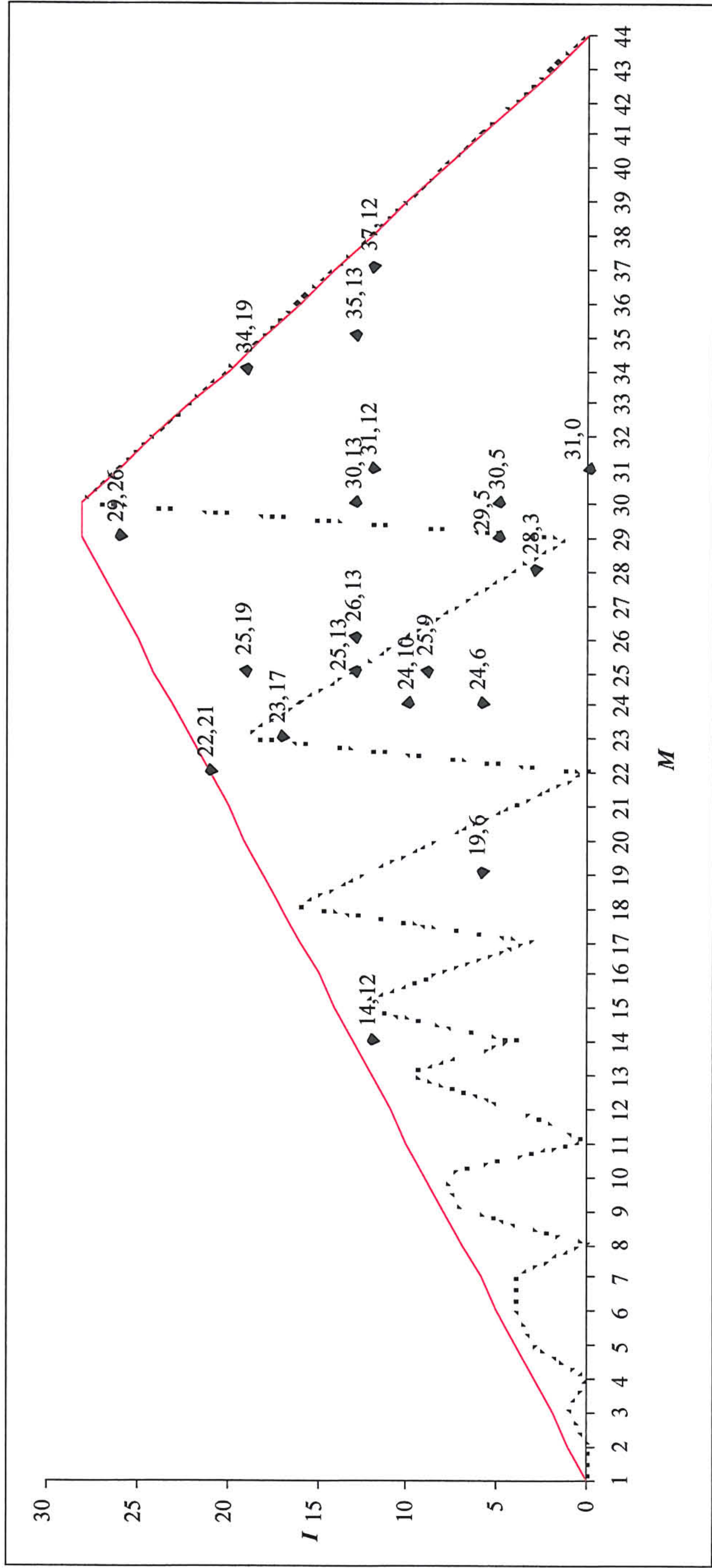


Figure 6.48: Fifth Version of the sieve of *Nekuia*.

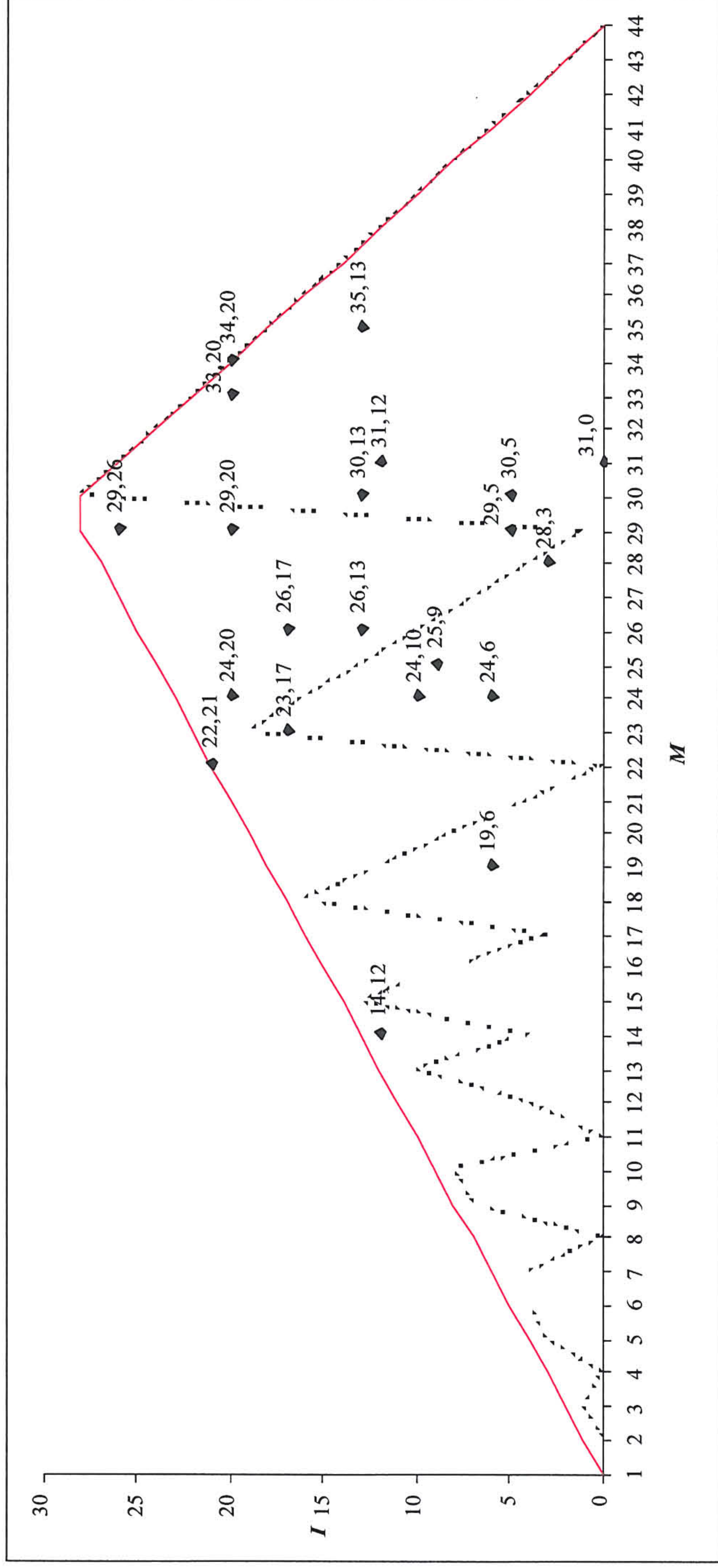


Figure 6.49: Inner Symmetry Chart for the $T_{84}(\text{mod}88)$ Transposition of the sieve of *Nekuia*.

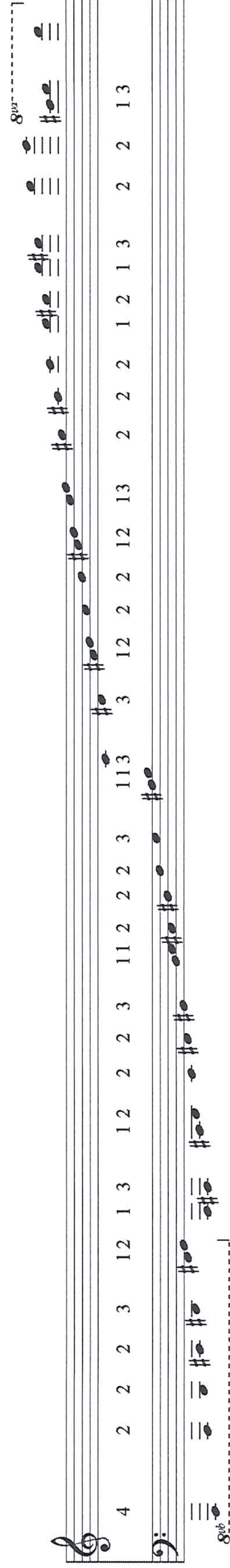
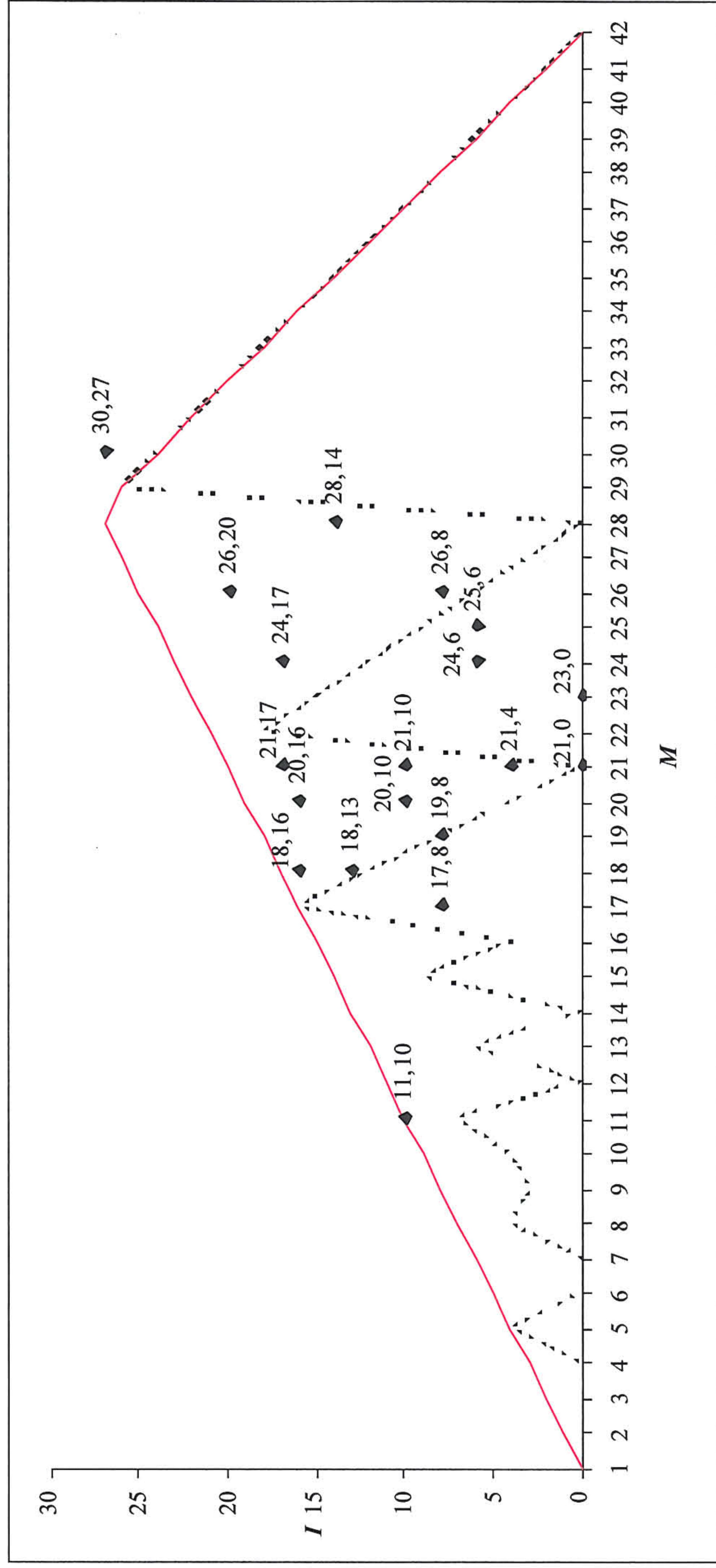


Figure 6.50: Opening Sieve of Komboi.

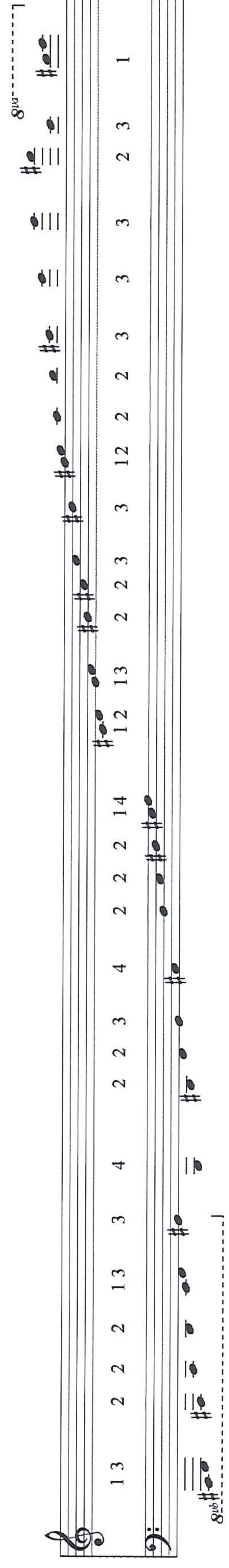
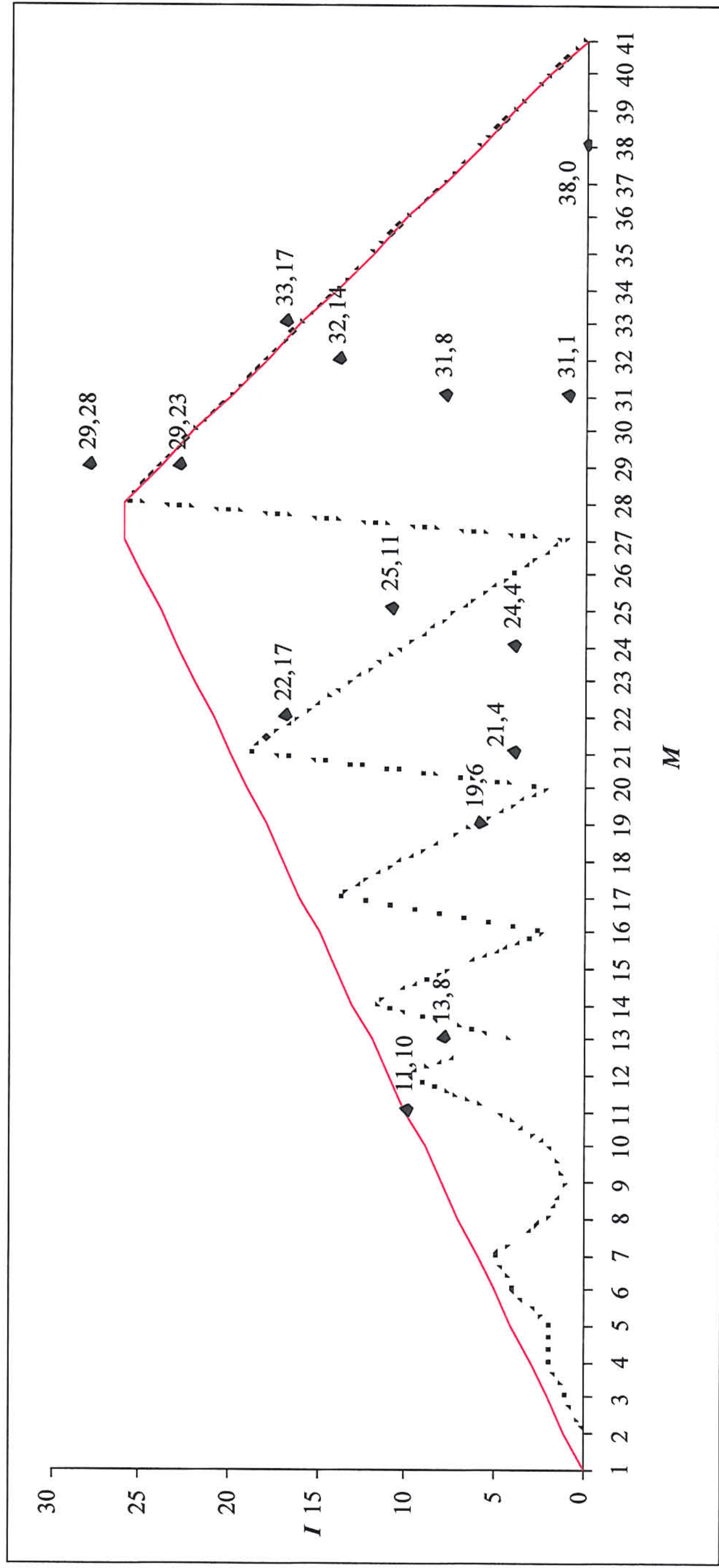


Figure 6.51: Sieve of Kombot.

α 2 14 3 3 2 3 2 3 2 3 2 3 2 3 3 2 3 2 12 3 2 12 3 3 2 3 3 2 3 2 3 2 3 2 3 14 4 5 4 2
 β 4 1 1
 γ 4 12 2 14 12 4 2 4 14 2 1 14 2 2 4 11 2 4 1 4 2 4 2 4 2 14 12 12
 δ 3 2 1 12 11 3 3 1 2 1 11 2 3 13 2 1 12 13 13 13 12 3 1 11 3 3 2 2 13 1 1
 δ' 3 2 1 12 11 3 3 1 2 1 11 2 3 13 2 1 12 13 13 12 12 3 11 13 2 2 13 13 1 12

The musical score consists of five systems, each with two staves. The notes are written in treble and bass clefs. A sequence of numbers (fingerings) is placed below the notes. At the end of each system, a chord is enclosed in a dashed box with the label '8va' above it.

Figure 6.52: Sieves in the Sketches of Shaar ($\alpha \rightarrow \delta$).

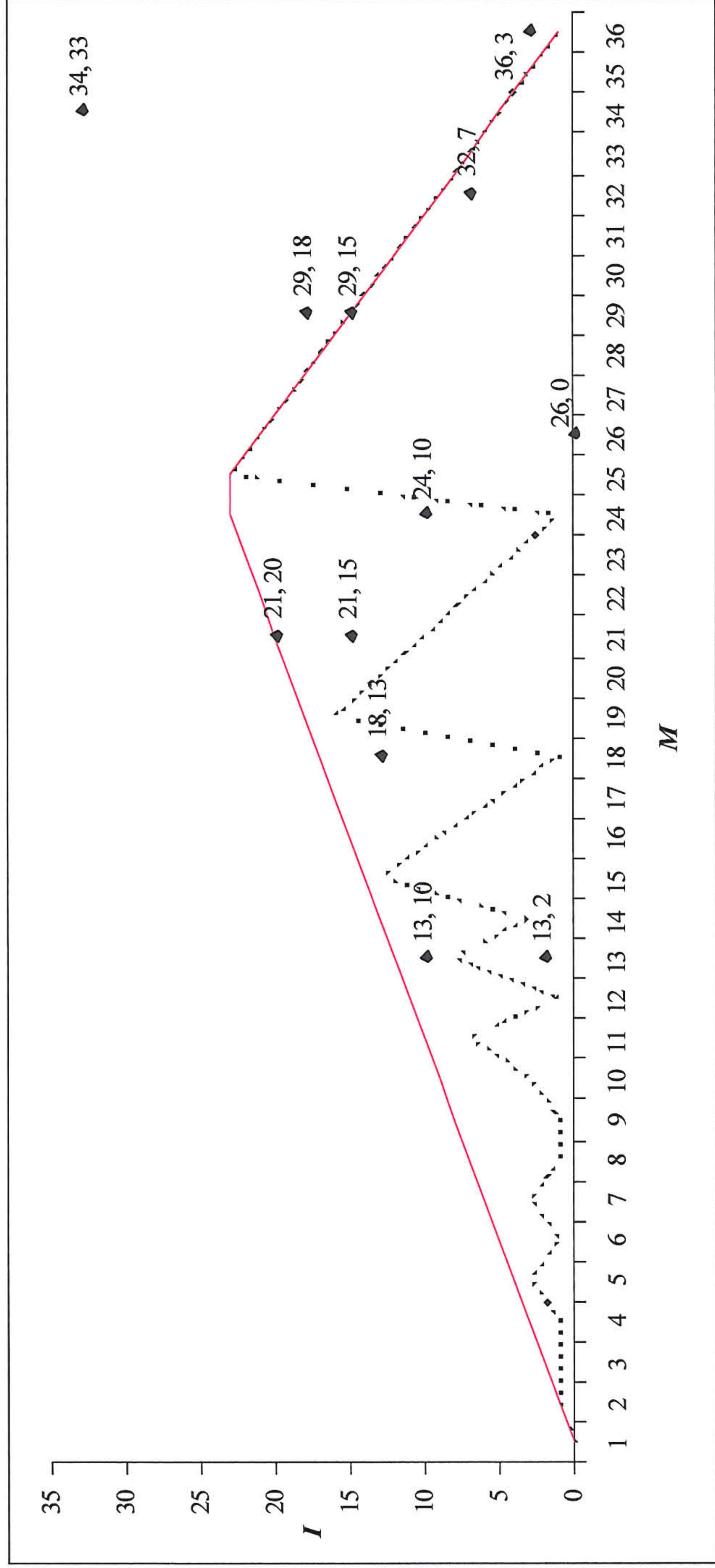


Figure 6.53: Inner Symmetry Chart for Sieve α of Shaar.

1	3	2	1	1	1	12	2	3	1	1
3	3	1	2	1	1	10	2	1	3	1
5	1	3	2	1	1	8	1	2	3	1
7	1	3	1	2	1	6	1	2	1	3
9	1	1	3	2	2	4	1	1	2	3
11	3	1	1	2	2	2	2	1	1	3

Figure 6.54: Intervallic Permutations in Sieve δ of *Shaar*.

1	4	1	2	12	2	1	4
3	1	2	4	10	4	2	1
5	4	2	1	8	1	2	4
7	2	4	1	6	1	4	2
9	1	4	2	4	2	4	1
11	4	1	2	2	2	1	4

Figure 6.55: Intervallic Permutations in Sieve γ of *Shaar*.

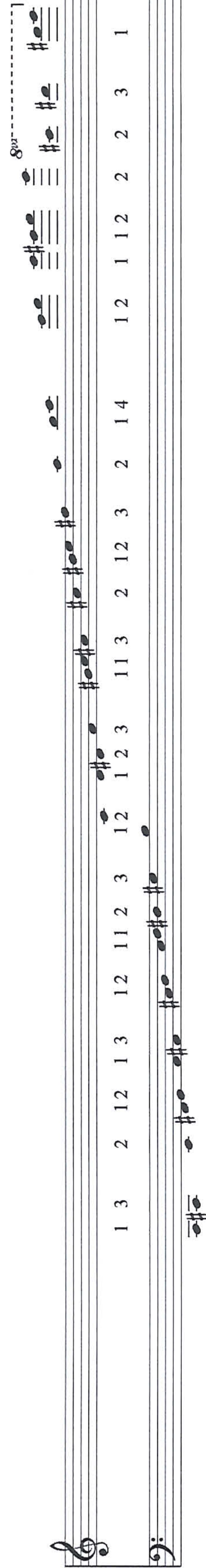
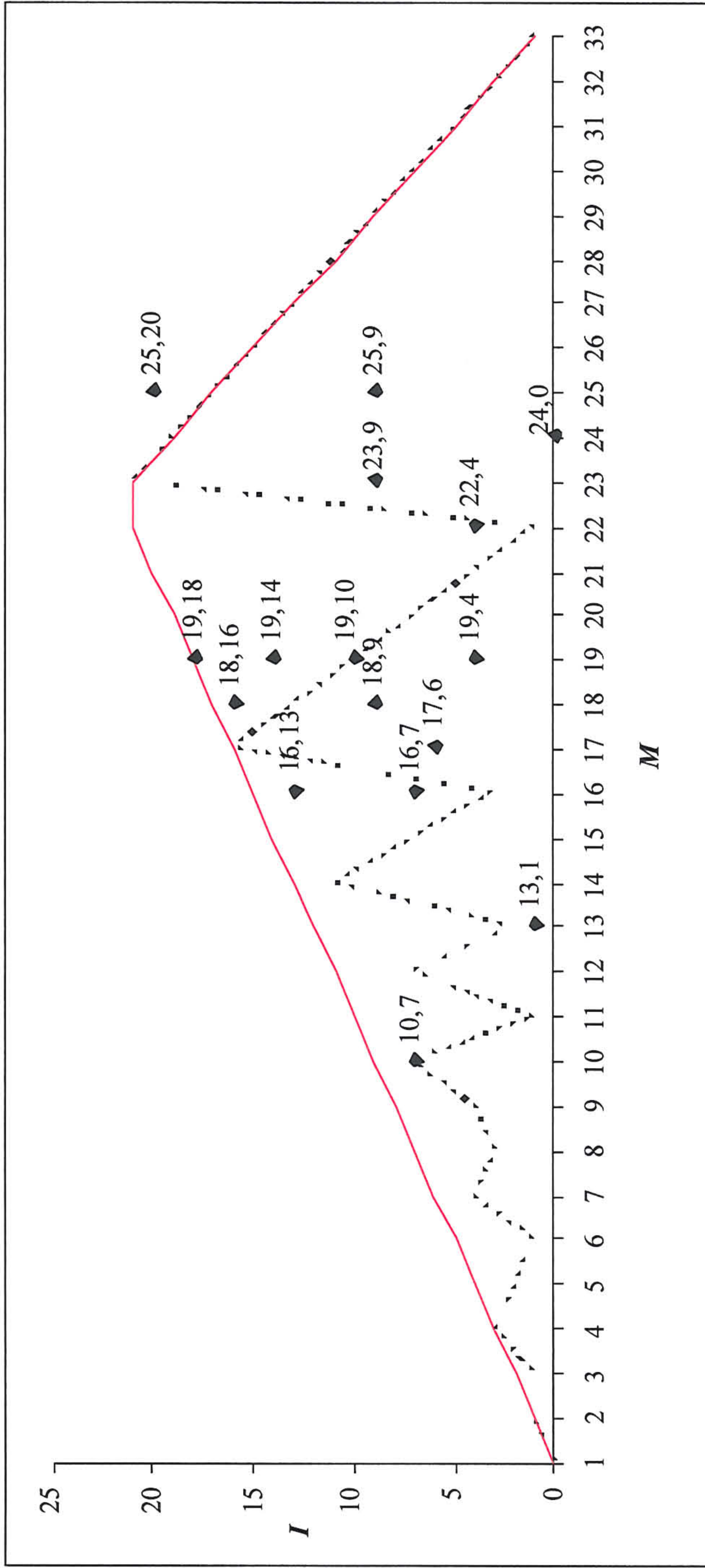


Figure 6.56: Sieve of Tetras.

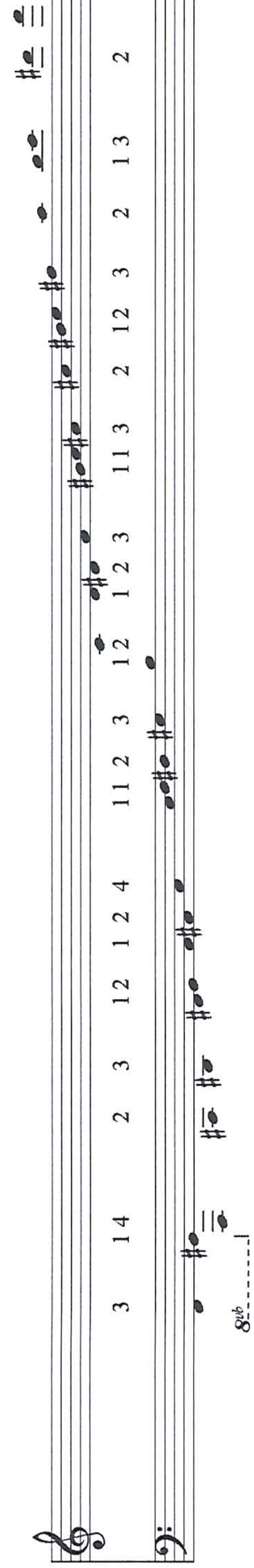
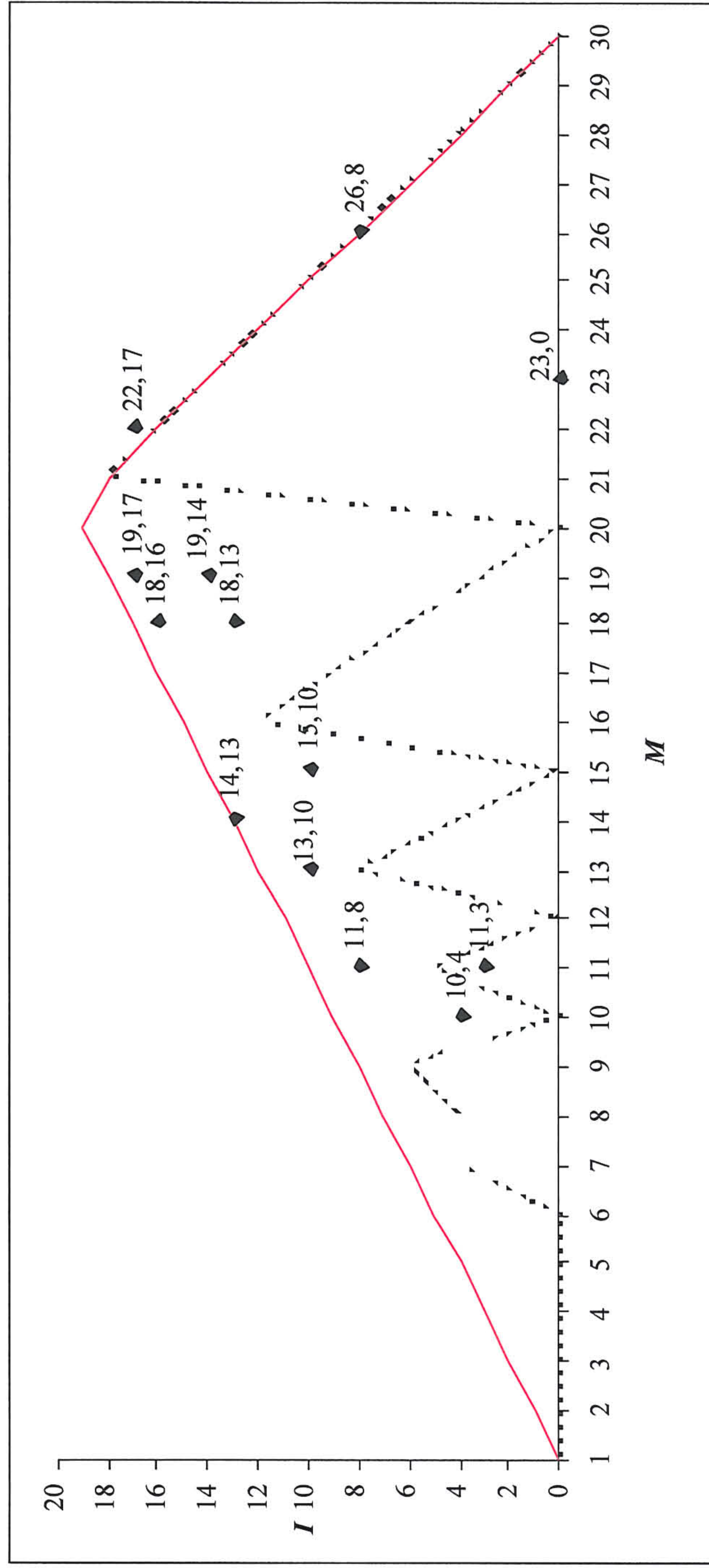


Figure 6.57: Opening Sieve of Khal Perr.

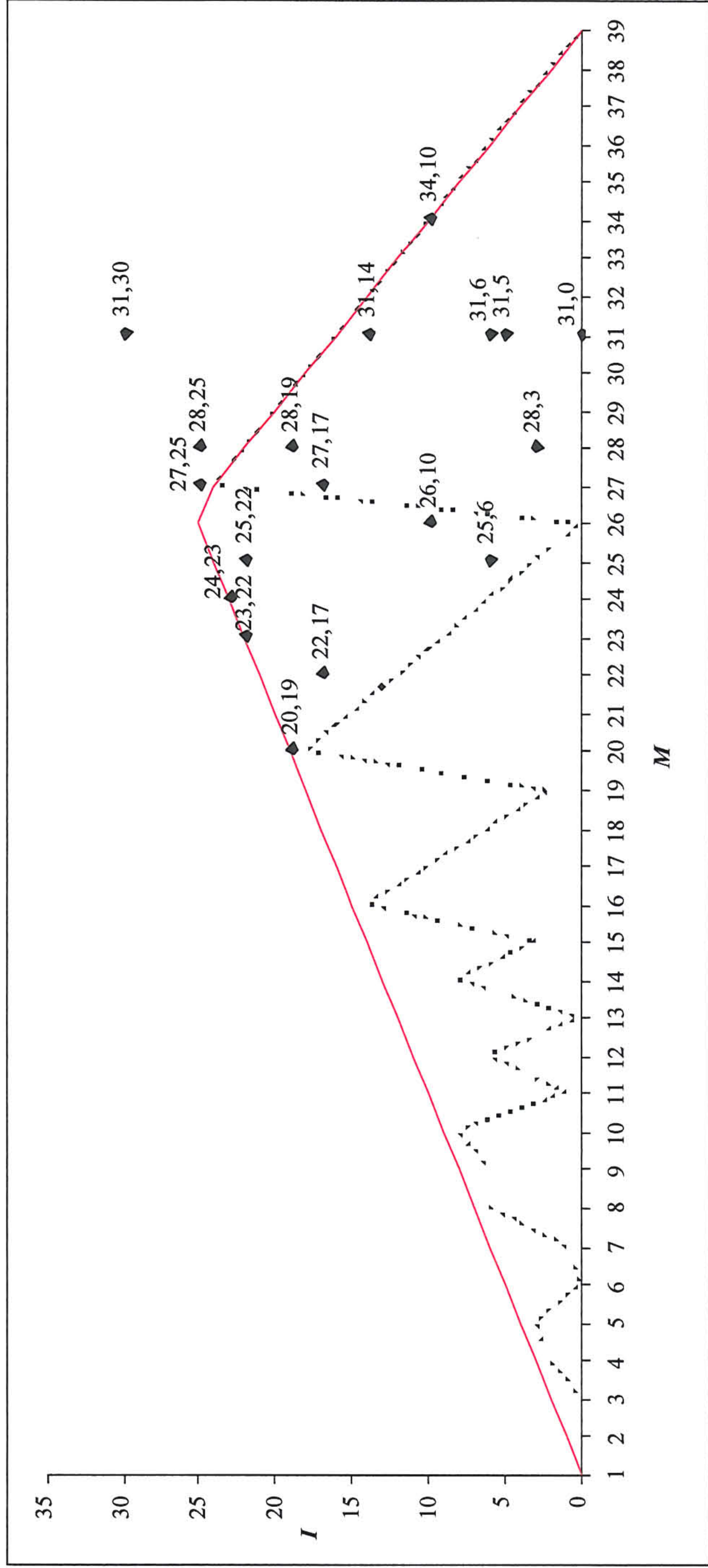


Figure 6.59: Sieve of Thallein.

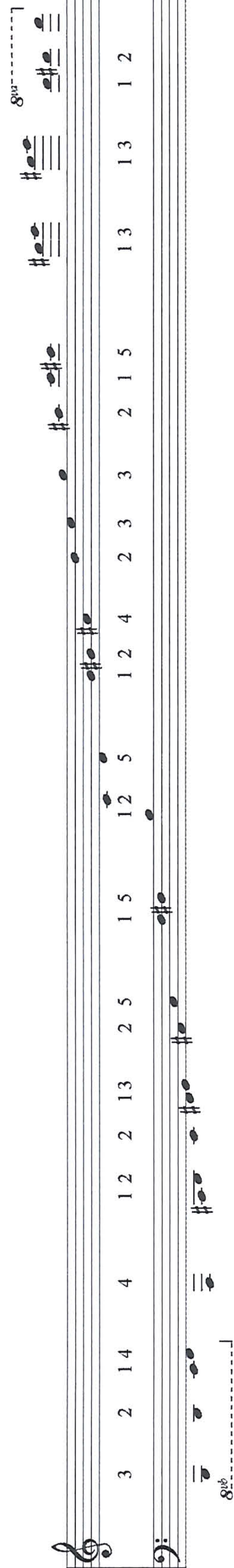
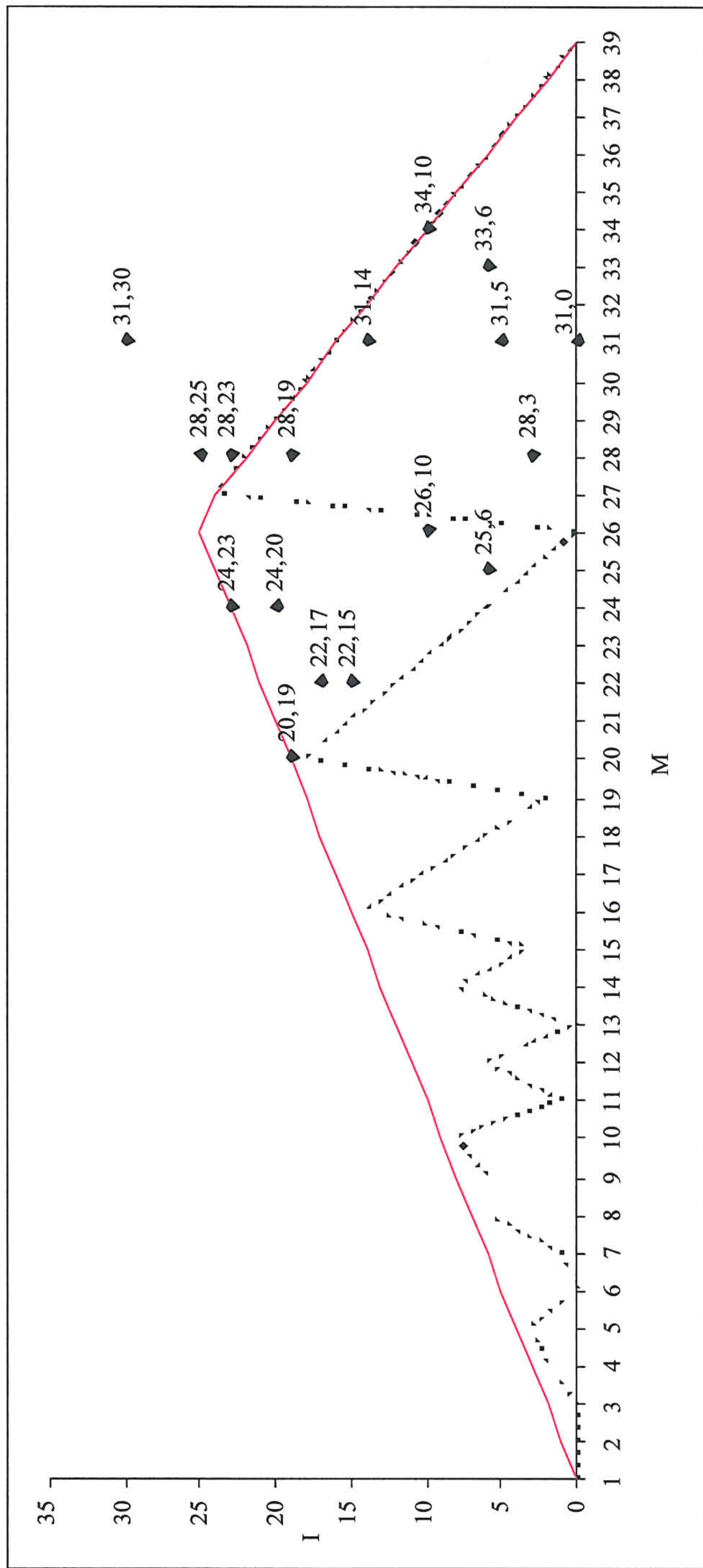


Figure 6.60: Sieve of *Thallein*, as it was used in *Alax*.

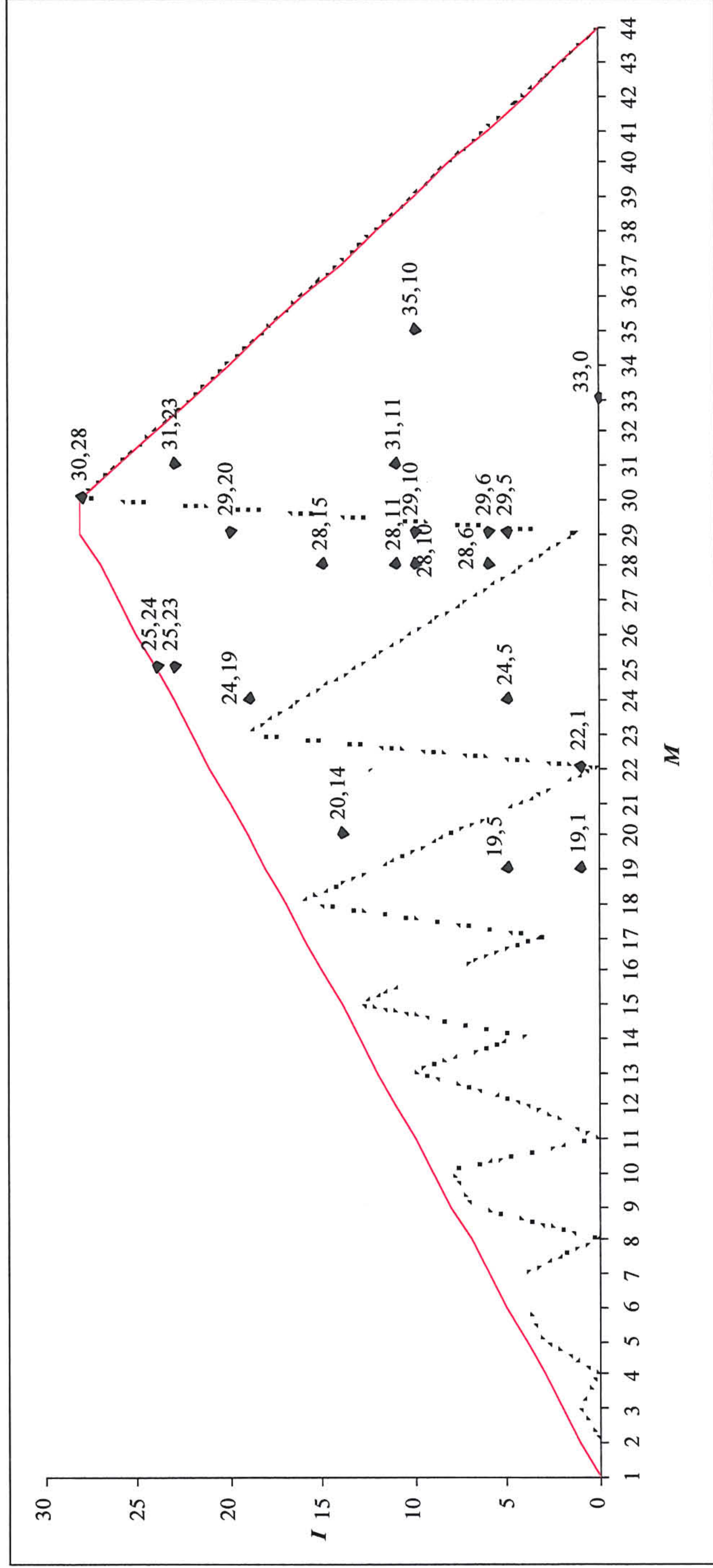


Figure 6.61: Inner Symmetry Chart of the $T_{64}(\text{mod}88)$ Transposition of the sieve of *Nekuia*.

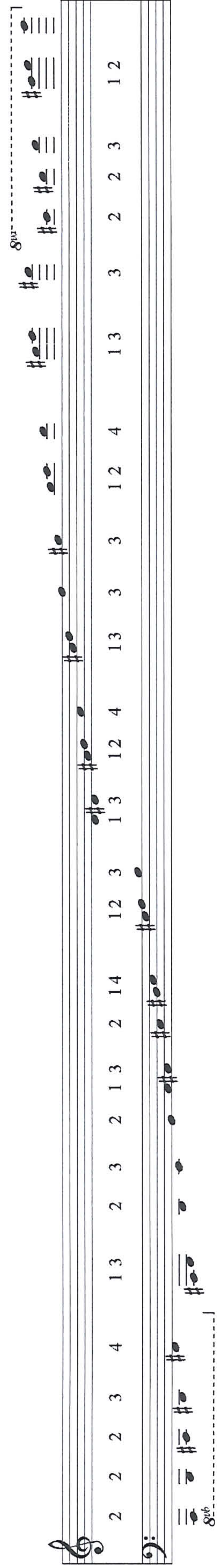
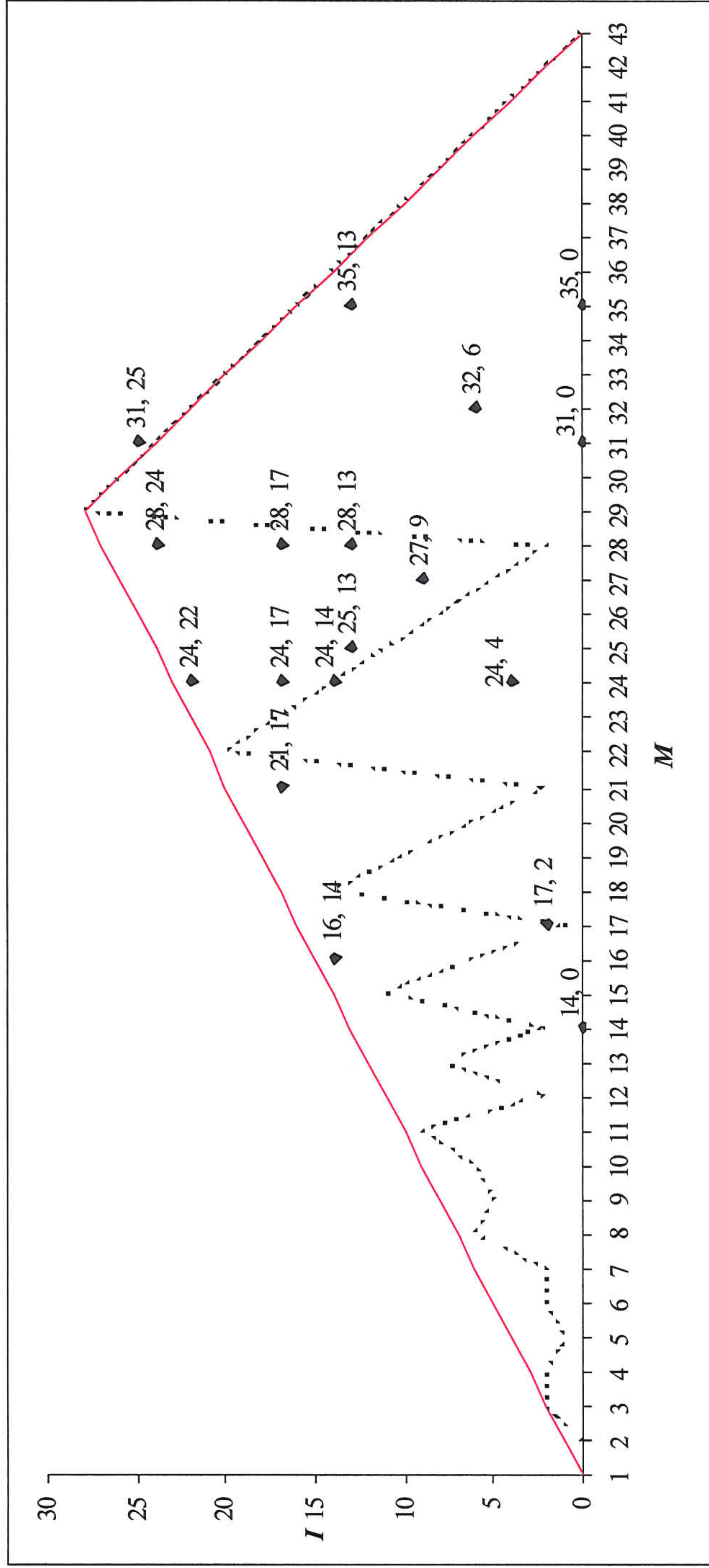


Figure 6.62: Sieve of Keqrops.

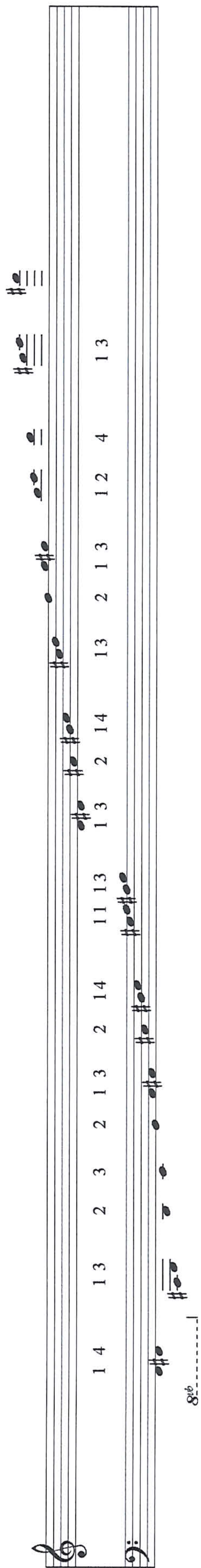
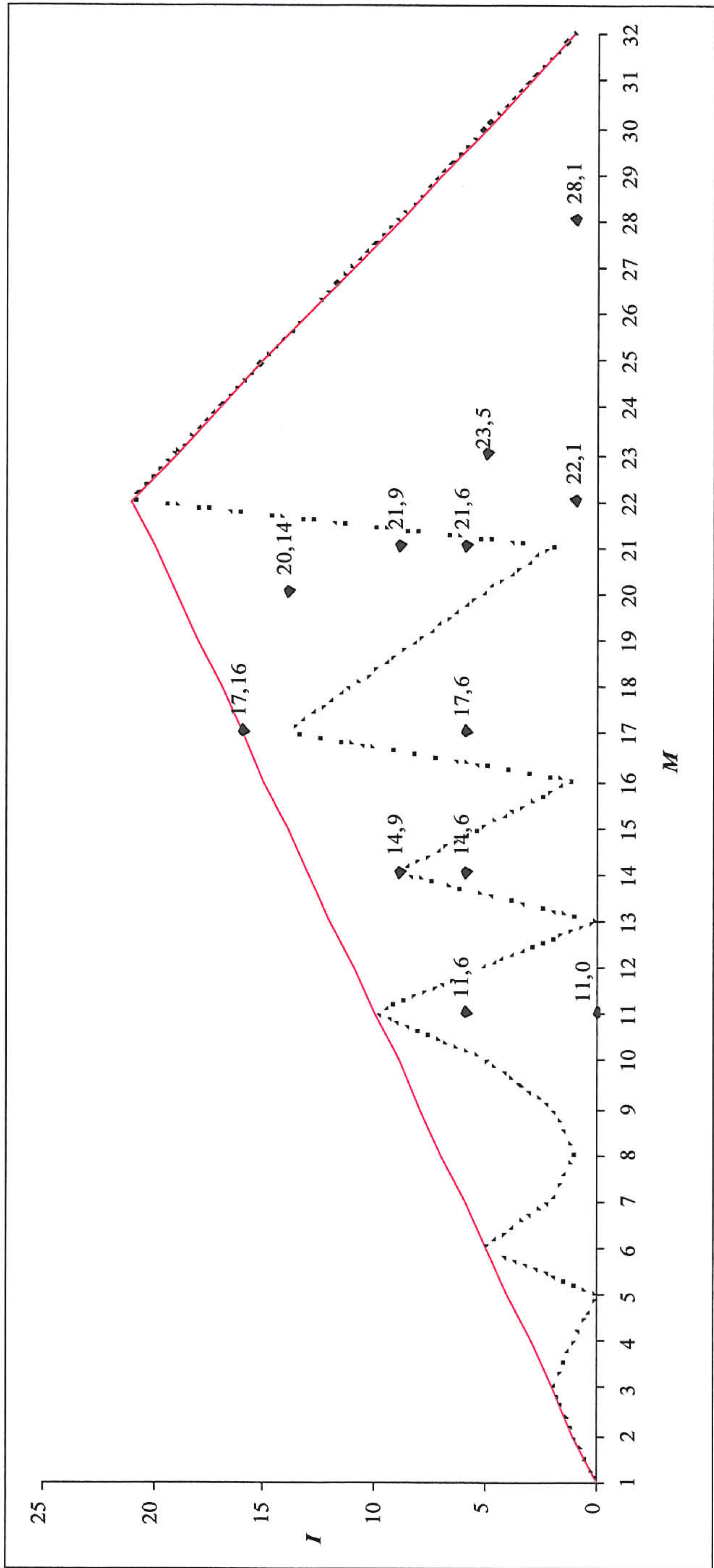


Figure 6.63: Version of the Sieve of Keqrops used in *A l'île de Gorée*.

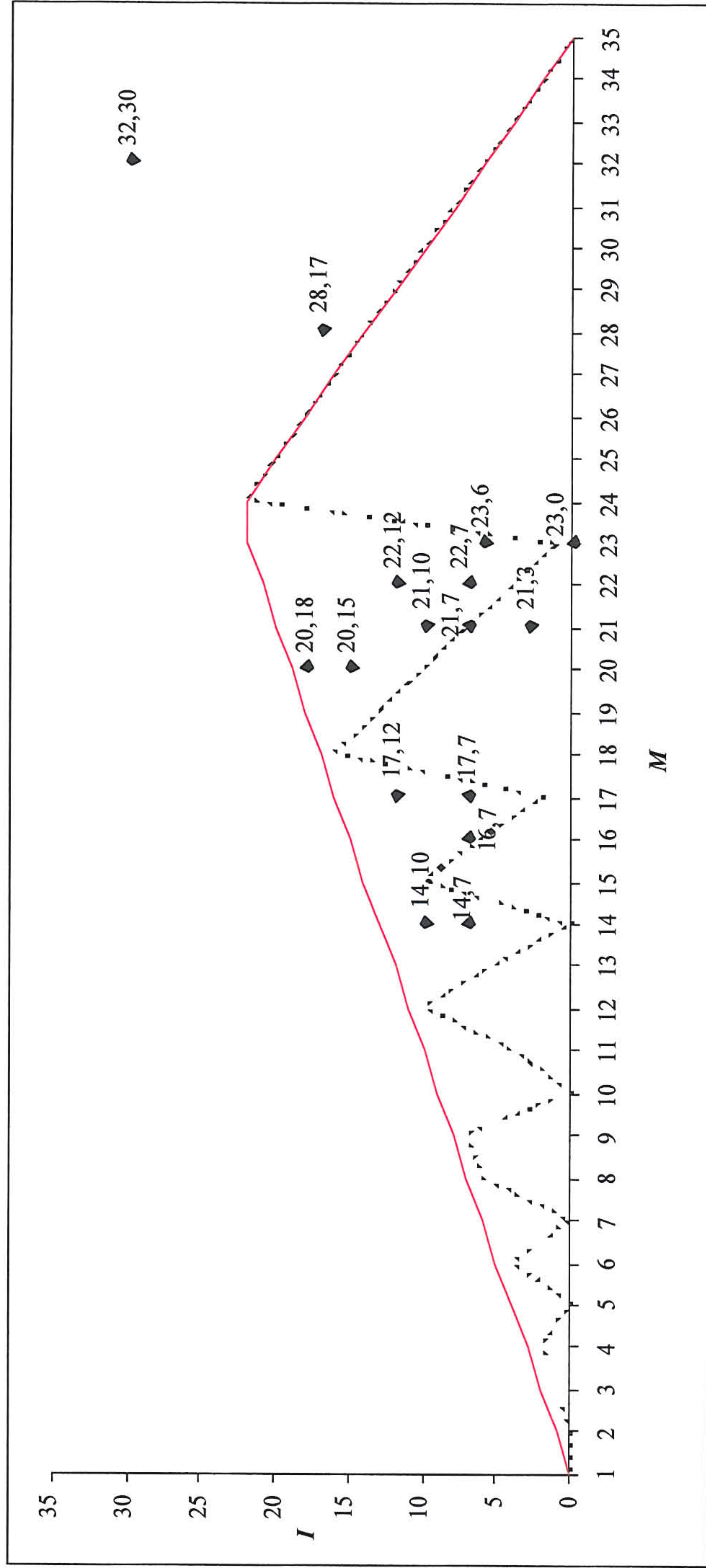


Figure 6.64: Version of the Sieve of Eratosthenes used in *Tuorakemu*.

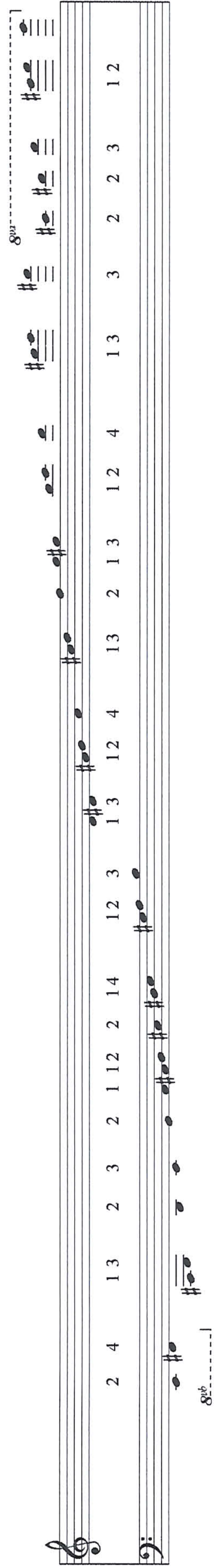
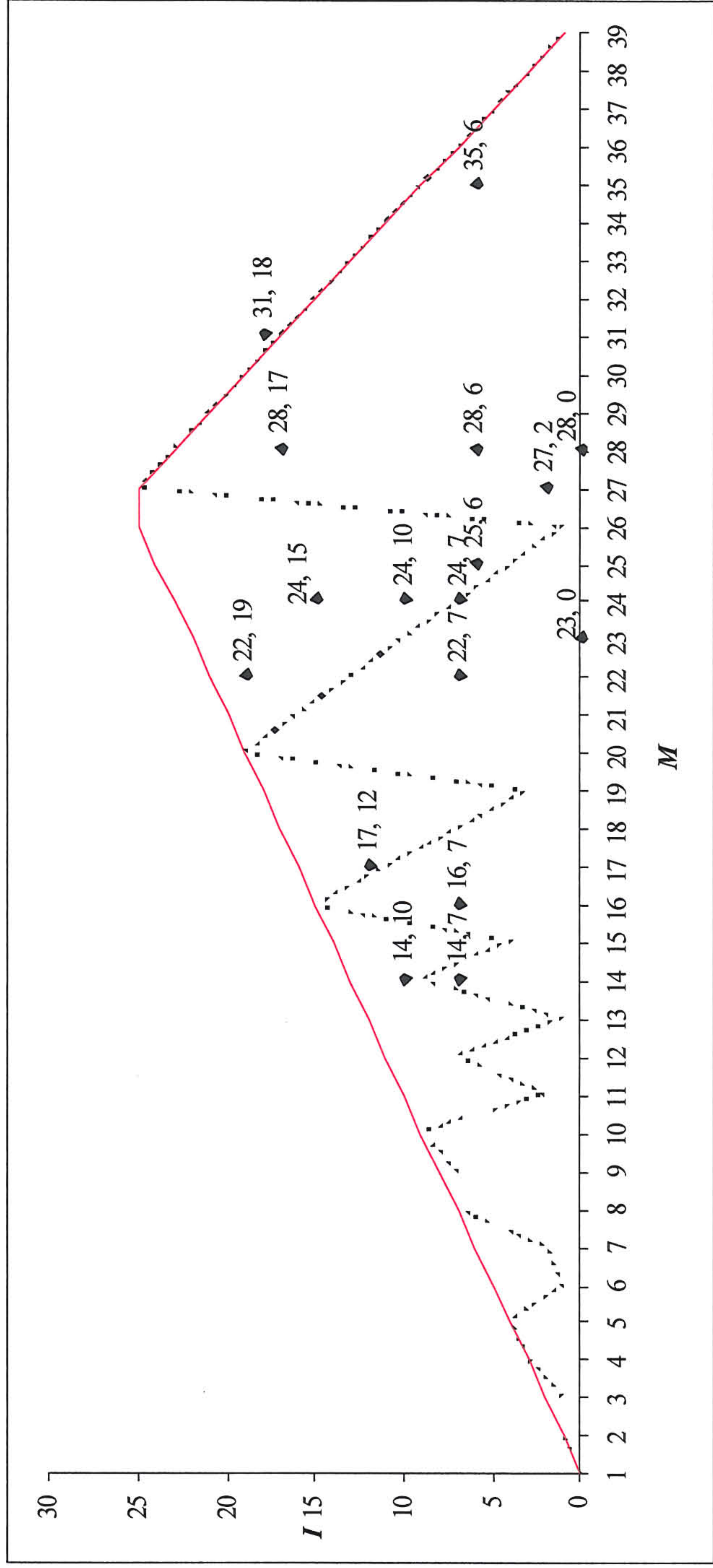


Figure 6.65: Version of the Sieve of *Kyaniya* used in *Kyaniya*.

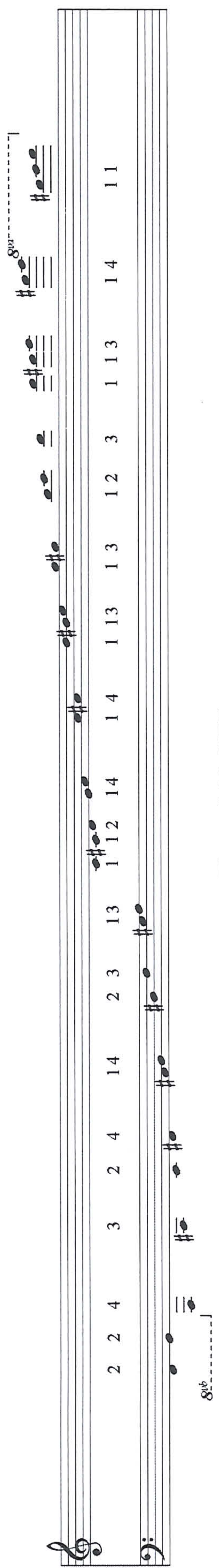
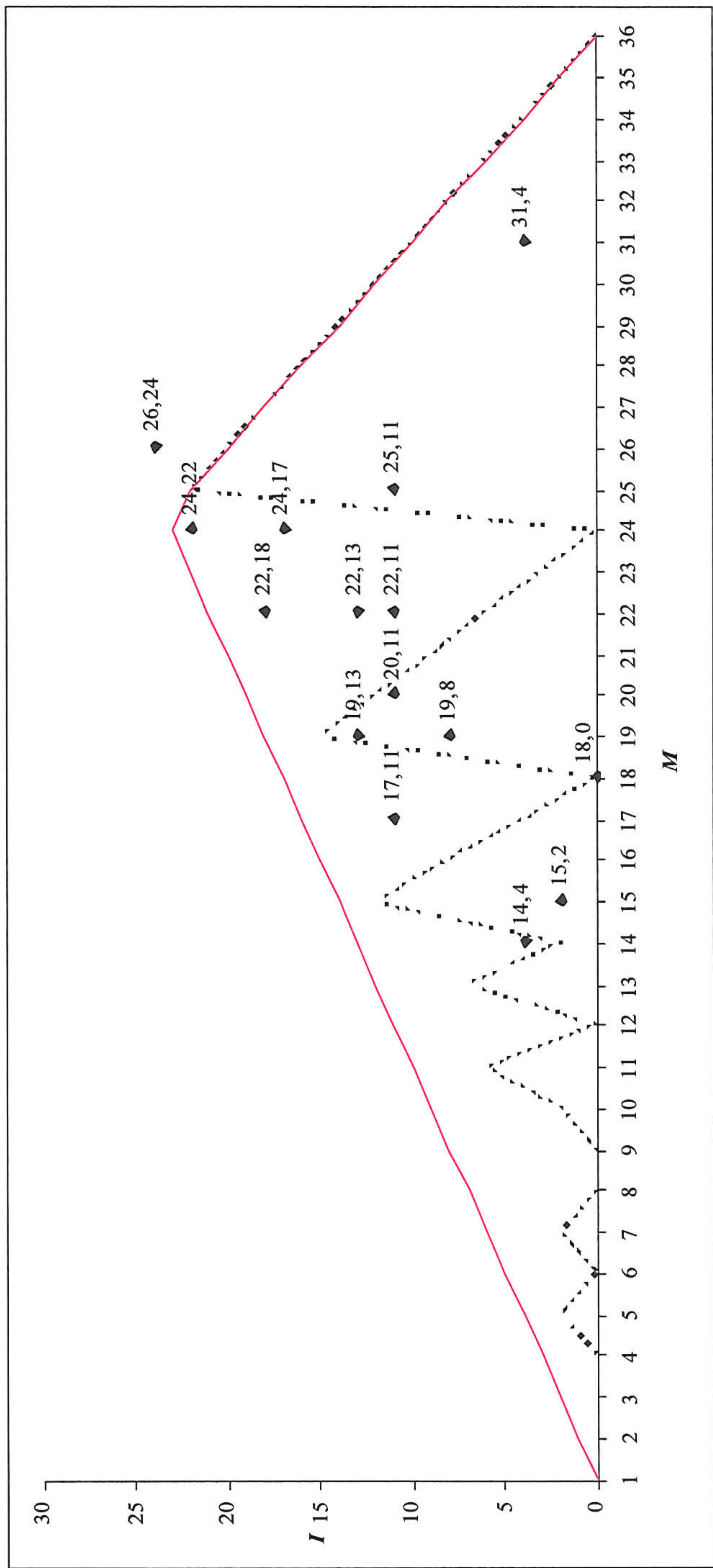


Figure 6.66: SWF.

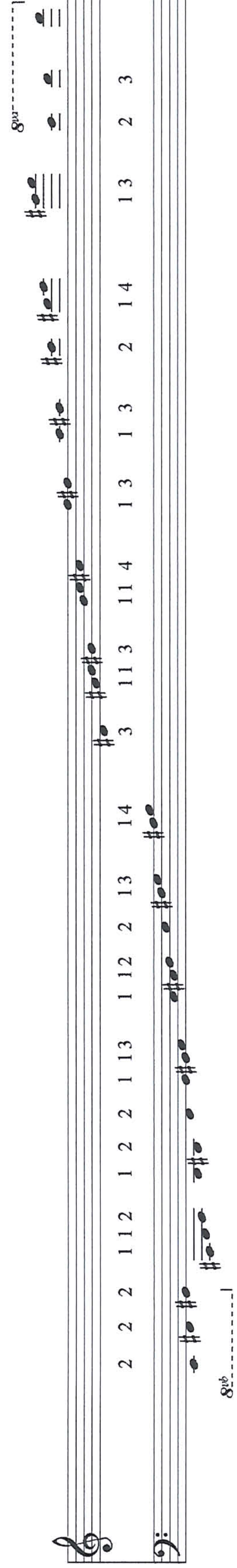
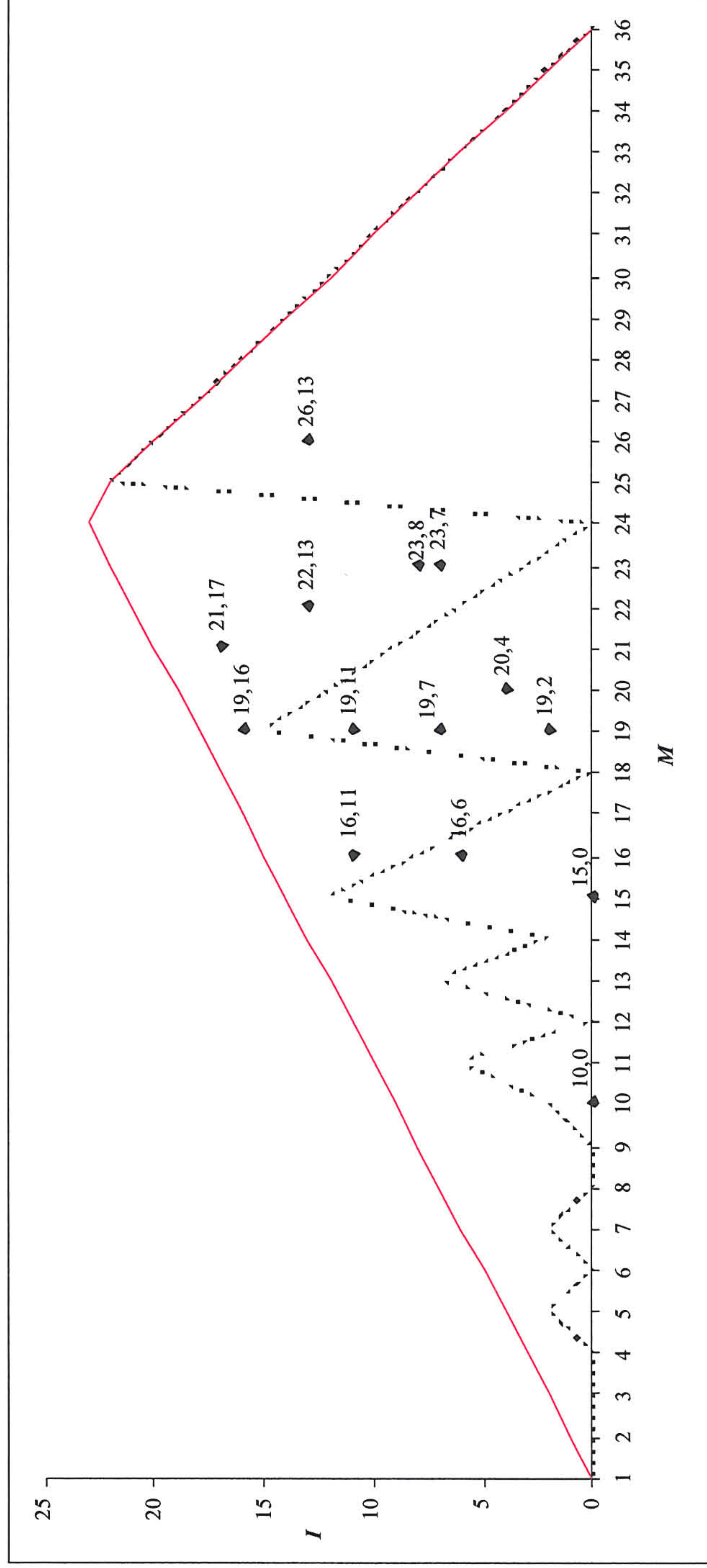


Figure 6.67: CSWF.

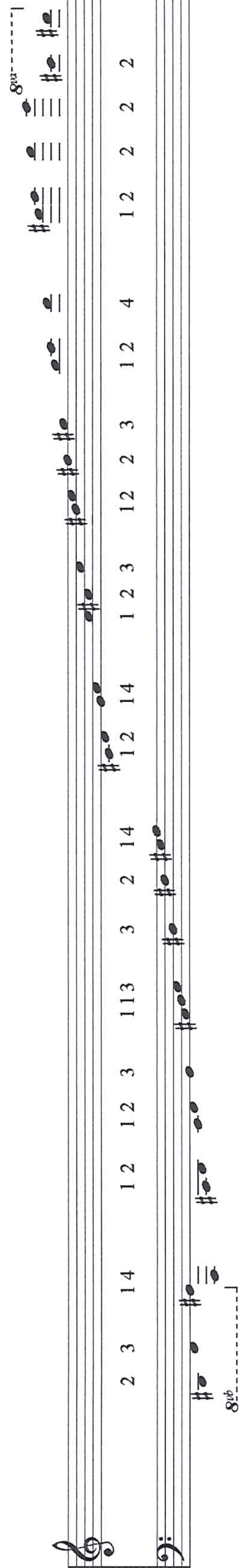
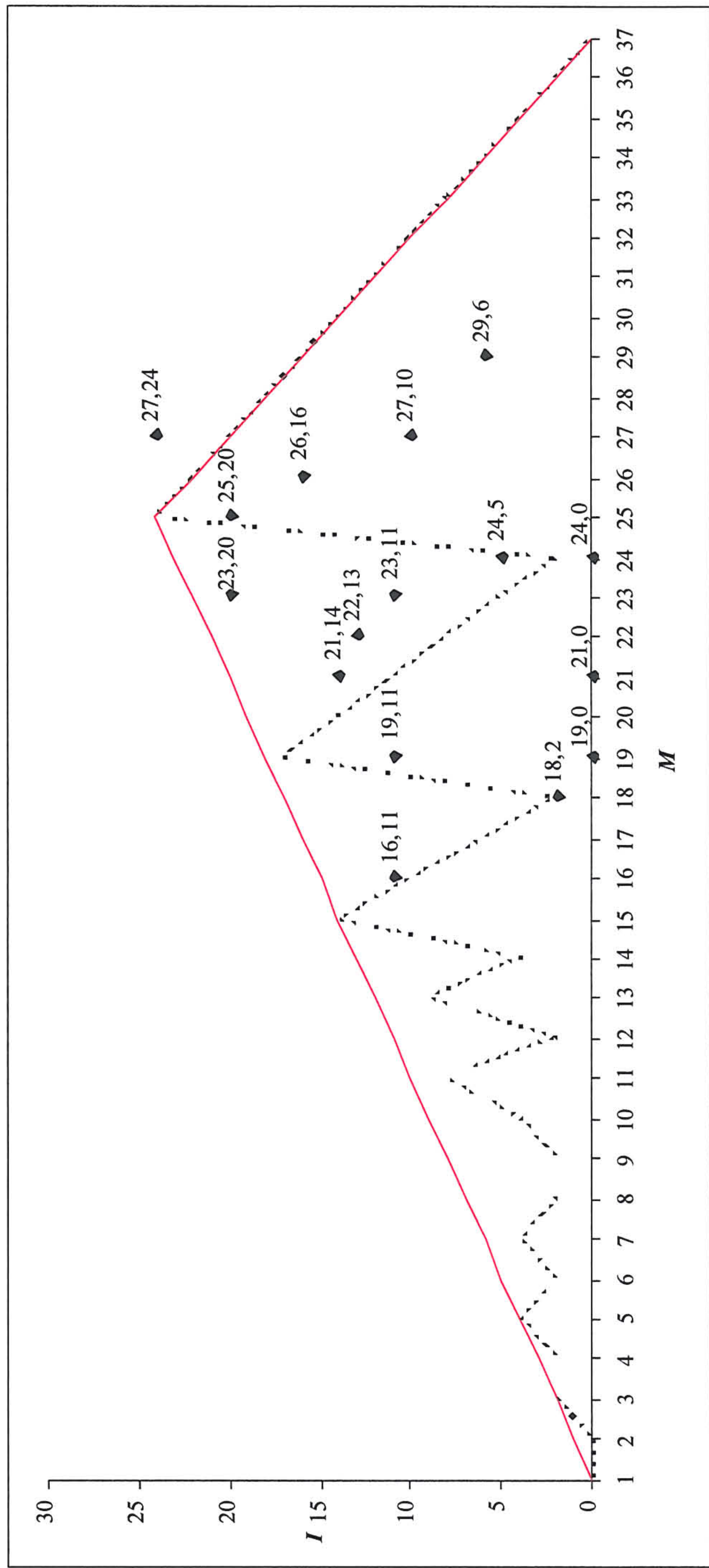


Figure 6.68: SWF'.

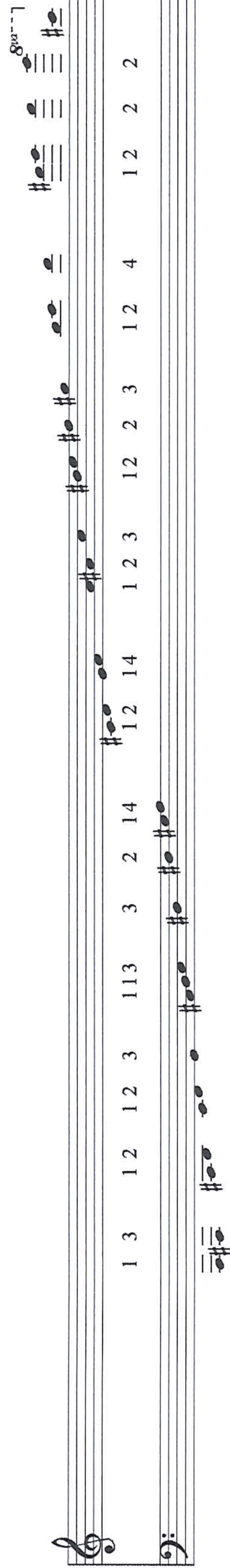
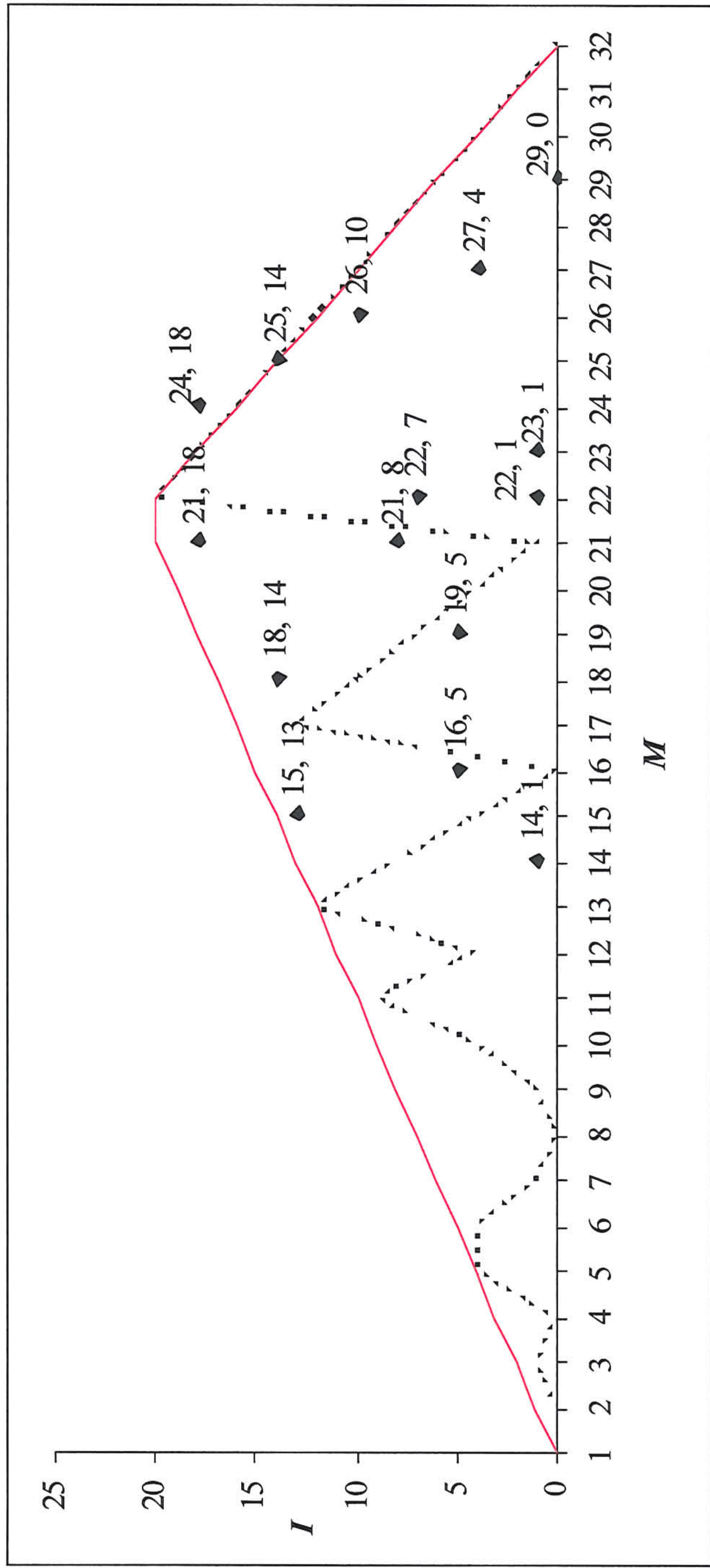


Figure 6.70: Sieve of Krinoïdi.

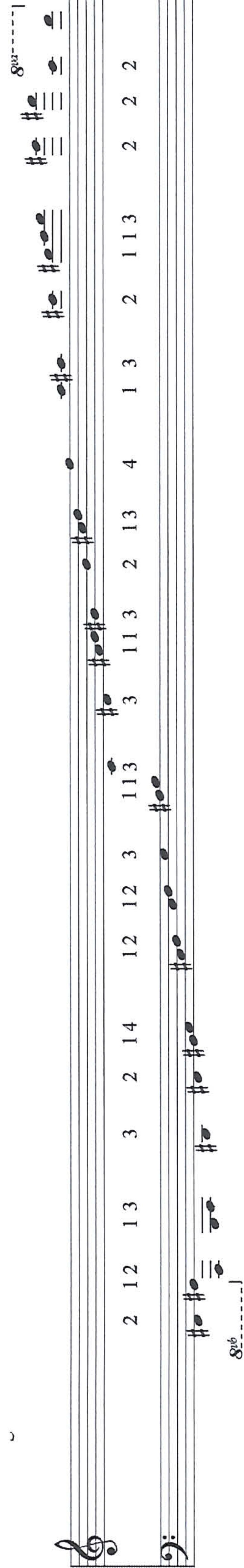
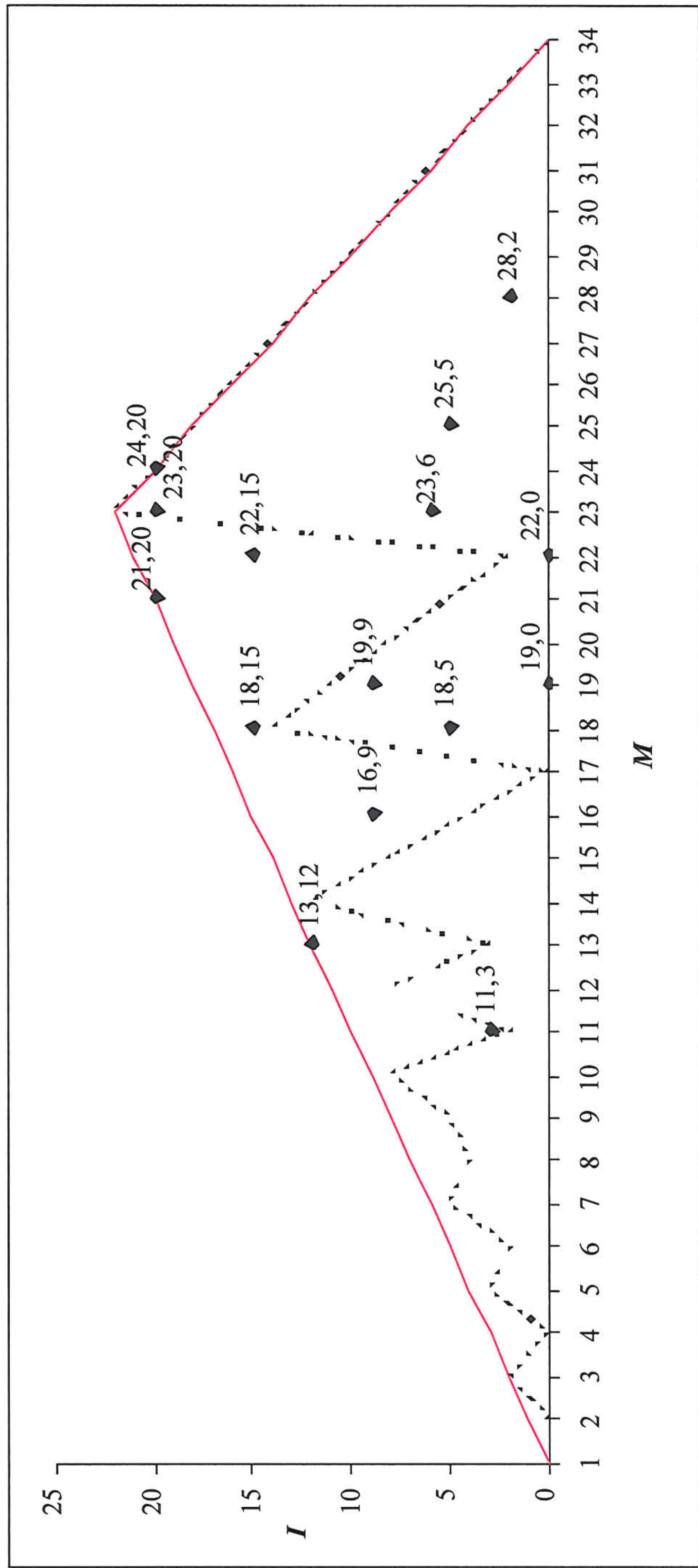


Figure 6.71: Complement of the Sieve of Krinoidi.

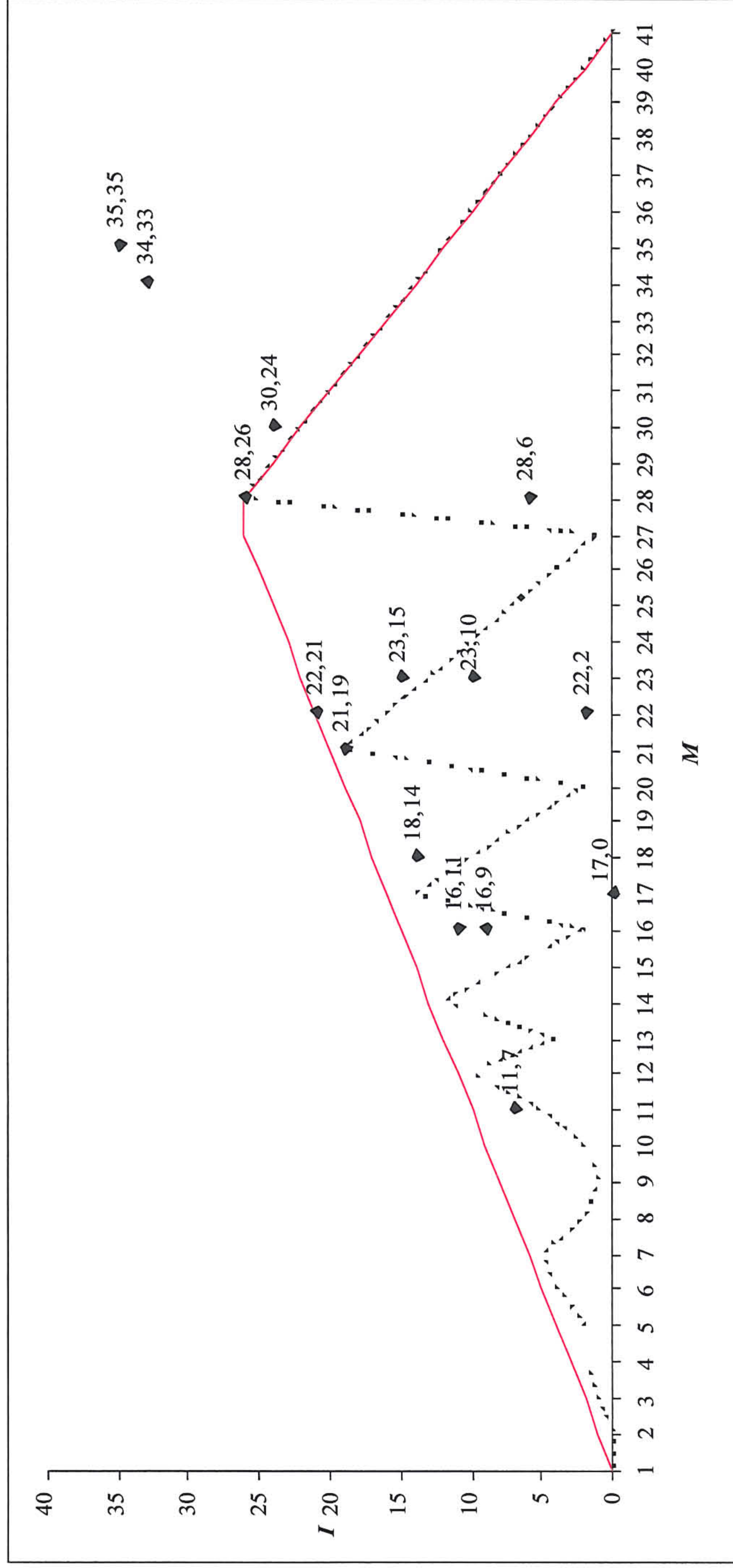


Figure 6.73: Sketches of *Exchange*, Formula of ASK.

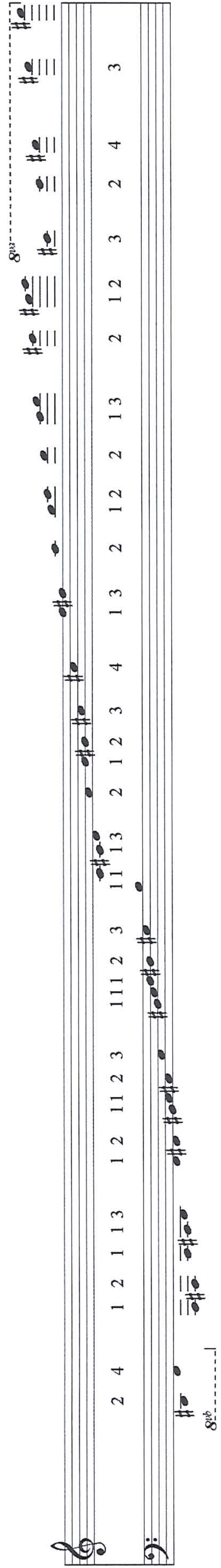
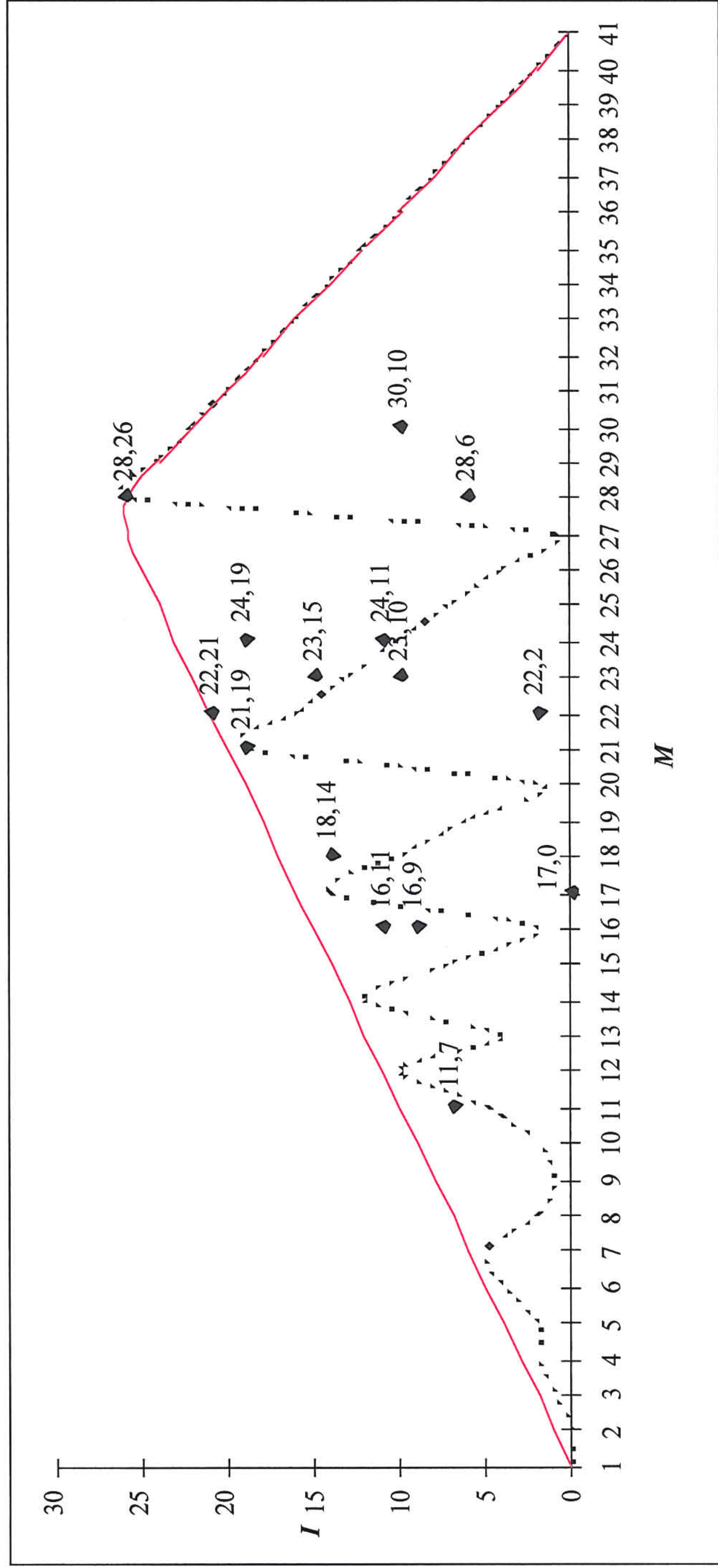


Figure 6.74: ASK.

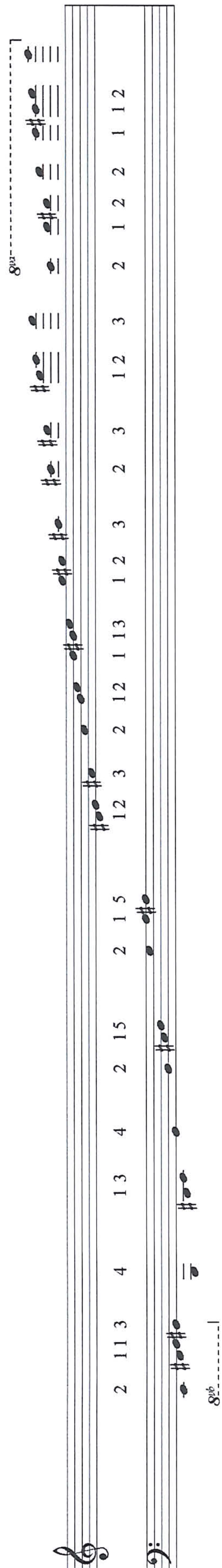
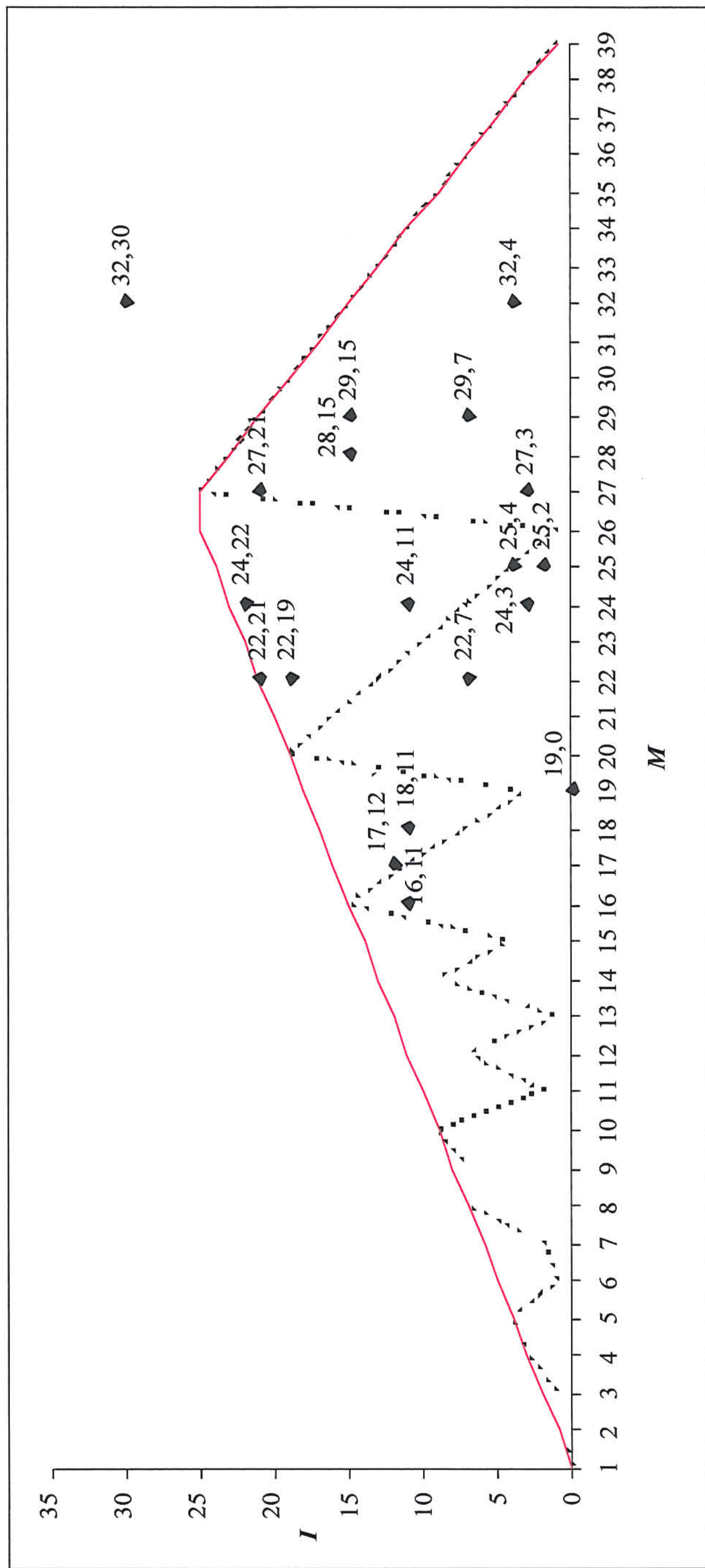


Figure 6.75: Complement of ASK.

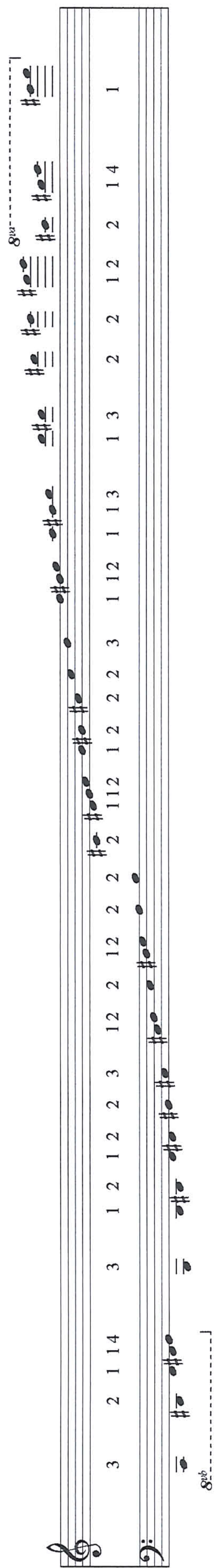
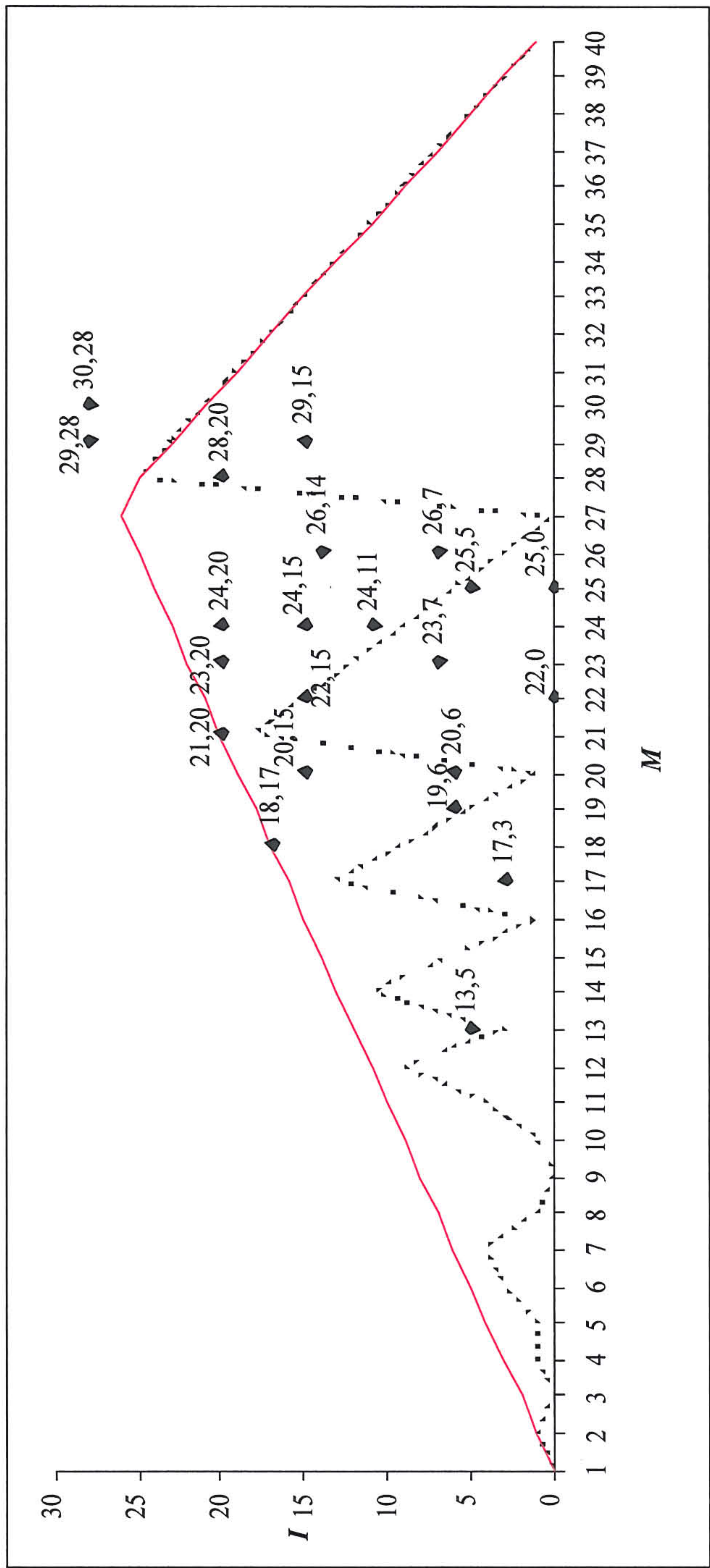


Figure 6.76: Sieve of Eratosthenes.

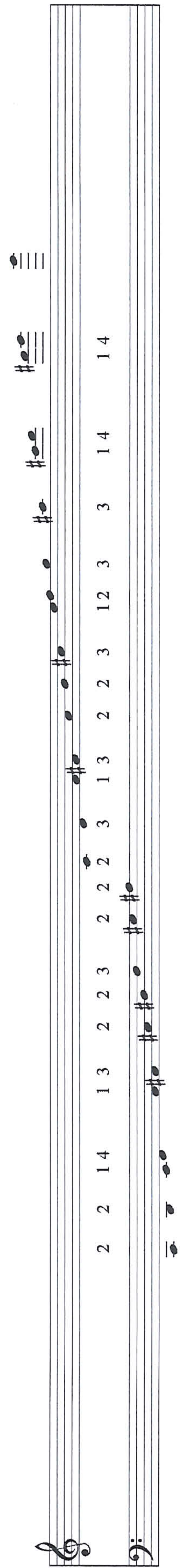
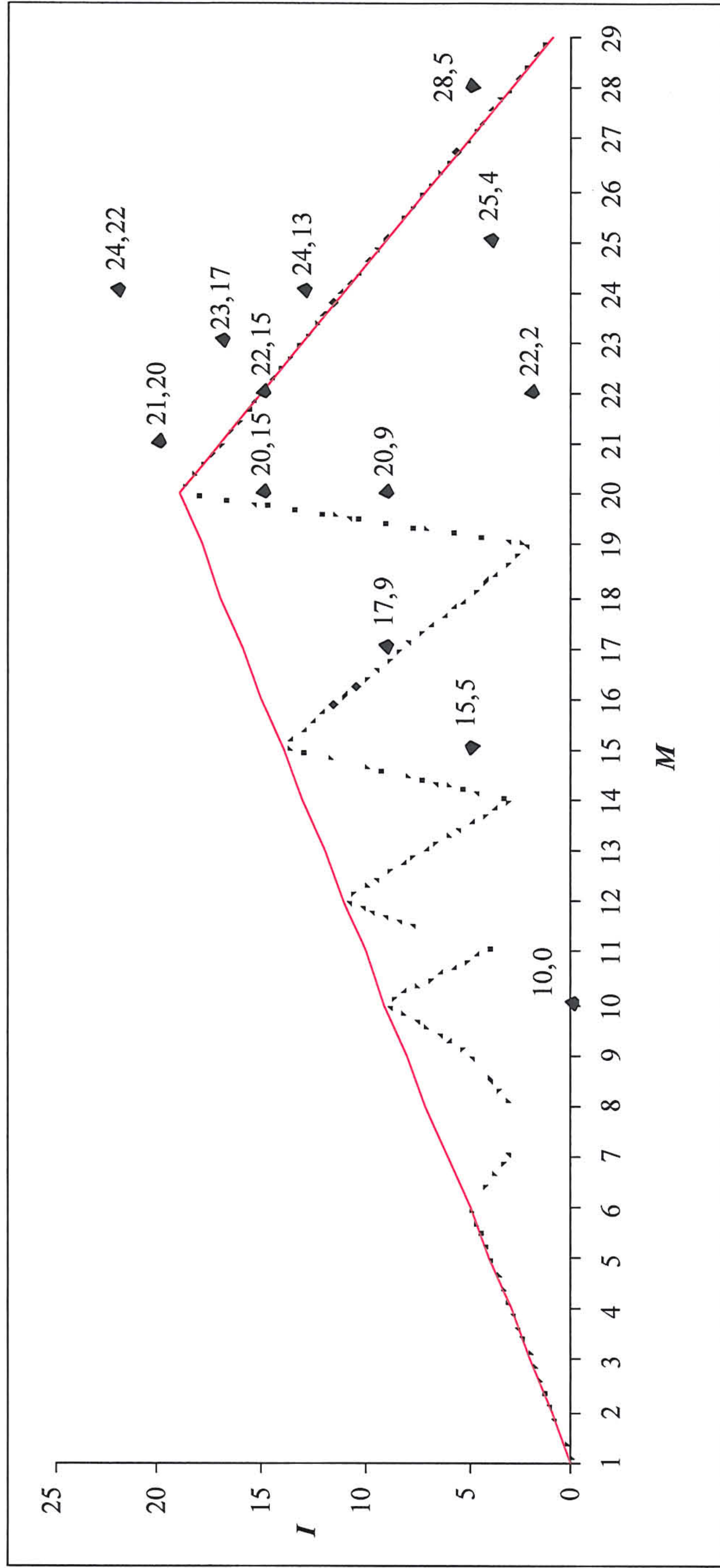


Figure 6.78: Complement of the Sieve of Epiclycle as used in Tetora.

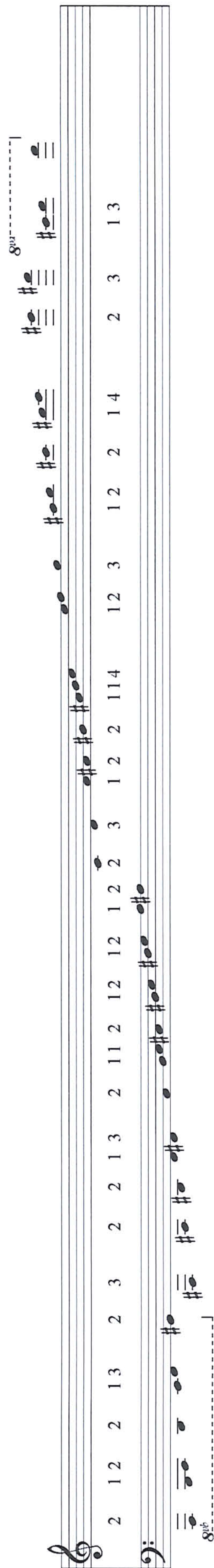
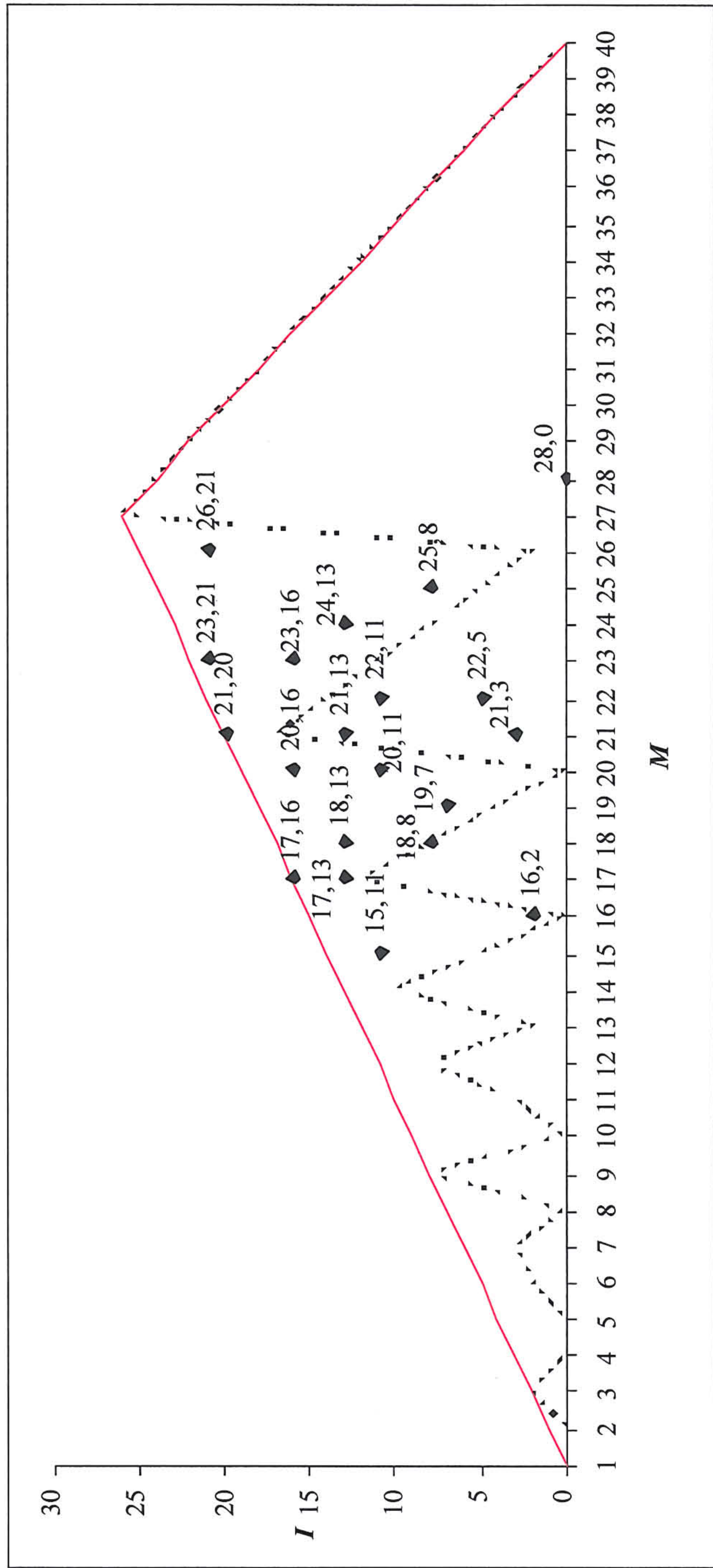


Figure 6.79: Sieve of Paille in the Wind.

11(mod88)

Bar 160

4 1 1 2 1 1 3 2 1 3 1 2 1 4 3 1 2 4 1 4 1 3 1 4 1 4 1 1 3 1 3 1 2 3 1 4

8^{va}

8(mod88)

Bar 160

4 1 1 2 1 1 3 2 1 3 1 2 1 4 3 4 4 1 3 1 4 1 3 1 4 1 1 3 1 3 1 2

8^{vb}

9(mod88)

Bar 161

1 1 3 2 1 3 3 1 4 1 1 4 1 3 1 2 1 1 3 1 3 1 2 3 1 4

8^{va}

9(mod88)

Bar 161

3 1 1 2 4 2 2 4 1 2 2 5 4 1 3 1 4 1 4 1 1 3 1

13(mod88)

8^{va-1}

Figure 7.1: Sieves in the Final Section of *Keqrops* and Segments of the Sieve of *Nekuia*.

The image displays a musical score for two staves, labeled Bar 161 and Bar 162 (Right Hand) and Bar 162 (Left Hand). The notation includes notes, rests, and fingerings. A sequence of numbers is written below the notes, likely representing a sieve or a specific sequence of values. The numbers are: [3 1 1 2 4 2 2 2 2 1 2 2 5] for Bar 161, [1 1 2 4 2 2 4 1 2 2] for Bar 162 (Right Hand), and [3 2 2 2 1 2 2 3 3 1 3 1 5] for Bar 162 (Left Hand). The notes are grouped into segments labeled with $9(\text{mod } 88)$, $5(\text{mod } 88)$, and $8(\text{mod } 88)$. The notes are written on a grand staff (treble and bass clefs). The numbers are written below the notes, and some are enclosed in brackets. The notes are written on a grand staff (treble and bass clefs). The notes are written on a grand staff (treble and bass clefs).

Figure 7.1: Sieves in the Final Section of *Keqrops* and Segments of the Sieve of *Nekuira*, cont.

The image shows a musical score for strings, specifically bars 47-50 of the piece 'Horos'. The score is written for five instruments: First Violin, Second Violin, Viola, Cello, and Double Bass. The First Violin part is marked with a forte dynamic (*sfz*) and includes an instruction for an octave shift (*8va*). The notation consists of notes and stems on five-line staves, with some notes beamed together. The Cello and Double Bass parts are written in a lower register, also using stems and notes. The Viola part is positioned between the two violin staves.

Figure 7.2: *Horos*, bars 47-50. Sieve Segments in the strings.

First Violin

3 1 2 4 1

Second Violin

1 7 1 1 3

Viola

3 2 1 1 5

Cello

6 2 2 3 5

Double Bass

4 2 2 2 2

Figure 7.3: *Ata*, bars 68-70.

Figure 7.4: *Ata*, bars 68-70, Vertical Pentachords.

The musical score is presented in six systems, each consisting of a treble clef staff and a bass clef staff. The notes and fingerings are as follows:

- System 1:** Treble clef: 16, 13; Bass clef: 16, 13.
- System 2:** Treble clef: 4, 12, 4; Bass clef: 4, 12, 4.
- System 3:** Treble clef: 3, 114; Bass clef: 3, 114.
- System 4:** Treble clef: 3, 14, 1; Bass clef: 3, 14, 1.
- System 5:** Treble clef: 12, 16; Bass clef: 12, 16.
- System 6:** Treble clef: 14, 16; Bass clef: 14, 16.

Figure 7.4: *Ata*, bars 68-70, Vertical Pentachords.

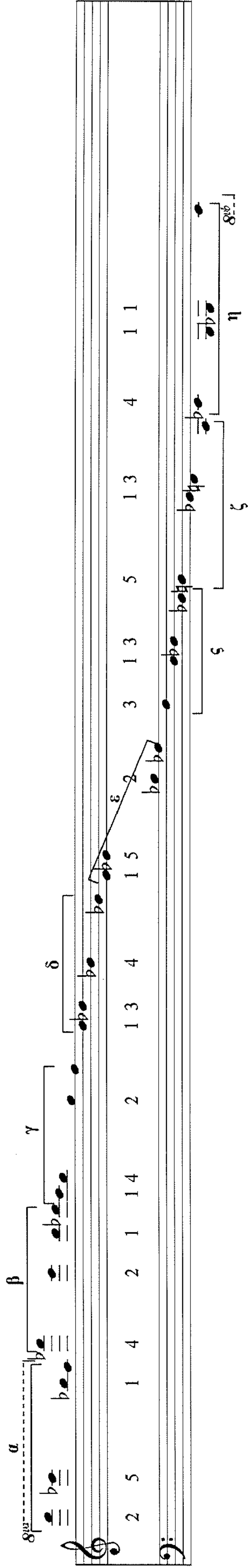


Figure 7.5: Sketches of *Keqrops*, Tetrachords of bars 126-137.

Bars:	126	127	128	129	130	131	132	133	134	135	136	137
Flute	γ	γ	γ	γ				β	β	β	β	β
Oboe		δ	δ	δ	γ			γ	γ	γ	γ	γ
Clarinet			ε		δ			β/γ	β/γ	β/γ	β/γ	β/γ
Bassoon				ζ	ζε	ζ	ζ	ζ				
Horn			δ	ζ	ζ	δ	δ	δ				
Trumpet			γ		δ	δ						
Trombone			ε		ε	ε	ε	ε				
Violin I									α	α	α	α
Violin II									β	β	β	β

Figure 7.6: The Tetrachords of bars 126-137, as they are used in *Keqrops*.

126												127												128											
Bars:												Bars:												Bars:											
Pitches:												Pitches:												Pitches:											
Time-values												Time-values												Time-values											
G	F	C	B	B	F	G	C	F	C	G	B	G	C	B	F	C	B	G	F	F	B	C	G	C	G	F	B	B	F	G	C				
1	2	3	4	2	3	1	4	1	3	4	2	4	1	3	2	1	1	1	4	4	1	4	2	3	3	2	4	1	2	3	1	4			

129												130												131											
Bars:												Bars:												Bars:											
Pitches:												Pitches:												Pitches:											
Time-values												Time-values												Time-values											
G	F	C	B	B	G	C	F	C	F	B	G	F	B	C	G	C	B	G	F	G	C	B	F	B	F	G	C	B	F	G	C				
1	2	3	4	4	2	1	3	2	4	1	3	1	4	2	3	1	2	3	4	4	1	3	2	2	4	1	2	4	1	3	2	4	1	3	

Figure 7.7: Permutations of the Elements of Tetrachord γ in bars 126-131 of *Keqrops*.

Bars:	0-12	13-14	14-18	18-21
Piano:	S	C	C	C
Strings:	C	C	S	S

Figure 7.8: The Exchange of the Sieve and its Complement in the First Section of *Akea*.

RH	0	2	5	7	10	12	15	17	20	23	25	27	30	32	35	37	39	41	43	46	49	52	55	57
	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
	59	61	63	65	67	69	72	74	76	79	80	82	85	87	90	92	95	98	101	103	105	108	110	112
	2	3	2	3	2	3	2	3	1	2	3	2	3	2	3	2	3	3	2	2	3	2	3	2
	114	117	120	122	124	127	129	131	133	136	139	142												
	3	3	2	2	3	2	2	2	3	3	3													
LH	0	3	5	8	11	13	16	18	20	22	25	27	29	31	34	36	38	41	43	45	46	(48)	51	
	3	2	3	3	2	3	2	2	2	1	2	2	2	2	3	2	2	3	2	2	1	2	3	
	54	56	58	60	62	63	65	67	69	71	73	76	(78)	79	82	85	87	88	91	94	96	99	102	105
	2	2	2	2	1	2	2	2	2	2	3	1	1	3	3	2	1	2	3	2	3	3	3	2
	107	109	112	114	117	120	123	125	127	130	132	135	138	141	143									
	2	3	2	3	3	2	2	2	3	2	3	3	3	3	2									

Figure 7.9: *Akea*, bars 21-29, the Time-points of the Accented Dyads in the Piano.

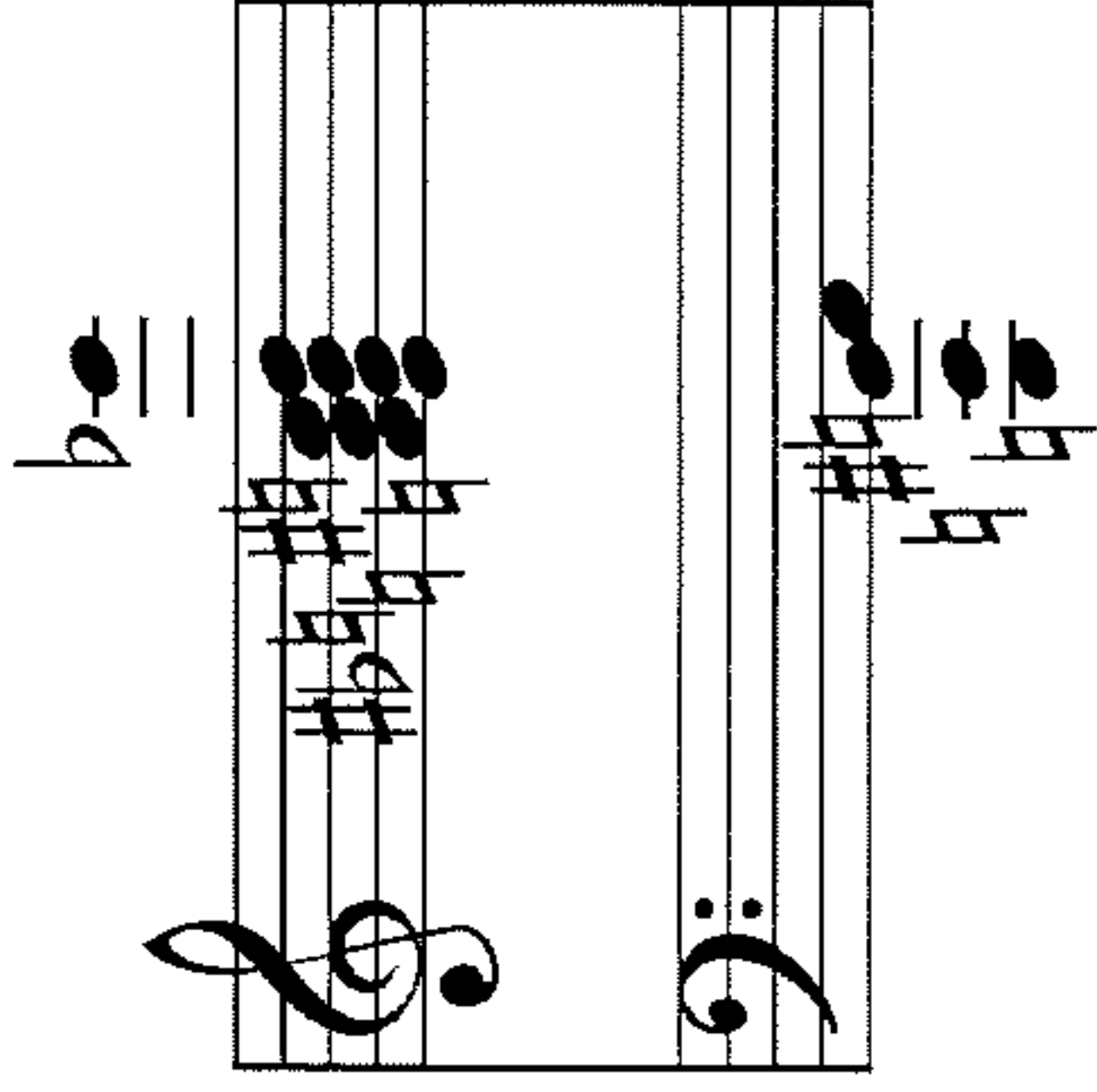


Figure 7.10: *Akea*, bar 36, Reiterated Chord.

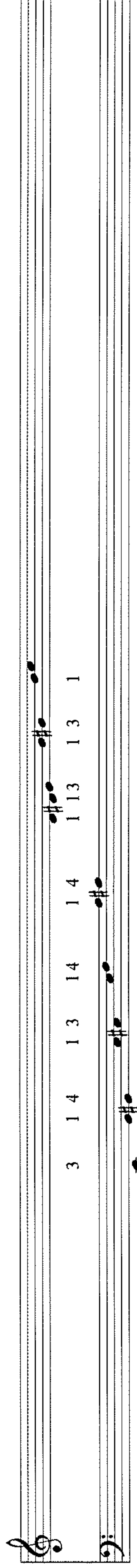


Figure 7.11: *Akea*, T-₁₂ Segment of the Original Sieve for the Piano Sieve-Clusters in bars 48-50.

Bars:	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Piano:	S	S	S	S- ₁₂	S- ₁₂	C	?	?	?	C	C	S- ₁₂	C	C	S
Strings:	S	S	S	C- ₁₂	C- ₁₂	C- ₁₂	C- ₁₂	C- ₁₂	S	S- ₁₂	C- ₁₂	S- ₁₂	S	S	C

Figure 7.12: The Sieve and its Octave Transpositions in the Middle Section of *Akea*.

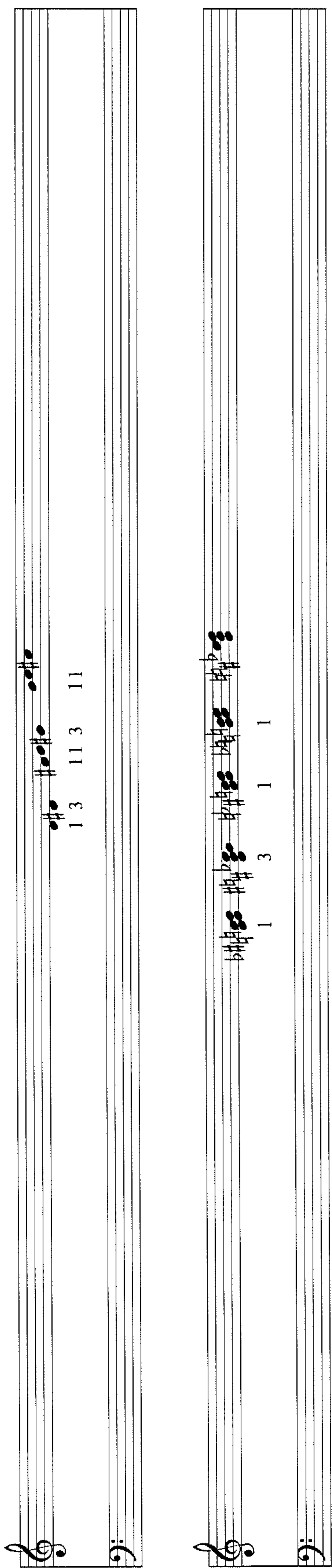


Figure 7.13: Sieve-Clusters from the Complement of the Sieve of *Akea*.

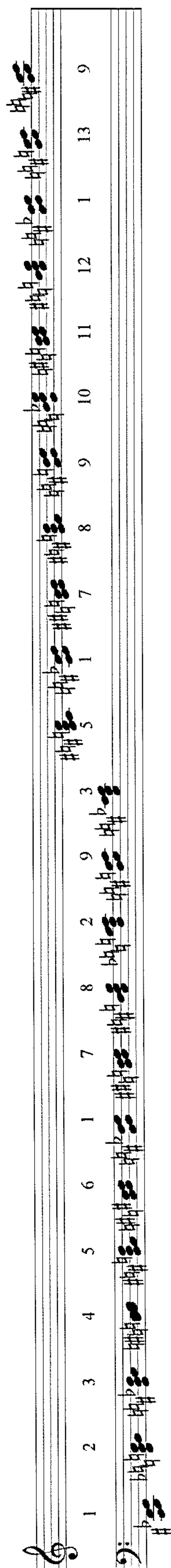


Figure 7.14: *Akea*, Sieve-Clusters of bars 71-78.

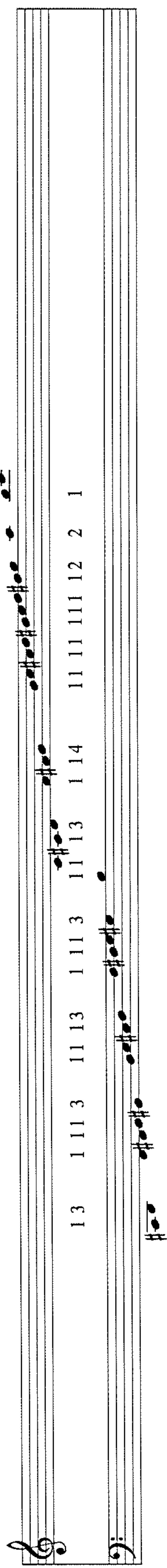


Figure 7.15: *Akea*, Pitch Content of bars 71-78.

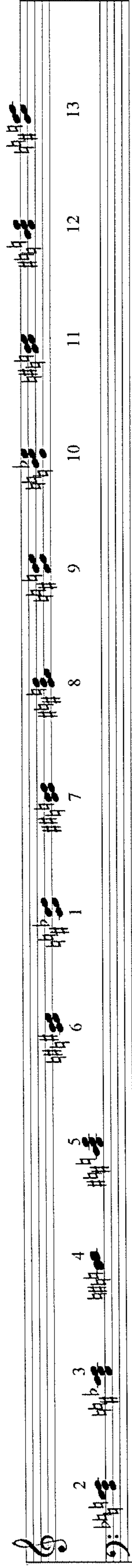


Figure 7.16: *Akea*, Sieve-Clusters of bars 71-78, after Octave Reduction.

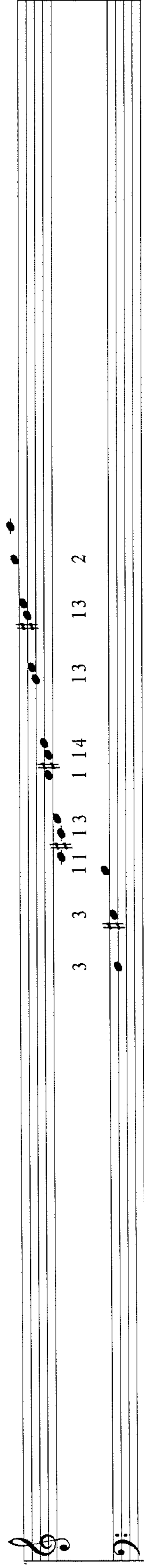


Figure 7.17: *Akea*, Pitch Content of the Sieve-Clusters of bars 71-78 (after Octave Reduction).

The image displays a musical score for a piece titled "The Sieves of À l'île de Gorée". The score is organized into five systems, labeled I through V. Each system consists of two staves: a treble clef staff on top and a bass clef staff on the bottom. The music is written in a rhythmic style, with notes and rests corresponding to the numbers in the rhythmic notation below each staff. The notation includes various note values (quarter, eighth, and sixteenth notes) and rests, often beamed together. The rhythmic notation is placed directly below the notes on the treble staff. System I has rhythmic notation 14, 12 1 2 2 1 1. System II has 2 13 1 2 1 4 2 2 4 1 3 1 1 3 1 4 1 3 1 4 1 1 3 1 3 1 2 1. System III has 1 1 2 2 2 2 3 2 4 1 1 4 3 1 2 2. System IV has 1 3 3 1 3 2 2 2 1 1 3 3 1 2 4 1 3 3. System V has 1 4 1 3 2 3 2 1 3 2 1 4 1 1 1 3 1 3 2 1 4 1 3 2 1 3 1 2 4 1 3. Each system also features a final chord or two notes on the treble staff, often with a sharp sign (#) indicating a key signature. There are two instances of an 8va marking with a dotted line, one in system II and one in system V, indicating an octave shift. The overall layout is clean and professional, typical of a printed musical score.

Figure 7.18: The Sieves of À l'île de Gorée.

The image displays a musical score for three instruments: winds, harpsichord, and strings. The score is organized into three systems, each with a grand staff (treble and bass clefs). The first system is labeled 'winds', the second 'harpichord', and the third 'strings'. Each system shows a sequence of chords for measures 'a' through 'f'. The chords are represented by groups of notes on the staves, with some notes marked with accidentals (sharps, flats, naturals). The 'winds' system shows a progression of chords that generally move from higher registers in measure 'a' to lower registers in measure 'f'. The 'harpichord' system shows a similar progression, with notes often appearing in pairs or groups. The 'strings' system shows a progression of chords that generally move from lower registers in measure 'a' to higher registers in measure 'f'. The overall structure suggests a harmonic sequence or a specific chord progression used in the piece.

Figure 7.19: À l'île de Gorée, Chords of the Chord Sequence in bars 30-60.

First Layer Second Layer Third Layer

a b c d e f g h i j k l m n

Bars 34-39	f	j	n	l	c	l	k	e	k	b	k	j	n	j	l	j	a	k	k	a	k	d	d	k	k	d	k	g	l	m	j	j	a	k		
	2	3	3	2	2	2	2	2	2	3	2	3	2	2	2	2	2	3	2	2	2	2	3	2	2	2	2	2	3	3	3	2	2	2	3	2
Bars 40-41	k	d	k	a	g	l	j	m	g																											
	2	3	2	2	2	3	3	2																												
Bars 47-49	j	k	l	g	k	e	j	a	k	e	k	e	k	e	k	k	k																			
	6	3	2	5	2	2	3	2	2	2	2	2	2	2	2	2	2																			
Bars 51-53	e	k	k	k	e	k	a	k	e																											
	3	2	2	2	2	3	2	2	3	2																										

Figure 7.20: À l'île de Gorée, bars 34-53, Brass Chord Sequence.

First Layer

Second Layer

Figure 7.21: *À l'île de Gorée*, bars 63-80, The Chords of the First Two Layers in the Chord Sequence.

V

II

2 4 13 2 3 2 13 2 13 13 14 13 14 14 14 113 13 112

8va.....

Figure 7.22: *À l'île de Gorée*, Sieve of bars 99-101.

8^{va}.....]

V

chord

1 4 1 3 2 3 2 1 3 2 1 4 1 1 1 3 1 2 3 2 1 4 1 2 1

Figure 7.23: À l'île de Gorée, Harpsichord Sieve of bars 102-116.

harpsichord

woodwinds

brass

strings

a b c d e f g

Figure 7.24: À l'île de Gorée, Chords of the Sequences in bars 127-137.

Period	Accented Tetrachords			
1 st	a	b	f	c
	3	2	2	3
2 nd	a	f	c	d
	2	3	3	2
3 rd	a	c	d	f
	2	2	2	3
4 th	a	c	e	d
	2	3	2	3
5 th	a	d	e	d
	2	2	3	2
6 th	a	e	e	f
	2	2	3	2
7 th	a	b	e	c
	3	2	3	2
8 th	a	c	e	d
	2	3	2	3
9 th	a	b	f	c
	2	3	2	3
10 th	a	e	e	f
	2	2	3	2
11 th	a	f	c	e
	2	3	3	2
12 th	a	b	e	c
	3	2	3	2

Figure 7.25: À l'île de Gorée, bars 127-137, The Accented Tetrachords in the Woodwinds' Chord Sequence.

Period	Trichords					
1 st	d	e	c	e	d	b
	/	2	3	3	2	2
2 nd	b	f	e	f	f	a
	/	3	2	2	3	2
3 rd	f	e	d	b	c	b
	/	3	2	3	2	2
4 th	e	d	a	f	d	e
	/	3	2	2	3	2
5 th	f	f	? 	c	a	f
	/	2	2	3	2	3
6 th	d	d	f	f	f	a
	/	2	3	3	3	2
7 th	c	c	f	d	f	c
	/	2	2	3	2	3
8 th	d	d	b	a	a	f
	/	3	3	2	3	2
9 th	c	c	f	d	f	c
	/	2	2	3	2	3
10 th	a	a	c	b	a	c
	/	3	2	2	3	2
11 th	d	d	c	d	b	a
	/	3	3	2	3	2
12 th	f	f	f	f	f	f
	/	/	/	/	/	/

Figure 7.26: À l'île de Gorée, bars 127-137, The Trichords in the Strings' Chord Sequence.

A B C D E F
 d/c a b d/c a b d/c a b d/c a b d/c a b d/c a b

Bar: 128	129	130	131	132
Rhythmic Cell: A B A C A C A D B C B A C A A D B C E F A E C	Rhythmic Cell: F D C A A C B B C A A C B A B B F	Rhythmic Cell: 134	Rhythmic Cell: 135	Rhythmic Cell: 136

Figure 7.27: *À l'île de Gorée*, bars 127-137, The Trichords in the Brass' Chord Sequence.

a)

b)

Figure 7.28: *Tetora*, pitch content and sieve of bars 27-30.

a) Chord Sequences and Transpositions:

Bars 21-24 (T ₀)	B	F	X	E	B	X	F	C	E	X	B	E	X	C	G	C	F	G	X	E	G	X	C	G
	3	/	1	3	/	1	2	/	1	2	1	/	1	1	2	3	2	2	2	2	1	1	1	2
Bars 40-42 (T ₀)	F	C	S	F	C	S	E	F	C	S	E	F	S	C	F	S	E	F	C	S	E			
	3	/	1	3	/	1	2	3	1	2	1	3	2	2	1	1	2	3	2	2	2			
Bars 48-50 (T ₀)	S	δ	S	S	δ	S	ε	S	δ	ε	γ	ε	S	S	δ	S	ε	S	ε	S	δ	S	S	
	3	1	1	3	1	1	2	3	1	2	1	3	2	2	1	1	2	3	2	2	2	2	2	

b) Chord Sequences and Substitutions:

40-42 → 48-50
F → S
C → δ
E → ε
A → γ

Figure 7.29: *Tetora*, bars 21-24, 40-42, and 48-50, Chord Sequences.

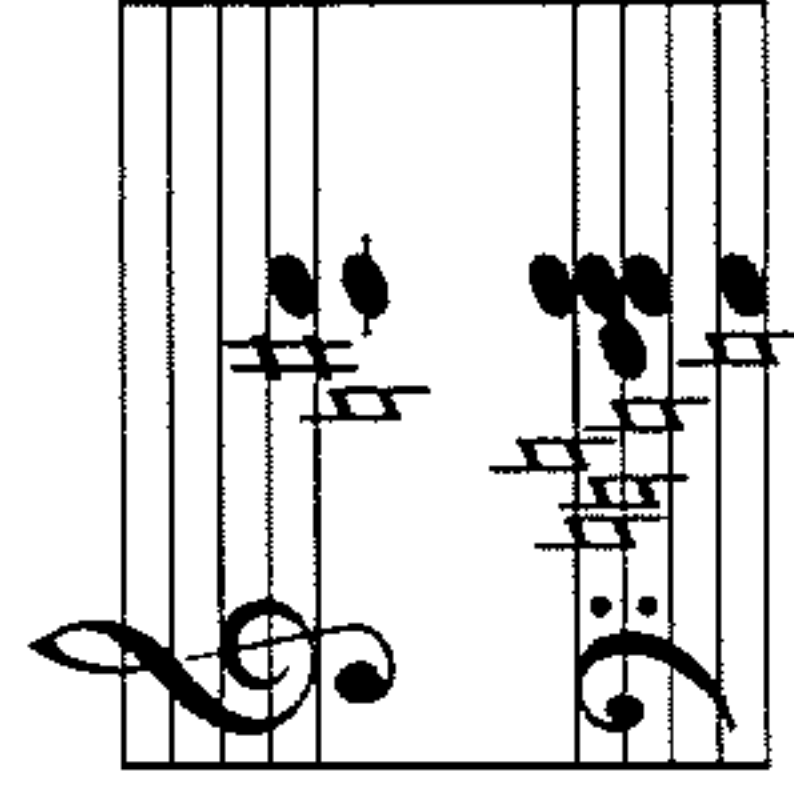


Figure 7.30: *Tetora*, bars 21-24, Low Heptachord (X).

The image displays musical notation for two string sections: upper strings (treble clef) and lower strings (bass clef). Each section contains five chord diagrams, labeled with Greek letters α through ϵ below the lower strings staff. The chords are as follows:

- α : Upper strings: F#4, A4, C#5; Lower strings: F#2, A2, C#3
- β : Upper strings: B4, D5, F#5; Lower strings: B2, D3, F#3
- γ : Upper strings: C#5, E5, G#5; Lower strings: C#3, E3, G#3
- δ : Upper strings: D5, F#5, A5; Lower strings: D3, F#3, A3
- ϵ : Upper strings: E5, G#5, B5; Lower strings: E3, G#3, B3

Figure 7.31: *Tetora*, Chords of bars 21-85.

The image displays musical notation for the chords of bars 115-137 in the piece *Tetora*. It consists of two staves: the upper staff is labeled "upper strings" and the lower staff is labeled "lower strings".

The upper strings staff shows six chords, each with a Greek letter label below it: α' , β' , γ' , δ' , ϵ' , and σ' . The lower strings staff shows six chords, each with a Greek letter label below it: α' , β' , γ' , δ' , ϵ' , and σ' .

The chords are represented by groups of notes on the staff lines, with accidentals (sharps and flats) indicating the specific pitches. The notation is arranged in a grid-like fashion, with the upper and lower strings staves aligned horizontally.

Figure 7.33: *Tetora*, chords of bars 115-137.

a) Chord Sequences and Transpositions:

Bars 115-116 (T ₀)	δ'	ε'	ε ₂ '	δ'	ε'	ε ₂ '	δ'	ε'	ε ₂ '	δ'	ε'	ε ₂ '	δ'	ε'	ε ₂ '	δ'	ε'	ε ₂ '
	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Bars 116-119 (T ₊₁)	ς'	β'	ε ₂ '	ς'	β'	ε ₂ '	ς'	β'	ε ₂ '	ς'	β'	ε ₂ '	ς'	β'	ε ₂ '	ς'	β'	ε ₂ '
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Bars 119-122 (T ₋₁)	γ'	α'	ε ₂ '	γ'	α'	ε ₂ '	γ'	α'	ε ₂ '	γ'	α'	ε ₂ '	γ'	α'	ε ₂ '	γ'	α'	ε ₂ '
	2	3	3	2	3	3	2	3	3	2	3	3	2	3	3	2	3	3
Bars 122-125 ³ (T ₊₃)	α'	γ'	ε ₂ '	α'	γ'	ε ₂ '	α'	γ'	ε ₂ '	α'	γ'	ε ₂ '	α'	γ'	ε ₂ '	α'	γ'	ε ₂ '
	3	1	1	3	1	1	3	1	1	3	1	1	3	1	1	3	1	1
Bars 125-128 (T ₋₂)	β'	δ'	ε ₂ '	β'	δ'	ε ₂ '	β'	δ'	ε ₂ '	β'	δ'	ε ₂ '	β'	δ'	ε ₂ '	β'	δ'	ε ₂ '
	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2

b) Chord Sequences and Substitutions:

115-116	116-119	119-122	122-125	125-128 ⁴
δ'	→	ς'	→	β'
ε'	→	β'	→	δ'
ς'	→	δ'	→	γ'
γ'	→	α'	→	ε'
	→	2	→	1
	→	2	→	2
	→	1	→	3

Figure 7.34: *Tetora*, bars 115-128, Chord Sequences.

³ With one exception: in chord α' C6 has been substituted for D#6, where C4 is middle C.

⁴ With some exception after the interruption of the sequences (See the last six columns of part [a] of the table).

⁵ With an exception at the correspondence of the last chord of bar 119 with the fourth of bar 122 (3 semiquavers instead of 2).

APPENDIX 1

Prime Factorisation of the first 200 Integers, with Primes and Prime Powers shown in bold:

1 = 1	21 = 3·7	41 = 41	61 = 61	81 = 3⁴	101 = 101	121 = 11²	141 = 3·47	161 = 7·23	181 = 181
2 = 2	22 = 2·11	42 = 2·3·7	62 = 2·31	82 = 2·41	102 = 2·3·17	122 = 2·61	142 = 2·71	162 = 2·3 ⁴	182 = 2·7·13
3 = 3	23 = 23	43 = 43	63 = 3 ² ·7	83 = 83	103 = 103	123 = 3·41	143 = 11·13	163 = 163	183 = 3·61
4 = 2 ²	24 = 2 ³ ·3	44 = 2 ² ·11	64 = 2⁶	84 = 2 ² ·3·7	104 = 2 ³ ·13	124 = 2 ² ·31	144 = 2 ⁴ ·3 ²	164 = 2 ² ·41	184 = 2 ³ ·23
5 = 5	25 = 5²	45 = 3 ² ·5	65 = 5·13	85 = 5·17	105 = 3·5·7	125 = 5³	145 = 5·29	165 = 3·5·11	185 = 5·37
6 = 2·3	26 = 2·13	46 = 2·23	66 = 2·3·11	86 = 2·43	106 = 2·53	126 = 2·3 ² ·7	146 = 2·73	166 = 2·83	186 = 2·3·31
7 = 7	27 = 3³	47 = 47	67 = 67	87 = 3·29	107 = 107	127 = 127	147 = 3·7 ²	167 = 167	187 = 11·17
8 = 2³	28 = 2 ² ·7	48 = 2 ⁴ ·3	68 = 2 ² ·17	88 = 2 ³ ·11	108 = 2 ² ·3 ³	128 = 2⁷	148 = 2 ² ·37	168 = 2 ³ ·3·7	188 = 2 ² ·47
9 = 3²	29 = 29	49 = 7²	69 = 3·23	89 = 89	109 = 109	129 = 3·43	149 = 149	169 = 13²	189 = 3 ³ ·7
10 = 2·5	30 = 2·3·5	50 = 2·5 ²	70 = 2·5·7	90 = 2·3 ² ·5	110 = 2·5·11	130 = 2·5·13	150 = 2·3·5 ²	170 = 2·5·17	190 = 2·5·19
11 = 11	31 = 31	51 = 3·17	71 = 71	91 = 7·13	111 = 3·37	131 = 131	151 = 151	171 = 3 ² ·19	191 = 191
12 = 2 ² ·3	32 = 2⁵	52 = 2 ² ·13	72 = 2 ³ ·3 ²	92 = 2 ² ·23	112 = 2 ⁴ ·7	132 = 2 ² ·3·11	152 = 2 ³ ·19	172 = 2 ² ·43	192 = 2 ⁶ ·3
13 = 13	33 = 3·11	53 = 53	73 = 73	93 = 3·31	113 = 113	133 = 7·19	153 = 3 ² ·17	173 = 173	193 = 193
14 = 2·7	34 = 2·17	54 = 2·3 ³	74 = 2·37	94 = 2·47	114 = 2·3·19	134 = 2·67	154 = 2·7·11	174 = 2·3·29	194 = 2·97
15 = 3·5	35 = 5·7	55 = 5·11	75 = 3·5 ²	95 = 5·19	115 = 5·23	135 = 3 ³ ·5	155 = 5·31	175 = 5 ² ·7	195 = 3·5·13
16 = 2⁴	36 = 2 ² ·3 ²	56 = 2 ³ ·7	76 = 2 ² ·19	96 = 2 ⁵ ·3	116 = 2 ² ·29	136 = 2 ³ ·17	156 = 2 ² ·3·13	176 = 2 ⁴ ·11	196 = 2 ² ·7 ²
17 = 17	37 = 37	57 = 3·19	77 = 7·11	97 = 97	117 = 3 ² ·13	137 = 137	157 = 157	177 = 3·59	197 = 197
18 = 2·3 ²	38 = 2·19	58 = 2·29	78 = 2·3·13	98 = 2·7 ²	118 = 2·59	138 = 2·3·23	158 = 2·79	178 = 2·89	198 = 2·3 ² ·11
19 = 19	39 = 3·13	59 = 59	79 = 79	99 = 3 ² ·11	119 = 7·17	139 = 139	159 = 3·53	179 = 179	199 = 199
20 = 2 ² ·5	40 = 2 ³ ·5	60 = 2 ² ·3·5	80 = 2 ⁴ ·5	100 = 2 ² ·5 ²	120 = 2 ³ ·3·5	140 = 2 ² ·5·7	160 = 2 ⁵ ·5	180 = 2 ² ·3 ² ·5	200 = 2 ³ ·5 ²

APPENDIX 2

Sieve Listings

Pour la Paix (1981)

Musical notation for the first system of 'Pour la Paix (1981)'. It consists of a treble clef staff and a bass clef staff. The treble staff contains a melodic line with a sequence of notes and rests. Below the treble staff, the following fingerings are indicated: 3, 2, 2, 12, 15, 1.

Musical notation for the second system of 'Pour la Paix (1981)'. It consists of a treble clef staff and a bass clef staff. The treble staff contains a melodic line with a sequence of notes and rests. Below the treble staff, the following fingerings are indicated: 1 1 2 1 2 4, 2 2 3, 2 13, 2 2 1 2 3, 12 2 2 1.

Musical notation for the third system of 'Pour la Paix (1981)'. It consists of a treble clef staff and a bass clef staff. The treble staff contains a melodic line with a sequence of notes and rests. Below the treble staff, the following fingerings are indicated: 1 15, 1 5, 1.

Musical notation for the fourth system of 'Pour la Paix (1981)'. It consists of a treble clef staff and a bass clef staff. The treble staff contains a melodic line with a sequence of notes and rests. Below the treble staff, the following fingerings are indicated: 13, 115, 1 2 16, 14, 11 2 1, 1.

Pour Maurice (1982)

Musical notation for the first system of 'Pour Maurice (1982)'. It consists of a treble clef staff and a bass clef staff. The treble staff contains a melodic line with a sequence of notes and rests. Below the treble staff, the following fingerings are indicated: 13, 2, 2, 3, 2 2 3, 3, 12 2 2 3, 13, 4, 2, 1. There is a dashed line above the treble staff with the word '8va' written above it, indicating an octave shift.

8^{va}..1

Musical notation for the first system, featuring a treble and bass clef with a melodic line and fingerings 4 2 13 4 3 2 14.

Chant des soleils (1983)

Musical notation for the second system, featuring a treble and bass clef with a melodic line and fingerings 2 113 113 1.

Musical notation for the third system, featuring a treble and bass clef with a melodic line and fingerings 3 12 2 1.

Idmen A (1985)

Musical notation for the fourth system, featuring a treble and bass clef with a melodic line and fingerings 3 2 3 2 3 3 2 3 2 3 14 14 13.

Musical notation for the fifth system, featuring a treble and bass clef with a melodic line and fingerings 12 4 113 2 2 2 13 12 4 14 12.

Alax (1985)

Musical notation for *Alax (1985)*. The piece is written on a grand staff with a treble clef on the upper staff and a bass clef on the lower staff. The notation includes a sequence of notes with a corresponding sequence of fret numbers: 1 3 2 4 1 4 2 1 2 1 2 3 1 4 1 2. The notes are primarily eighth and quarter notes, with some beamed eighth notes.

Keren (1986)

Musical notation for *Keren (1986)*. The piece is written on a grand staff with a treble clef on the upper staff and a bass clef on the lower staff. The notation includes a sequence of notes with a corresponding sequence of fret numbers: 3 1 1 4 1 4 1 1 2 2 1 4 1 1 2 2 1 1. The notes are primarily eighth and quarter notes, with some beamed eighth notes.

Jalons (1986)

Musical notation for *Jalons (1986)*. The piece is written on a grand staff with a treble clef on the upper staff and a bass clef on the lower staff. The notation includes a sequence of notes with a corresponding sequence of fret numbers: 1 1 4 1 3 2 3 2 1 2 1 2 1 3 2 1 4 1 1 1 3 1 2 2 3 1 4 2 2 3 1 4 1 3 2 1 3 2 1 3 2 1 3 1 2 1 3 1 2 3 1 2 3 1 4 1 1 4 1 4 1 3 1 3 1 2 2. The notation includes various musical symbols such as 8^{va} (octave up) and 8^{va} (octave down) markings, and a final measure with a 7^{va} marking. The notes are primarily eighth and quarter notes, with some beamed eighth notes.

2 1 3 4 2 2 1 2 3 2 4 1 3 4 2 2 1 2 3 2 4 3 3 2 4 1 2 1 4 4 1 2 1

1 3 14 114 13 13 2 1

8va

8vb

Tracées (1987)

4 4 112 1 12 12 1 3 13 113 3 1 4 1 4 1 3

3 3 3 4 3 13 2 4 1 4 2 1 2 2 1 3 113 12 4 1 3 1 2

8va

8vb

Waarg (1988)

Musical score for *Waarg (1988)*. The score consists of two staves: a treble clef staff and a bass clef staff. The treble staff contains a sequence of notes with the following fingering numbers written below: 2 1 3, 2 1 4, 12 3, 1 3, 1 2 3, 1 3, 2 1 3, 1 2 4, 1 3, 3, 2 2. The bass staff contains a sequence of notes with the following fingering numbers written below: 2 1 3, 2 1 4, 12 3, 1 3, 1 2 3, 1 3, 2 1 3, 1 2 4, 1 3, 3, 2 2. Above the treble staff, there are three groups of notes with a dashed line and an '8va' marking above them, indicating an octave shift. The notes are: a group of three notes with fingering 1, a group of three notes with fingering 3, and a group of three notes with fingering 2.

Tetora (1990)

Musical score for *Tetora (1990)*. The score consists of two staves: a treble clef staff and a bass clef staff. The treble staff contains a sequence of notes with the following fingering numbers written below: 1 1 2, 2 2 2, 4 4, 1. The bass staff contains a sequence of notes with the following fingering numbers written below: 1 1 2, 2 2 2, 4 4, 1.

Musical score for *Tetora (1990)*. The score consists of two staves: a treble clef staff and a bass clef staff. The treble staff contains a sequence of notes with the following fingering numbers written below: 1 1 2, 2 2 2, 4 4, 1. The bass staff contains a sequence of notes with the following fingering numbers written below: 1 1 2, 2 2 2, 4 4, 1.

Musical score for *Tetora (1990)*. The score consists of two staves: a treble clef staff and a bass clef staff. The treble staff contains a sequence of notes with the following fingering numbers written below: 1 2, 1 1 2, 2 2, 1 1 3, 1 1 1. The bass staff contains a sequence of notes with the following fingering numbers written below: 1 2, 1 1 2, 2 2, 1 1 3, 1 1 1.

Musical score for *Tetora (1990)*. The score consists of two staves: a treble clef staff and a bass clef staff. The treble staff contains a sequence of notes with the following fingering numbers written below: 2 2 2, 2 3, 1 3. The bass staff contains a sequence of notes with the following fingering numbers written below: 2 2 2, 2 3, 1 3.

2 12 4 1

A musical staff system with a treble clef on the left and a bass clef on the right. The staff contains a sequence of notes with fingerings: 2, 12, 4, and 1. The notes are positioned on the second, third, and fourth lines of the treble clef staff.

1 114 2 4 2 2 2 2 2

A musical staff system with a treble clef on the left and a bass clef on the right. The staff contains a sequence of notes with fingerings: 1, 114, 2, 4, 2, 2, 2, 2, 2. The notes are positioned on the first, second, and third lines of the treble clef staff.

12 4 1

A musical staff system with a treble clef on the left and a bass clef on the right. The staff contains a sequence of notes with fingerings: 12, 4, and 1. The notes are positioned on the second, third, and fourth lines of the treble clef staff.

2 2 113 12 2 2 3 2

A musical staff system with a treble clef on the left and a bass clef on the right. The staff contains a sequence of notes with fingerings: 2, 2, 113, 12, 2, 2, 3, 2. The notes are positioned on the second, third, and fourth lines of the treble clef staff.

2 2 12 2 14

A musical staff system with a treble clef on the left and a bass clef on the right. The staff contains a sequence of notes with fingerings: 2, 2, 12, 2, 14. The notes are positioned on the second, third, and fourth lines of the treble clef staff.

2 2 1 2 2 2 2 1 2 2 1 2 2

Dox-Orkh (1991)

2 3 2 3 1 2 1 1

3 1 2 1 2 2 2 2 3 2

2 4 1 3 4 1 2 4 4 1 4 4 1 1 3 2 4 1 3 1 3 1

1 3 2 2 1 2 3 1 4 1 4 4 1 1 3 2 4 1 3 1 3 2 1 2 1 1

2 2 1 3 1 2 4 5

Roài (1991)

1 3 1 2 3 2 1 3 1 3 2 1 3

Troorkh (1991)

2 2 1 3 2 3 2 3 1 2 4 1 4

1 2 2 1 3 1 1 2 4 2

1 2 2 2 2 1 2 1

APPENDIX 3

Full Scores and Score Excerpts

Note: Occasional marks on the scores are not related to the present analysis. They are performance notes and, unfortunately, could not be removed.

***Keqrops* (1896, for piano and orchestra)**

Bars 121-141 & 160-165

Handwritten musical score for multiple staves. The top staff is marked with a tempo of $\text{♩} = 36$ and a measure number of 27. The score includes various performance instructions such as *non legato*, *legato*, *sans fondus*, and *sond*. It also features dynamic markings like *pp*, *mf*, and *ppp*. The notation includes complex rhythmic patterns, some with triplets and sixteenth notes. The score is divided into measures, with some measures containing multiple notes and rests.

Continuation of the handwritten musical score. This section features more complex rhythmic structures, including triplets and sixteenth notes. The notation is dense, with many notes and rests. The score includes dynamic markings such as *mf* and *pp*. The bottom of the page shows some additional notation, including a measure with a *sonnent 8+* marking and a *leg.* instruction.

bois, cors: legato et ff

130

133

The musical score consists of multiple staves. The top section (measures 130-133) is for woodwinds and brass. It includes parts for Flute (F), Clarinet (C), Bassoon (B), Trumpet (K), and Trombone (K). The notation is dense with notes, slurs, and dynamic markings. Key markings include 'legato' and 'ff' (fortissimo). The bottom section (measures 130-133) appears to be for strings, with complex rhythmic patterns and dynamic markings like 'ff' and 'sfz'.

Handwritten musical score for measures 136-139. The score includes multiple staves with complex notation, including chords and melodic lines. A large number '31' is written in the upper right corner of the first system. A circled word 'PIANO' is present in the lower right of the first system. The bottom staff of the first system is labeled 'HRP' and contains the text 'pesant (divisi)'. Measure numbers 136, 137, 138, and 139 are indicated at the beginning of their respective systems.

Handwritten musical score for measures 139-142. The score continues with multiple staves. A circled 'V?' is visible in the lower right of the first system of this section. The bottom staff of the first system of this section is labeled 'Tutti:'. Measure numbers 139, 140, 141, and 142 are indicated at the beginning of their respective systems.

***À l'île de Gorée* (1896, for amplified harpsichord and ensemble)**

Full Score

6 9

Fl. *f Bois : #. mf*

Hb

Cl

Fg *mp (m/phon) # (#)*

C

TP *cuivres: mf pp # mf p pp (m/phon)*

Tb

Vi+Vii

Va

Vc *f # f*

Cb *cordes: # sauf Ca p*

9 12

CLV

12 15

Fl

Hb

CLV

Vi+Vii

Va

Vc *cordes: pp*

pp mf pp

15 19

Fg *SEP + p*

C *c: un peu hauché sec p*

TP *mf lid - sound*

Tb *mf sound straight p*

CLV

9 21

pp mp sf

9F:8 7F:5 9F:7 6F:5 9F:7 7F:6 5F:4

9F:8 7F:5 6F:5 5F:4 6F:7 7F:5 4F:3 4F:3

24 24

sf

6F:5 9F:7 4F:3 4F:3 7F:5 3F:2 3 3 7F:5 4F:3 9F:7 5F:4 9F:7 5F:4 6F:5 6F:5 7F:6 8F:7 9F:8 9F:8

24 27

sf

6F:5 7F:6 8F:7 9F:8 1F:1 9F:8 8F:7 7F:6 8F:7 7F:5 8F:7 7F:6 6F:5 5F:4 9F:7 9F:3 7F:5 3F:2 4F:3 3F:2 7F:5

27

FI

Hb

CI

Fg

C

TP

TB

CLV

bois: ties lies *ff*

C+TP+TB

mf

9F:7

5F:4

30

FI

Hb

CI

Fg

CUINR

CLV

Bois: *ff*

C+TB

mf

5F:8

3F:4

7F:5

5F:7

5F:6

4F:5

6F:7

33

FI

Hb

CI

Fg

C

TP

TB

CLV

VI+

VII

VA

VC

CB

stacc

stacc

stacc

stacc

VI

VII

CORDES: *pp*

6 5 39

Handwritten musical score for measures 6-8. The score is written on multiple staves, including a grand staff (treble and bass clefs) and a lower section with a bass clef. The music features complex rhythmic patterns, including triplets and sixteenth notes. Dynamic markings such as *mp* and *mf* are present. Chord diagrams are provided for the upper staves, showing fingerings for various chords. The key signature is one sharp (F#).

9 42

Handwritten musical score for measures 9-12. The score continues on multiple staves, including a grand staff and a lower section with a bass clef. The music features complex rhythmic patterns, including triplets and sixteenth notes. Dynamic markings such as *mp* and *mf* are present. Chord diagrams are provided for the upper staves, showing fingerings for various chords. The key signature is one sharp (F#). A handwritten note "(+idem sb)" is visible in the lower section of the first measure.

54

57

Musical score for measures 54-57. The score includes parts for Flute I (FI), Horn B (Hb), Clarinet (Cl), Bassoon (Fg), Cello (C), Trumpet (TP), Trombone (TB), Violin I (LV), Violin II (VI), Violin III (VII), Viola (VA), Violoncello (VC), and Contrabass (CB). The score features various musical notations including notes, rests, and dynamic markings such as $9F:7$, $4F:3$, $1/1$, $7F:4$, $6F:3$, $1/1$, $6F:4$, $1/1$, $5F:4$, $7F:6$, and $1/1$. There are also some numerical markings like 3, 5, and 3.

57

Pour les notes sans queues: 1) Attaquer les notes aux endroits géométriques précis par rapport à la battue régulière des doubles croches.
 2) Tenir chaque note jusqu'à la suivante.

60

Musical score for measures 57-60. The score includes parts for Flute I (FI), Horn B (Hb), Clarinet (Cl), Bassoon (Fg), Cello (C), Trumpet (TP), Trombone (TB), Violin I (LV), Violin II (VI), Violin III (VII), Viola (VA), Violoncello (VC), and Contrabass (CB). The score features various musical notations including notes, rests, and dynamic markings such as $2F:7$, $7F:6$, $5F:3$, $5F:4$, $5F:3$, $3F:2$, $7F:6$, $5F:4$, $5F:3$, $7F:5$, and $7F:3$. There are also some numerical markings like 3 and 3.

13 les accords secs partout
v v etc →

66

un peu
bando

(sourd)

(sourd)

5f: 6-

CORDES: ppp

66 69

(3 Bois: f)

(CORDES: pp)

69 72

(5F:6)

CORDES: mp

72 75

CORDES: mp

75 78

staccatissimo

VI+VII. des cordes
no. en delaché, sec

cordes: ff

78

1

Hb

Cl

Fg

C

TP

Tb

CLV

VI

VII

VA

VC

CB

bois: ff

Cuivres (ff) + FG S

Detailed description: This block contains the musical score for measures 78 through 81. It includes staves for Horns (Hb), Clarinets (Cl), Flutes (Fg), Corno (C), Trumpets (TP), Trombones (Tb), Clarinet in E-flat (CLV), Violins (VI), Violas (VII), Violas (VA), Cellos (VC), and Contrabasses (CB). The woodwinds and brass are marked with a forte (ff) dynamic. The strings are marked with piano (p) dynamics. The score shows complex rhythmic patterns and melodic lines for the woodwinds and brass, with the strings providing a harmonic and rhythmic foundation.



81

CLV

CORDES

ppp

Detailed description: This block shows the continuation of the musical score for measures 81 through 84. It features the Clarinet in E-flat (CLV) and the string section (CORDES). The CLV part is highly rhythmic and melodic. The strings are marked with piano-pianissimo (ppp) dynamics and play a supporting role with sustained chords and rhythmic patterns.



84

CLV

CORDES

Detailed description: This block contains the musical score for measures 84 through 87. It continues the parts for the Clarinet in E-flat (CLV) and the string section (CORDES). The CLV part maintains its rhythmic intensity, while the strings provide a steady accompaniment.

99

Fl
Hb
Cl
Fg
C
TP
TB
VI
VII
VA
VC
CB

Tutti: ff →



102

Fl
Hb
Cl
Fg
C
TP
TB

Bois: pp

lire au maximum.

VI
VII
VA
VC
CB

CORDES: mp

laisser en gardant la distance des doigts à la main gauche, irrégulière.

117 $\frac{4}{4}$ $\frac{12}{8}$ $\frac{3}{4}$ $\frac{4}{4}$ 120

Cuires: *f*
et *legatissimo*

120 123

Basse: *ff*
et *legatissimo*

123 126

Handwritten musical score for measures 126-129. The score includes staves for Flute (Fl), Horns (Hb), Clarinet (Cl), Bassoon (Fg), Trumpet (Tp), C Trumpet / Trombone (C+ / Tb), Clarinet in E-flat (Clv), Violin I/II (VI+VII), Viola/Celli (VA+VC), and Cello/Bass (Cb). The Flute part is marked with 'Fl 126' and '129'. The Cello/Bass part includes the instruction 'CORDES: mf'. The score is densely written with notes, rests, and dynamic markings.



Handwritten musical score for measures 129-132. The instrumentation remains the same as the previous system. The Flute part is marked with 'Fl 129' and '132'. The score continues with complex rhythmic patterns and dynamic markings across all staves.

ralentir — *progressivement*

Handwritten musical score for measures 132-135. The instrumentation remains the same. The Flute part is marked with 'Fl 132' and '135'. The score concludes with a final cadence and dynamic markings.

Lent-

135

138

Handwritten musical score for measures 135-138. It consists of four staves. The top staff has a dynamic marking of (p) and a tempo marking of 'Lent-'. The second staff has a dynamic marking of (mf). The third and fourth staves have a dynamic marking of (f). Chord symbols are written below the staves, including 5F:8, 5F:7, and 6F:8.

||

38

Assez lent

141

Handwritten musical score for measures 38-141. It consists of two staves. Chord symbols are written below the staves, including 7F:5, 5F:3, 4F:5, 6F:7, 7F:6, and 8F:7.

||

141

144

Handwritten musical score for measures 141-144. It consists of two staves. Chord symbols are written below the staves, including 9F:8, 6F:4, 6F:7, and 7F:5.

||

144

Handwritten musical score for measures 144. It consists of two staves. Chord symbols are written below the staves, including 5F:7, 5F:8, and 5F:8.

***Horos* (1986, for orchestra)**

Bars 46-51

***Akea* (1986, for piano and string quartet)**

Full Score

AKÉA

POUR QUATUOR A CORDES ET PIANO

COMMANDE DE L'ETAT. AU FESTIVAL D'AUTOMNE A PARIS ET A SON DIRECTEUR MICHEL GUY.

44 0 (204010) les arpèges partent au le temps et si contraires, arrivent en même temps. ils sont rapides. I. XENAKIS ~12/

30

Violin I, Violin II, Viola, Cello, Piano

f Ped → *vibrato très large tutti mais pas mécanique*

mf *mf* *mf*

vibrato 2 large

31

Violin I, Violin II, Viola, Cello, Piano

mf *pp* *VI+VII: mp*

tutti: son bridge (IV+III)

61

Violin I, Violin II, Viola, Cello, Piano

mf *legato - soutenu* *mp*

91

Violin I, Violin II, Viola, Cello, Piano

mp *mf* *ped II ped* *vibr. très large non mécanique* *vibr.*

78

Handwritten musical score system 1, measures 1-15. Includes staves for piano and bass. Annotations include *f*, *mf*, *sfz*, and circled numbers (8), (9), (10). Pedal markings are present. Measure numbers 15 and 16 are indicated.

Handwritten musical score system 2, measures 16-23. Includes staves for piano and bass. Annotations include *f*, *sfz*, and circled numbers (11), (12), (13), (14), (15), (16), (17), (18), (19), (20), (21), (22), (23). Pedal markings are present. Measure numbers 18, 19, 20, 21, 22, 23 are indicated.

Handwritten musical score system 3, measures 24-29. Includes staves for piano and bass. Annotations include *f*, *sfz*, and circled numbers (24), (25), (26), (27), (28), (29). Pedal markings are present. Measure numbers 24, 25, 26, 27, 28, 29 are indicated.

Handwritten musical score system 4, measures 30-33. Includes staves for piano and bass. Annotations include *f*, *sfz*, and circled numbers (30), (31), (32), (33). Pedal markings are present. Measure numbers 30, 31, 32, 33 are indicated.

Cordes: f

Handwritten musical score system 1, measures 27-30. Includes dynamic markings *f* and *mf*.

Handwritten musical score system 2, measures 31-34. Includes dynamic markings *f* and *mf*.

Handwritten musical score system 3, measures 35-38. Includes dynamic markings *mf*, *f*, and *mf*. Contains circled annotations.

Handwritten musical score system 4, measures 39-42. Includes dynamic markings *f*, *mf*, and *f*.

Handwritten musical score, first system. Includes measures 1-6 and 4-9. Features dense chordal textures and triplets. A large arrow points to the beginning of the system.

Handwritten musical score, second system. Includes measures 10-14 and 15-19. Features dense chordal textures and triplets. Includes the instruction: *CORDES: f ademi. 1/2 Tied*. Measure numbers 41 and 42 are visible.

Handwritten musical score, third system. Includes measures 20-24 and 25-29. Features dense chordal textures and triplets. Includes the instruction: *(T) rid-*.

Handwritten musical score, fourth system. Includes measures 30-34 and 35-39. Features dense chordal textures and triplets. Includes the instruction: *Cordes: p*. Measure numbers 47 and 48 are visible.

Handwritten musical score for measures 75-78. The system includes a grand staff with piano and violin parts. Measure 75 is marked with *9F:3*. Measure 76 features a circled *(Divisi)* marking. Measure 77 is marked with *9F:18*. Measure 78 is marked with *9F:18*. The piano part includes a circled *(fff)* dynamic marking.

Handwritten musical score for measures 79-82. The system includes a grand staff with piano and violin parts. Measure 79 is marked with *5F:3*. Measure 80 is marked with *5F:5*. Measure 81 is marked with *5F:3*. Measure 82 is marked with *5F:3*. The piano part includes a circled *(fff)* dynamic marking and a circled *(mf)* dynamic marking. A *Ped* marking is present in measure 82.

Handwritten musical score for measures 83-86. The system includes a grand staff with piano and violin parts. Measure 83 is marked with *6F:5*. Measure 84 is marked with *1F:1*. Measure 85 is marked with *6F:5*. Measure 86 is marked with *6F:5*. The piano part includes a circled *(p)* dynamic marking and a circled *(mf)* dynamic marking. A *Ped* marking is present in measure 86.

Handwritten musical score for measures 87-90. The system includes a grand staff with piano and violin parts. Measure 87 is marked with *6F:5*. Measure 88 is marked with *1F:1*. Measure 89 is marked with *6F:5*. Measure 90 is marked with *6F:5*. The piano part includes a circled *(p)* dynamic marking and a circled *(mf)* dynamic marking. A *Ped* marking is present in measure 90. The system concludes with four circled *sfpp* dynamic markings.

25 (♩ = 50)

(p)

← Ped →

avec chaleur passionnée
Warm passion in cantata

(7) *f*

(7) *f*

(c)

← Ped →

← Ped →

← Ped →

mf

in assés long

92

← Ped →

← Ped →

***Ata* (1987, for orchestra)**

Bars 1-9 & 64-75

(♩=72)

64 - 8

Handwritten musical score for measures 64-66. The score includes staves for Flute (Fl), Horns (Hb), Clarinet (Cl), Bassoon (Fg), Cello (C), Trumpet (Tp), Trombone (Tb), Violin I (VI), Violin II (VII), Viola (VA), Violoncello (Vc), and Contrabass (Cb). The music is in 4/4 time with a tempo of quarter note = 72. Performance markings include *stacc.*, *f*, and *mf*. The Contrabass part includes the instruction *(pizz)*. The section concludes with the instruction *Cordes: ff*.

67

Handwritten musical score for measures 67-70. The score includes staves for Flute (Fl), Horns (Hb), Clarinet (Cl), Bassoon (Fg), Cello (C), Trumpet (Tp), Trombone (Tb), Violoncello (Vc), Violin I (VI), Violin II (VII), Viola (VA), Violoncello (Vc), and Contrabass (Cb). The music continues in 4/4 time. Performance markings include *Range*, *Timbre*, *p*, and *(pizz)*. The section concludes with the instruction *(Cordes ff)*.

70 (♩ ≈ 72)

- 12 -

Handwritten musical score for measures 70-72. The score includes staves for Flute 1 (Fl), Flute 2 (Fl2), Clarinet 1 (Cl), Flute 3 (Fl3), Clarinet 2 (Cl2), Bassoon (Fg), Bassoon 2 (C), Trumpet (T), Trombone (TB), Percussion (P), Violin 1 (V1), Violin 2 (V2), Viola (A), Cello (C), and Double Bass (B). The music features complex rhythmic patterns with many triplets and sixteenth notes. Performance markings include *mf*, *pizz*, and *flatt sec*. The key signature has one flat, and the time signature is 4/4.

Handwritten musical score for measures 73-75. The score includes staves for Flute 1 (Fl), Flute 2 (Fl2), Clarinet 1 (Cl), Flute 3 (Fl3), Clarinet 2 (Cl2), Bassoon (Fg), Bassoon 2 (C), Trumpet (T), Trombone (TB), Percussion (P), Violin 1 (V1), Violin 2 (V2), Viola (A), Cello (C), and Double Bass (B). The music continues with complex rhythmic patterns, including many triplets. Performance markings include *p* and *flatt sec*. The key signature has one flat, and the time signature is 4/4.

***Echange* (1989, for bass clarinet and ensemble)**

Bars 1-9

ECHANGE

Pour Clarinette basse et ensemble instrumental

I. Xenakis 1989

dur. ~ 14 min.

Dédié à HARRY SPARNAAY et à l'ASKO ensemble

commande de : "Stichting Amsterdams Fonds voor de Kunst" pour l'ensemble ASKO

Instrumentation : 1 clarinette Basse en soliste (+ 13 instr.)

1 Flûte, 1 Hautbois, 1 Clarinette en Sib, 1 Basson, 1 Cor en Fa, 1 Trompette en Ut,

1 Trombone ténor, 1 Tuba, 2 Violons, 1 Alto, 1 Violoncelle, 1 Contrebasse.

Notation en notes réelles sauf à la contrebasse qui sonne *grave*. Pas de vibrato!

1 $\text{♩} \approx 60 \text{ MM}$ ASK

4

vers sons fendus (progression dans grave)

7

leggissimo

***Tetora* (1990, for string quartet)**

Full Score

TETORA

I. XENAKIS

Dur. ≈ 17'

POUR QUATUOR A CORDES

ARDITTI 1990

Commande du Dr. Wolfgang Becker de la WDR (COLOGNE) et des disques MONTAIGNE (Caisse des Dépôts et Consignations, PARIS), pour le quatuor ARDITTI à l'initiative de M. Harry Vogt de la WDR.

le titre = 4 en Dorien.

$\Gamma > 72 \text{ MM}$

(5. > 72 HH)

- 2 -

16

Musical score for measures 16-18. Measure 16 starts with a triplet of eighth notes. The score is written for three staves (treble, alto, and bass clefs).

19

Musical score for measures 19-21. The score continues across three staves.

22

Musical score for measures 22-24. This system features a complex texture with many accidentals and dynamic markings across three staves.

25

Musical score for measures 25-27. Measure 25 includes a *mf* dynamic marking. The system concludes with the instruction *ff partout*.

28

Musical score for measures 28-30. Measure 28 includes the instruction *port. belli*. The system ends with *mp partout* and *auf VJT*.

31

Musical score for measures 31-33. Measure 31 includes the instruction *port.*. The system concludes with the instruction *accentuer les notes non liées*.

Le T. et L

(♩ > 72 MM)

- 3 -

34

Handwritten musical score for measures 34-36. It consists of three staves: a treble clef staff with a melodic line, a bass clef staff with a bass line, and a grand staff (piano) with chords and accompaniment. The music is in a complex key signature with multiple sharps and flats.

37

rispondi

Handwritten musical score for measures 37-39. It consists of three staves. The notation is dense with many accidentals and slurs. The word "rispondi" is written above the first staff.

40

au talon

Handwritten musical score for measures 40-42. It consists of three staves. The word "au talon" is written above the first staff. The music features complex rhythmic patterns and many accidentals.

43

(au talon)

Handwritten musical score for measures 43-45. It consists of three staves. The word "(au talon)" is written above the first staff. The notation is very complex with many accidentals.

46

(au talon) → *au talon* → *Norm.*

Handwritten musical score for measures 46-48. It consists of three staves. The word "(au talon)" is written above the first staff. The word "Norm." is written below the second staff. The music is highly complex.

49

legatissimo

Handwritten musical score for measures 49-51. It consists of three staves. The word "legatissimo" is written above the first staff. The music is characterized by long, flowing lines.

52 (5 > 72)

- 4 -

(♩ > 72)

-5-

70

Musical score for measures 70-72. It consists of three staves: two treble clefs and one bass clef. The music is in a complex key signature with multiple sharps and flats. The notation includes various rhythmic values, accidentals, and dynamic markings.

73

Musical score for measures 73-75. It consists of three staves: two treble clefs and one bass clef. The notation includes various rhythmic values, accidentals, and dynamic markings.

76

Musical score for measures 76-78. It consists of three staves: two treble clefs and one bass clef. The notation includes various rhythmic values, accidentals, and dynamic markings.

79

Musical score for measures 79-81. It consists of three staves: two treble clefs and one bass clef. The notation includes various rhythmic values, accidentals, and dynamic markings.

82

Musical score for measures 82-84. It consists of three staves: two treble clefs and one bass clef. The notation includes various rhythmic values, accidentals, and dynamic markings.

85

Musical score for measures 85-87. It consists of three staves: two treble clefs and one bass clef. The notation includes various rhythmic values, accidentals, and dynamic markings.

(♩ = 72 mm)

88

91

94

97

100

103

f cresc →

#

106 $\text{♩} = 72$ -7- $F \approx 80$ long

109 $\text{♩} = 9F:8$ mf

112 $\text{♩} = 50$

115 $\text{♩} = 72$ *and*

118

121

124 (♩=72)

-8-