

TABLE OF ROTATION SEQUENCES OF $x_{n+1} = x_n^2 - \lambda$

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ABSTRACT

Symbolic table is presented for the periodic orbits of the iterates of $x_{n+1} = x_n^2 - \lambda$. This provides some useful informations about the periodic points in the Smale's horseshoe map and will be applied to the bifurcation problems of periodic points in the Hénon map.

1. INTRODUCTION

This note provides only a table of rotation sequences correlated with the periodic orbits in a map:

$$f: \mathbb{R} \rightarrow \mathbb{R}; x \rightarrow f(x) = x^2 - \lambda \quad (1)$$

where λ is a real parameter. Since Myrberg's pioneering work [1], many authors discuss about the iterations of (1), see for example [2][3]. For $\lambda > 2$ all possible periodic points of (1) are generated. Hence there exists an isomorphism of periodic points between the Smale's horseshoe map and the map (1). The periodic points of (1) can be naturally imbedded in a horseshoe rectangle region. This fact is effectively used for the discussion of the bifurcation problems of the periodic points in the Hénon map[4][5].

Combinatorial algorithm for obtaining the rotation sequence is reported in [6]. The algorithm can be easily implemented in a small computer. Tables and imbedded figures of the rotation sequences are illustrated in [7]. Listings of computer program in Basic are also found in [7].

2. NOTATIONS

There are many notations and symbols to specify the periodic orbits of (1)[2][3]. Here we show the symbols used in our table in §3 by an illustrated example of a 6-periodic orbit with the multiplier $S = 0$, called a critical orbit, shown in Fig. 1. The periodic points are numbered consecutively in decimal with the increasing order of x . By the iteration of (1), the point 1 moves as follows:

$$1 \rightarrow 6 \rightarrow 4 \rightarrow 2 \rightarrow 5 \rightarrow 3 \rightarrow 1 \quad (2)$$

The decimal sequence of the orbit is then expressed by $[d] = 164253$. Note that the point 3 lies on the minimum point $x = 0$. Assigning + sign to the points 4, 5, 6 and - sign to 1, 2, and starting from the point 1, we obtain a binary sequence $[-++-+]$, where the sign does not assign to the point 3. In this sequence the first symbol is always - sign so that omitting it Myrberg introduced the binary rotation sequence $[r] = [++-+]$, which we call the rotation sequence of Myrberg. Note that the value of the parameter λ giving $S = 0$ is called the critical value of λ . Note also that the alphabet $\{-, +\}$ is written by $\{L, R\}$ in [3].

From the rotation sequence of Myrberg $[r]$ we obtain two kinds of noncritical rotation sequences: $[++-+]$ and $[++-+-]$, where the last sign + or - is attached to $[r]$. This corresponds to the splitting of the point 3 into the positive or negative direction of x . The rotation sequences are also rewritten by the alphabet $\{1, 0\}$:

$$a_0 = [1001001], a_1 = [1001011] \quad (3)$$

where we write down full symbols with 6 bits, that is the first and last signs are attached to $[r]$ with $\{1, 0\}$.

Now if we consider the standard shift transformation applied to the repeated sequences of (3): $\cdots aa.aa \cdots$, the periodic points of (3) can be easily imbedded in a horseshoe rectangle as illustrated in Fig. 2, where the point moves along the directional segment by the horseshoe map. Note that the rectangle is symbolically coordinated by the binary numbers shown in Fig. 3. The rotation sequence imbedded in the rect-

angle is called *symmetric* if the orbit is symmetric with respect to the diagonal line shown in Fig. 3. If a rotation sequence is dissymmetric, then there exists another dissymmetric sequence called the adjoint sequence. They have a symmetric property with respect to the diagonal line in Fig. 3.

Finally a periodic point in the rectangle is directly unstable if $0 < S_1 < 1 < S_2$, and is inversely unstable if $S_1 < -1 < S_2 < 0$, where S_1 and S_2 denote the multiplier of the periodic point.

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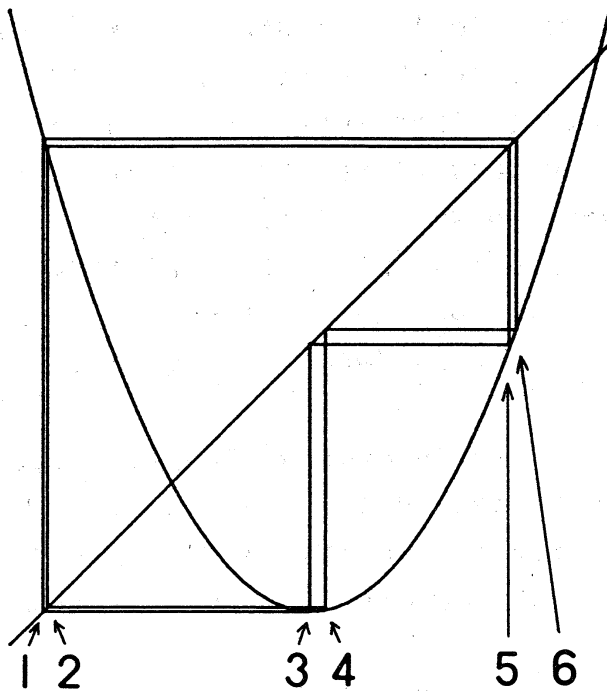
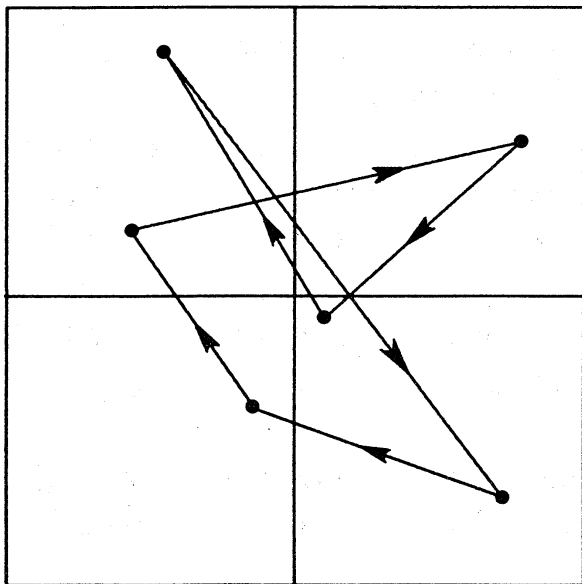
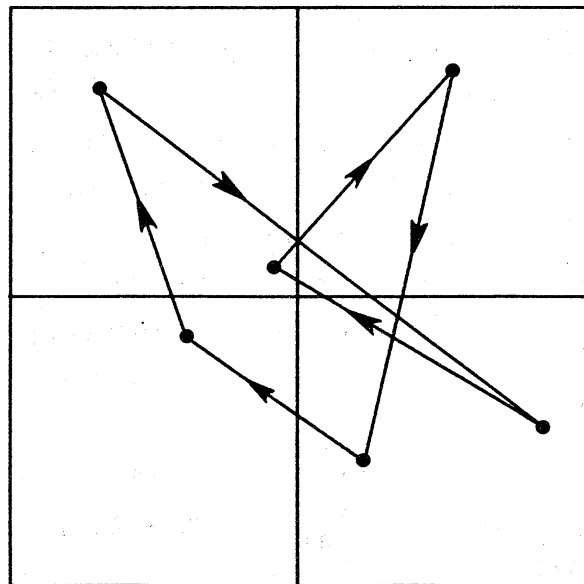


Fig. 1. Example of a critical 6-periodic orbit.
 $\lambda = 1.77289\dots$



(2) 1 6 4 2 5 3 [100101]

(a)



(3) 1 6 5 3 2 4 [100110]

(b)

Fig. 2. An imbedded dissymmetric orbit (a) and its adjoint (b).

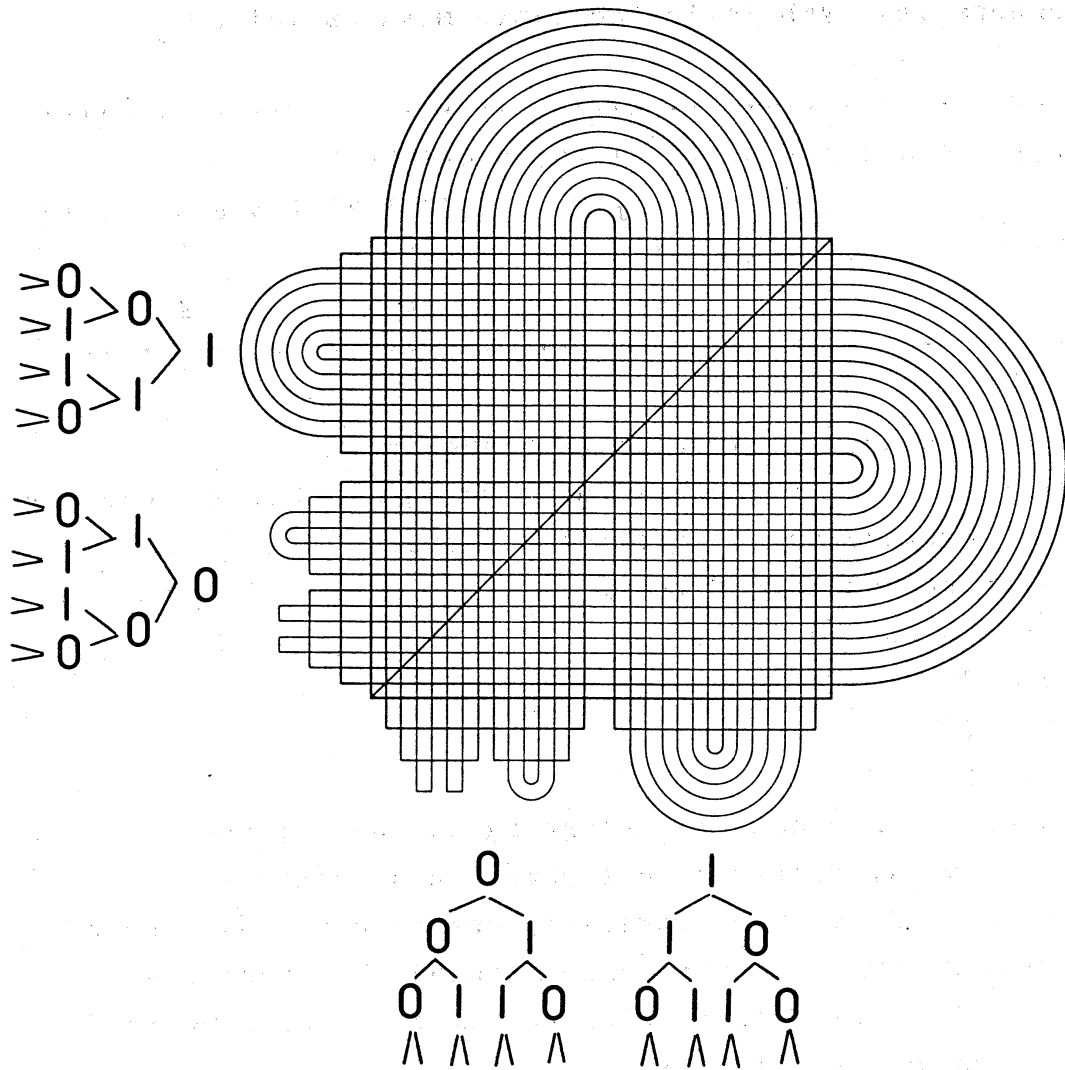


Fig. 3. Horseshoe rectangle and its binary coordinate.

3. TABLE OF ROTATION SEQUENCES

Numbers and symbols in the table mean as follows:

```

.....
2  1.77289  1 6 4 2 5 3 [++-+] 10010 0(S-D-2)
                                     1(D-I-2) 1 6 5 3 2 4 (3)
↑      ↑           ↑           ↑           ↑           ↑           ↑
a      b           c           d           e           f           g
.....

```

a: consecutive number of rotation sequence.

b: critical value λ for obtaining Myrberg's rotation sequence.

c: decimal expression of rotation sequence.

d: rotation sequence of Myrberg.

e: binary expression of (3).

f: 0 (S - D - 2)

↑ ↑ ↑ ↑

f_1 f_2 f_3 f_4

f_1 : 0 or 1: the last bit assigning to the expression (e).

f_2 : S or D: symmetric or dissymmetric sequence.

f_3 : D or I: directly or inversely unstable periodic point.

f_4 : winding number of the orbit around the inversely unstable fixed point corresponding to the repeated sequence $\cdots 1111.1111 \cdots$.

g: adjoint sequence when the sequence is dissymmetric.

8 1.9171 1 8 7 4 2 6 3 5[+---+]1001101 0(D-D-3) 1 8 6 3 5 2 7 4 (5)
1(D-I-3) 1 8 6 3 4 2 7 5 (6)
9 1.94178 1 8 6 4 2 7 5 3[+++ +]1000100 0(S-D-2)
1(D-I-2) 1 8 7 5 3 2 6 4 (12)
10 1.96076 1 8 7 5 2 6 3 4[+++ +]1000101 0(S-I-3)
1(D-D-3) 1 8 7 6 3 4 2 5 (11)
11 1.9722 1 8 7 6 3 4 2 5[+++ -]1000111 0(D-D-3) 1 8 7 5 2 6 3 4 (10)
1(S-I-3)
12 1.98166 1 8 7 5 3 2 6 4[+++ +]1000110 0(D-I-2) 1 8 6 4 2 7 5 3 (9)
1(S-D-2)
13 1.98879 1 8 7 6 4 2 5 3[++++ +]1000010 0(S-D-2)
1(D-I-2) 1 8 7 6 5 3 2 4 (14)
14 1.99433 1 8 7 6 5 3 2 4[++++ -]1000011 0(D-I-2) 1 8 7 6 4 2 5 3 (13)
1(S-D-2)
15 1.99796 1 8 7 6 5 4 2 3[++++ +]1000001 0(S-D-2) 1(S-I-2)
16 1.99977 1 8 7 6 5 4 3 2[++++ +]1000000 0(S-I-1) 1(S-D-1)

----- Order of rotation sequence = 9 , Number of rotation sequences = 28 -----

1 1.55528 1 9 5 4 6 3 7 2 8[+-----]10111111 0(S-I-4) 1(S-D-4)
2 1.59568 1 9 5 4 6 2 8 3 7[+-----]10111101 0(S-D-4) 1(S-I-4)
3 1.65613 1 9 5 3 7 2 8 4 6[+---+]10110101 0(S-I-4)
1(D-D-4) 1 9 6 2 8 4 5 3 7 (4)
4 1.69014 1 9 6 2 8 4 5 3 7[+---+]10110111 0(D-D-4) 1 9 5 3 7 2 8 4 6 (3)
1(S-I-4)
5 1.78587 1 9 6 3 7 4 2 8 5[+++ +]10010110 0(D-D-3) 1 9 7 4 3 6 2 8 5 (11)
1(D-I-3) 1 9 8 5 2 7 4 3 6 (12)
6 1.82276 1 9 7 2 8 4 5 3 6[+++ +]10010111 0(S-I-4)
1(D-D-4) 1 9 8 4 5 3 6 2 7 (9)
7 1.84129 1 9 7 3 6 2 8 4 5[+++ +]10010101 0(S-D-4)
1(D-I-4) 1 9 8 4 5 2 7 3 6 (8)
8 1.87838 1 9 8 4 5 2 7 3 6[+++ +]10011101 0(D-I-4) 1 9 7 3 6 2 8 4 5 (7)
1(S-D-4)
9 1.89078 1 9 8 4 5 3 6 2 7[++-----]10011111 0(D-D-4) 1 9 7 2 8 4 5 3 6 (6)
1(S-I-4)
10 1.90312 1 9 7 4 3 5 2 8 6[+++ +]10011110 0(S-I-3)
1(D-D-3) 1 9 8 5 2 7 4 3 6 (12)
11 1.91144 1 9 7 4 3 6 2 8 5[+++ +]10011010 0(D-D-3) 1 9 6 3 7 4 2 8 5 (5)
1(S-I-3)
12 1.92229 1 9 8 5 2 7 4 3 6[+++ +]10011011 0(D-I-3) 1 9 6 3 7 4 2 8 5 (5)
1(D-D-3) 1 9 7 4 3 5 2 8 6 (10)
13 1.93224 1 9 7 4 2 8 6 3 5[+++ +]10011001 0(S-D-3) 1(S-I-3)
14 1.94958 1 9 7 5 2 8 6 3 4[+++ +]10001001 0(D-I-3) 1 9 8 6 3 5 2 7 4 (16)
1(D-D-3) 1 9 8 6 3 4 2 7 5 (17)
15 1.95733 1 9 8 6 2 7 4 3 5[+++ +]10001011 0(S-D-3)
1(D-I-3) 1 9 8 7 4 3 5 2 6 (18)
16 1.96402 1 9 8 6 3 5 2 7 4[+++ +]10001010 0(D-I-3) 1 9 7 5 2 8 6 3 4 (14)
1(D-D-3) 1 9 8 7 4 2 6 3 5 (19)
17 1.96942 1 9 8 6 3 4 2 7 5[+++ +]10001110 0(D-D-3) 1 9 7 5 2 8 6 3 4 (14)
1(D-I-3) 1 9 8 7 4 2 6 3 5 (19)
18 1.97478 1 9 8 7 4 3 5 2 6[+++ -]10001111 0(D-I-3) 1 9 8 6 2 7 4 3 5 (15)
1(S-D-3)
19 1.97946 1 9 8 7 4 2 6 3 5[+++ +]10001101 0(D-D-3) 1 9 8 6 3 5 2 7 4 (16)
1(D-I-3) 1 9 8 6 3 4 2 7 5 (17)

22 1.93539 1 10 8 5 2 9 7 4 3 6[+--+---]100110011 0(D-I-3) 1 10 7 4 2 9 6 3 8 5 (21)
 1(S-D-3)
 23 1.94687 1 10 8 6 2 9 7 4 3 5[+++----]100010011 0(D-D-3) 1 10 9 6 3 7 4 2 8 5 (25)
 1(D-I-3) 1 10 9 7 4 3 5 2 8 6 (32)
 24 1.9519 1 10 8 5 2 9 6 3 7 4[+++----]100010010 0(S-I-3)
 1(D-D-3) 1 10 9 7 4 3 6 2 8 5 (33)
 25 1.95542 1 10 9 6 3 7 4 2 8 5[+++----]100010110 0(D-D-3) 1 10 8 6 2 9 7 4 3 5 (23)
 1(D-I-3) 1 10 9 8 5 2 7 4 3 6 (34)
 26 1.9591 1 10 9 7 2 8 4 5 3 6[+++----]100010111 0(S-I-4)
 1(D-D-4) 1 10 9 8 4 5 3 6 2 7 (31)
 27 1.96238 1 10 9 7 3 6 2 8 4 5[+++----]100010101 0(S-D-4)
 1(D-I-4) 1 10 9 8 4 5 2 7 3 6 (30)
 28 1.96582 1 10 8 6 3 5 2 9 7 4[+++----]100010100 0(S-I-3)
 1(D-D-3) 1 10 9 7 4 2 8 6 3 5 (35)
 29 1.96774 1 10 8 6 3 4 2 9 7 5[+++----]100011100 0(S-D-3)
 1(D-I-3) 1 10 9 7 4 2 8 6 3 5 (35)
 30 1.97086 1 10 9 8 4 5 2 7 3 6[+++----]100011101 0(D-I-4) 1 10 9 7 3 6 2 8 4 5 (27)
 1(S-D-4)
 31 1.9735 1 10 9 8 4 5 3 6 2 7[+++----]100011111 0(D-D-4) 1 10 9 7 2 8 4 5 3 6 (26)
 1(S-I-4)
 32 1.97604 1 10 9 7 4 3 5 2 8 6[+++----]100011110 0(D-I-3) 1 10 8 6 2 9 7 4 3 5 (23)
 1(D-D-3) 1 10 9 8 5 2 7 4 3 6 (34)
 33 1.97829 1 10 9 7 4 3 6 2 8 5[+++----]100011010 0(D-D-3) 1 10 8 5 2 9 6 3 7 4 (24)
 1(S-I-3)
 34 1.98058 1 10 9 8 5 2 7 4 3 6[+++----]100011011 0(D-I-3) 1 10 9 6 3 7 4 2 8 5 (25)
 1(D-D-3) 1 10 9 7 4 3 5 2 8 6 (32)
 35 1.98272 1 10 9 7 4 2 8 6 3 5[+++----]100011001 0(D-D-3) 1 10 8 6 3 5 2 9 7 4 (28)
 1(D-I-3) 1 10 8 6 3 4 2 9 7 5 (29)
 36 1.98548 1 10 8 6 4 2 9 7 5 3[+++----]100001000 0(S-D-2)
 1(D-I-2) 1 10 9 7 5 3 2 8 6 4 (43)
 37 1.98794 1 10 9 7 5 2 8 6 3 4[+++----]100001001 0(D-I-3) 1 10 9 8 6 3 5 2 7 4 (39)
 1(D-D-3) 1 10 9 8 6 3 4 2 7 5 (40)
 38 1.9896 1 10 9 8 6 2 7 4 3 5[+++----]100001011 0(S-D-3)
 1(D-I-3) 1 10 9 8 7 4 3 5 2 6 (41)
 39 1.99112 1 10 9 8 6 3 5 2 7 4[+++----]100001010 0(D-I-3) 1 10 9 7 5 2 8 6 3 4 (37)
 1(D-D-3) 1 10 9 8 7 4 2 6 3 5 (42)
 40 1.99248 1 10 9 8 6 3 4 2 7 5[+++----]100001110 0(D-D-3) 1 10 9 7 5 2 8 6 3 4 (37)
 1(D-I-3) 1 10 9 8 7 4 2 6 3 5 (42)
 41 1.99375 1 10 9 8 7 4 3 5 2 6[+++----]100001111 0(D-I-3) 1 10 9 8 6 2 7 4 3 5 (38)
 1(S-D-3)
 42 1.99489 1 10 9 8 7 4 2 6 3 5[+++----]100001101 0(D-D-3) 1 10 9 8 6 3 5 2 7 4 (39)
 1(D-I-3) 1 10 9 8 6 3 4 2 7 5 (40)
 43 1.99592 1 10 9 7 5 3 2 8 6 4[+++----]100001100 0(D-I-2) 1 10 8 6 4 2 9 7 5 3 (36)
 1(S-D-2)
 44 1.9968 1 10 9 8 6 4 2 7 5 3[+++----]100000100 0(S-D-2)
 1(D-I-2) 1 10 9 8 7 5 3 2 6 4 (47)
 45 1.99761 1 10 9 8 7 5 2 6 3 4[+++----]100000101 0(S-I-3)
 1(D-D-3) 1 10 9 8 7 6 3 4 2 5 (46)
 46 1.99829 1 10 9 8 7 6 3 4 2 5[+++----]100000111 0(D-D-3) 1 10 9 8 7 5 2 6 3 4 (45)
 1(S-I-3)
 47 1.99886 1 10 9 8 7 5 3 2 6 4[+++----]100000110 0(D-I-2) 1 10 9 8 6 4 2 7 5 3 (44)
 1(S-D-2)
 48 1.99931 1 10 9 8 7 6 4 2 5 3[+++----]100000010 0(S-D-2)
 1(D-I-2) 1 10 9 8 7 6 5 3 2 4 (49)

49 1.99965 1 10 9 8 7 6 5 3 2 4[+++++--]100000011 0(D-I-2) 1 10 9 8 7 6 4 2 5 3 (48)
 1(S-D-2)
 50 1.99987 1 10 9 8 7 6 5 4 2 3[+++++--]100000001 0(S-D-2) 1(S-I-2)
 51 1.99999 1 10 9 8 7 6 5 4 3 2[+++++--]100000000 0(S-I-1) 1(S-D-1)

----- Order of rotation sequence = 11 , Number of rotation sequences = 93 -----

1 1.5479 1 11 6 5 7 4 8 3 9 2 10[+-----]1011111111 0(S-I-5) 1(S-D-5)
 2 1.56363 1 11 6 5 7 4 8 2 10 3 9[+-----+--]1011111101 0(S-D-5) 1(S-I-5)
 3 1.5868 1 11 6 5 7 3 9 2 10 4 8[+-----+--]1011110101 0(S-I-5)
 1(D-D-5) 1 11 6 4 8 2 10 5 7 3 9 (4)
 4 1.60431 1 11 6 4 8 2 10 5 7 3 9[+-----+--]1011110111 0(D-D-5) 1 11 6 5 7 3 9 2 10 4 8 (3)
 1(S-I-5)
 5 1.64871 1 11 7 3 9 2 10 5 6 4 8[+-----+--]1011010111 0(S-I-5)
 1(D-D-5) 1 11 8 2 10 5 6 4 7 3 9 (8)
 6 1.66311 1 11 6 3 9 4 8 2 10 5 7[+-----+--]1011010101 0(S-D-5)
 1(D-I-5) 1 11 7 2 10 5 6 3 9 4 8 (7)
 7 1.68452 1 11 7 2 10 5 6 3 9 4 8[+-----+--]1011011101 0(D-I-5) 1 11 6 3 9 4 8 2 10 5 7 (6)
 1(S-D-5)
 8 1.69524 1 11 8 2 10 5 6 4 7 3 9[+-----+--]1011011111 0(D-D-5) 1 11 7 3 9 2 10 5 6 4 8 (5)
 1(S-I-5)
 9 1.73201 1 11 7 2 10 6 3 9 5 4 8[+-----+--]1011011011 0(S-I-4) 1(S-D-4)
 10 1.79606 1 11 8 2 10 6 3 9 5 4 7[+-----+--]1001011011 0(S-D-4)
 1(D-I-4) 1 11 9 5 4 7 2 10 6 3 8 (27)
 11 1.80821 1 11 8 3 9 5 4 7 2 10 6[+-----+--]1001011010 0(S-I-4)
 1(D-D-4) 1 11 10 6 3 8 2 9 5 4 7 (30)
 12 1.81177 1 11 8 3 9 5 4 6 2 10 7[+-----+--]1001011110 0(D-D-4) 1 11 9 5 4 6 3 8 2 10 7 (26)
 1(D-I-4) 1 11 10 7 2 9 5 4 6 3 8 (33)
 13 1.81982 1 11 9 2 10 5 6 4 7 3 8[+-----+--]1001011111 0(S-I-5)
 1(D-D-5) 1 11 10 5 6 4 7 3 8 2 9 (24)
 14 1.8257 1 11 8 2 10 5 6 3 9 4 7[+-----+--]1001011101 0(D-D-5) 1 11 9 3 8 2 10 5 6 4 7 (16)
 1(D-I-5) 1 11 9 4 7 2 10 5 6 3 8 (21)
 15 1.83868 1 11 8 3 9 4 7 2 10 5 6[+-----+--]1001010101 0(S-I-5)
 1(D-D-5) 1 11 10 5 6 3 8 2 9 4 7 (22)
 16 1.8438 1 11 9 3 8 2 10 5 6 4 7[+-----+--]1001010111 0(D-D-5) 1 11 8 2 10 5 6 3 9 4 7 (14)
 1(D-I-5) 1 11 10 5 6 4 7 2 9 3 8 (23)
 17 1.84992 1 11 8 4 7 3 9 5 2 10 6[+-----+--]1001010110 0(D-I-4) 1 11 9 5 3 8 4 7 2 10 6 (31)
 1(D-D-4) 1 11 10 6 2 9 5 3 8 4 7 (34)
 18 1.85376 1 11 8 4 6 2 10 7 3 9 5[+-----+--]1001010010 0(S-D-4)
 1(D-I-4) 1 11 9 5 3 7 2 10 8 4 6 (29)
 19 1.86808 1 11 8 4 5 2 10 7 3 9 6[+-----+--]1001110010 0(S-I-4)
 1(D-D-4) 1 11 9 5 3 7 2 10 8 4 6 (29)
 20 1.87171 1 11 8 4 5 3 9 6 2 10 7[+-----+--]1001110110 0(D-D-4) 1 11 9 5 3 8 4 6 2 10 7 (32)
 1(D-I-4) 1 11 10 6 2 9 5 3 8 4 7 (34)
 21 1.87649 1 11 9 4 7 2 10 5 6 3 8[+-----+--]1001110111 0(D-I-5) 1 11 8 2 10 5 6 3 9 4 7 (14)
 1(D-D-5) 1 11 10 5 6 4 7 2 9 3 8 (23)
 22 1.88025 1 11 10 5 6 3 8 2 9 4 7[+-----+--]1001110101 0(D-D-5) 1 11 8 3 9 4 7 2 10 5 6 (15)
 1(S-I-5)
 23 1.88915 1 11 10 5 6 4 7 2 9 3 8[+-----+--]1001111101 0(D-I-5) 1 11 9 3 8 2 10 5 6 4 7 (16)
 1(D-D-5) 1 11 9 4 7 2 10 5 6 3 8 (21)
 24 1.89234 1 11 10 5 6 4 7 3 8 2 9[+-----+--]1001111111 0(D-D-5) 1 11 9 2 10 5 6 4 7 3 8 (13)
 1(S-I-5)
 25 1.89575 1 11 9 5 4 6 3 7 2 10 8[+-----+--]1001111110 0(S-I-4)
 1(D-D-4) 1 11 10 7 2 9 5 4 6 3 8 (33)

26 1.89809 1 11 9 5 4 6 3 8 2 10 7[+-----+]1001111010 0(D-D-4) 1 11 8 3 9 5 4 6 2 10 7 (12)
 1(D-I-4) 1 11 10 6 3 8 2 9 5 4 7 (30)
 27 1.90149 1 11 9 5 4 7 2 10 6 3 8[+-----+]1001111011 0(D-I-4) 1 11 8 2 10 6 3 9 5 4 7 (10)
 1(S-D-4)
 28 1.90503 1 11 9 5 4 6 2 10 8 3 7[+-----+]1001111001 0(S-D-4) 1(S-I-4)
 29 1.90961 1 11 9 5 3 7 2 10 8 4 6[+-----+]1001101001 0(D-I-4) 1 11 8 4 6 2 10 7 3 9 5 (18)
 1(D-D-4) 1 11 8 4 5 2 10 7 3 9 6 (19)
 30 1.91297 1 11 10 6 3 8 2 9 5 4 7[+-----+]1001101011 0(D-D-4) 1 11 8 3 9 5 4 7 2 10 6 (11)
 1(D-I-4) 1 11 9 5 4 6 3 8 2 10 7 (26)
 31 1.916 1 11 9 5 3 8 4 7 2 10 6[+-----+]1001101010 0(D-I-4) 1 11 8 4 7 3 9 5 2 10 6 (17)
 1(S-D-4)
 32 1.91819 1 11 9 5 3 8 4 6 2 10 7[+-----+]1001101110 0(D-D-4) 1 11 8 4 5 3 9 6 2 10 7 (20)
 1(S-I-4)
 33 1.921 1 11 10 7 2 9 5 4 6 3 8[+-----+]1001101111 0(D-I-4) 1 11 8 3 9 5 4 6 2 10 7 (12)
 1(D-D-4) 1 11 9 5 4 6 3 7 2 10 8 (25)
 34 1.92359 1 11 10 6 2 9 5 3 8 4 7[+-----+]1001101101 0(D-D-4) 1 11 8 4 7 3 9 5 2 10 6 (17)
 1(D-I-4) 1 11 8 4 5 3 9 6 2 10 7 (20)
 35 1.93083 1 11 9 5 2 10 7 3 8 4 6[+-----+]1001100101 0(S-I-4)
 1(D-D-4) 1 11 9 6 2 10 8 4 5 3 7 (36)
 36 1.93371 1 11 9 6 2 10 8 4 5 3 7[+-----+]1001100111 0(D-D-4) 1 11 9 5 2 10 7 3 8 4 6 (35)
 1(S-I-4)
 37 1.93749 1 11 8 5 2 10 7 4 3 9 6[+-----+]1001100110 0(S-I-3) 1(S-D-3)
 38 1.94499 1 11 9 6 2 10 7 4 3 8 5[+-----+]1000100110 0(S-D-3)
 1(D-I-3) 1 11 10 7 4 3 8 5 2 9 6 (59)
 39 1.94833 1 11 9 7 2 10 8 4 5 3 6[+-----+]1000100111 0(D-I-4) 1 11 10 7 3 8 4 5 2 9 6 (45)
 1(D-D-4) 1 11 10 8 4 5 3 6 2 9 7 (52)
 40 1.95074 1 11 9 6 2 10 7 3 8 4 5[+-----+]1000100101 0(D-D-4) 1 11 10 7 3 8 4 6 2 9 5 (46)
 1(D-I-4) 1 11 10 8 4 5 3 7 2 9 6 (51)
 41 1.95326 1 11 9 6 3 8 5 2 10 7 4[+-----+]1000100100 0(S-I-3)
 1(D-D-3) 1 11 10 7 4 2 9 6 3 8 5 (60)
 42 1.95417 1 11 9 6 3 7 4 2 10 8 5[+-----+]1000101100 0(D-D-3) 1 11 9 7 4 3 6 2 10 8 5 (56)
 1(D-I-3) 1 11 10 8 5 2 9 7 4 3 6 (61)
 43 1.95641 1 11 10 7 2 9 5 3 8 4 6[+-----+]1000101101 0(D-I-4) 1 11 10 8 3 7 2 9 5 4 6 (47)
 1(D-D-4) 1 11 10 8 4 6 2 9 5 3 7 (50)
 44 1.95821 1 11 10 8 2 9 5 4 6 3 7[+-----+]1000101111 0(S-D-4)
 1(D-I-4) 1 11 10 9 5 4 6 3 7 2 8 (53)
 45 1.95999 1 11 10 7 3 8 4 5 2 9 6[+-----+]1000101110 0(D-I-4) 1 11 9 7 2 10 8 4 5 3 6 (39)
 1(D-D-4) 1 11 10 9 6 2 8 4 5 3 7 (58)
 46 1.96152 1 11 10 7 3 8 4 6 2 9 5[+-----+]1000101010 0(D-D-4) 1 11 9 6 2 10 7 3 8 4 5 (40)
 1(D-I-4) 1 11 10 9 5 3 7 2 8 4 6 (57)
 47 1.96321 1 11 10 8 3 7 2 9 5 4 6[+-----+]1000101011 0(D-I-4) 1 11 10 7 2 9 5 3 8 4 6 (43)
 1(D-D-4) 1 11 10 9 5 4 6 2 8 3 7 (54)
 48 1.96486 1 11 9 7 3 6 2 10 8 4 5[+-----+]1000101001 0(S-D-4)
 1(D-I-4) 1 11 10 8 4 5 2 9 7 3 6 (49)
 49 1.96865 1 11 10 8 4 5 2 9 7 3 6[+-----+]1000111001 0(D-I-4) 1 11 9 7 3 6 2 10 8 4 5 (48)
 1(S-D-4)
 50 1.97014 1 11 10 8 4 6 2 9 5 3 7[+-----+]1000111011 0(D-D-4) 1 11 10 7 2 9 5 3 8 4 6 (43)
 1(D-I-4) 1 11 10 9 5 4 6 2 8 3 7 (54)
 51 1.97157 1 11 10 8 4 5 3 7 2 9 6[+-----+]1000111010 0(D-I-4) 1 11 9 6 2 10 7 3 8 4 5 (40)
 1(D-D-4) 1 11 10 9 5 3 7 2 8 4 6 (57)
 52 1.97283 1 11 10 8 4 5 3 6 2 9 7[+-----+]1000111110 0(D-D-4) 1 11 9 7 2 10 8 4 5 3 6 (39)
 1(D-I-4) 1 11 10 9 6 2 8 4 5 3 7 (58)
 53 1.97415 1 11 10 9 5 4 6 3 7 2 8[+-----+]1000111111 0(D-I-4) 1 11 10 8 2 9 5 4 6 3 7 (44)
 1(S-D-4)

54 1.97541 1 11 10 9 5 4 6 2 8 3 7[++++-----]1000111101 0(D-D-4) 1 11 10 8 3 7 2 9 5 4 6 (47)
 1(D-I-4) 1 11 10 8 4 6 2 9 5 3 7 (50)
 55 1.97672 1 11 9 7 4 3 5 2 10 8 6[++++-----]1000111100 0(S-I-3)
 1(D-D-3) 1 11 10 8 5 2 9 7 4 3 6 (61)
 56 1.97764 1 11 9 7 4 3 6 2 10 8 5[++++---+][1000110100 0(D-D-3) 1 11 9 6 3 7 4 2 10 8 5 (42)
 1(D-I-3) 1 11 10 7 4 2 9 6 3 8 5 (60)
 57 1.97889 1 11 10 9 5 3 7 2 8 4 6[++++---+][1000110101 0(D-I-4) 1 11 10 7 3 8 4 6 2 9 5 (46)
 1(D-D-4) 1 11 10 8 4 5 3 7 2 9 6 (51)
 58 1.98002 1 11 10 9 6 2 8 4 5 3 7[++++---+][1000110111 0(D-D-4) 1 11 10 7 3 8 4 5 2 9 6 (45)
 1(D-I-4) 1 11 10 8 4 5 3 6 2 9 7 (52)
 59 1.98114 1 11 10 7 4 3 8 5 2 9 6[++++---+][1000110110 0(D-I-3) 1 11 9 6 2 10 7 4 3 8 5 (38)
 1(S-D-3)
 60 1.98217 1 11 10 7 4 2 9 6 3 8 5[++++---+][1000110010 0(D-D-3) 1 11 9 6 3 8 5 2 10 7 4 (41)
 1(D-I-3) 1 11 9 7 4 3 6 2 10 8 5 (56)
 61 1.98326 1 11 10 8 5 2 9 7 4 3 6[++++-----]1000110011 0(D-I-3) 1 11 9 6 3 7 4 2 10 8 5 (42)
 1(D-D-3) 1 11 9 7 4 3 5 2 10 8 6 (55)
 62 1.9844 1 11 9 7 4 2 10 8 6 3 5[++++-----]1000110001 0(S-D-3) 1(S-I-3)
 63 1.98647 1 11 9 7 5 2 10 8 6 3 4[++++-----]1000010001 0(D-I-3) 1 11 10 8 6 3 5 2 9 7 4 (69)
 1(D-D-3) 1 11 10 8 6 3 4 2 9 7 5 (70)
 64 1.98748 1 11 10 8 6 2 9 7 4 3 5[++++-----]1000010011 0(D-D-3) 1 11 10 9 6 3 7 4 2 8 5 (66)
 1(D-I-3) 1 11 10 9 7 4 3 5 2 8 6 (73)
 65 1.98838 1 11 10 8 5 2 9 6 3 7 4[++++---+][1000010010 0(S-I-3)
 1(D-D-3) 1 11 10 9 7 4 3 6 2 8 5 (74)
 66 1.9892 1 11 10 9 6 3 7 4 2 8 5[++++---+][1000010110 0(D-D-3) 1 11 10 8 6 2 9 7 4 3 5 (64)
 1(D-I-3) 1 11 10 9 8 5 2 7 4 3 6 (75)
 67 1.98999 1 11 10 9 7 2 8 4 5 3 6[++++---+][1000010111 0(S-I-4)
 1(D-D-4) 1 11 10 9 8 4 5 3 6 2 7 (72)
 68 1.99075 1 11 10 9 7 3 6 2 8 4 5[++++---+][1000010101 0(S-D-4)
 1(D-I-4) 1 11 10 9 8 4 5 2 7 3 6 (71)
 69 1.99149 1 11 10 8 6 3 5 2 9 7 4[++++---+][1000010100 0(D-I-3) 1 11 9 7 5 2 10 8 6 3 4 (63)
 1(D-D-3) 1 11 10 9 7 4 2 8 6 3 5 (76)
 70 1.99213 1 11 10 8 6 3 4 2 9 7 5[++++-----]1000011100 0(D-D-3) 1 11 9 7 5 2 10 8 6 3 4 (63)
 1(D-I-3) 1 11 10 9 7 4 2 8 6 3 5 (76)
 71 1.99281 1 11 10 9 8 4 5 2 7 3 6[++++-----]1000011101 0(D-I-4) 1 11 10 9 7 3 6 2 8 4 5 (68)
 1(S-D-4)
 72 1.99344 1 11 10 9 8 4 5 3 6 2 7[++++-----]1000011111 0(D-D-4) 1 11 10 9 7 2 8 4 5 3 6 (67)
 1(S-I-4)
 73 1.99405 1 11 10 9 7 4 3 5 2 8 6[++++-----]1000011110 0(D-I-3) 1 11 10 8 6 2 9 7 4 3 5 (64)
 1(D-D-3) 1 11 10 9 8 5 2 7 4 3 6 (75)
 74 1.99461 1 11 10 9 7 4 3 6 2 8 5[++++---+][1000011010 0(D-D-3) 1 11 10 8 5 2 9 6 3 7 4 (65)
 1(S-I-3)
 75 1.99516 1 11 10 9 8 5 2 7 4 3 6[++++---+][1000011011 0(D-I-3) 1 11 10 9 6 3 7 4 2 8 5 (66)
 1(D-D-3) 1 11 10 9 7 4 3 5 2 8 6 (73)
 76 1.99567 1 11 10 9 7 4 2 8 6 3 5[++++---+][1000011001 0(D-D-3) 1 11 10 8 6 3 5 2 9 7 4 (69)
 1(D-I-3) 1 11 10 8 6 3 4 2 9 7 5 (70)
 77 1.99618 1 11 9 7 5 3 2 10 8 6 4[++++---+][1000011000 0(S-I-2) 1(S-D-2)
 78 1.99657 1 11 10 8 6 4 2 9 7 5 3[++++---+][1000001000 0(S-D-2)
 1(D-I-2) 1 11 10 9 7 5 3 2 8 6 4 (85)
 79 1.99702 1 11 10 9 7 5 2 8 6 3 4[++++---+][1000001001 0(D-I-3) 1 11 10 9 8 6 3 5 2 7 4 (81)
 1(D-D-3) 1 11 10 9 8 6 3 4 2 7 5 (82)
 80 1.99742 1 11 10 9 8 6 2 7 4 3 5[++++---+][1000001011 0(S-D-3)
 1(D-I-3) 1 11 10 9 8 7 4 3 5 2 6 (83)
 81 1.99779 1 11 10 9 8 6 3 5 2 7 4[++++---+][1000001010 0(D-I-3) 1 11 10 9 7 5 2 8 6 3 4 (79)
 1(D-D-3) 1 11 10 9 8 7 4 2 6 3 5 (84)

82 1.99813 1 11 10 9 8 6 3 4 2 7 5[+++++---]1000001110 0(D-D-3) 1 11 10 9 7 5 2 8 6 3 4 (79)
 1(D-I-3) 1 11 10 9 8 7 4 2 6 3 5 (84)
 83 1.99844 1 11 10 9 8 7 4 3 5 2 6[+++++---]1000001111 0(D-I-3) 1 11 10 9 8 6 2 7 4 3 5 (80)
 1(S-D-3)
 84 1.99872 1 11 10 9 8 7 4 2 6 3 5[+++++---]1000001101 0(D-D-3) 1 11 10 9 8 6 3 5 2 7 4 (81)
 1(D-I-3) 1 11 10 9 8 6 3 4 2 7 5 (82)
 85 1.99898 1 11 10 9 7 5 3 2 8 6 4[+++++---]1000001100 0(D-I-2) 1 11 10 8 6 4 2 9 7 5 3 (78)
 1(S-D-2)
 86 1.9992 1 11 10 9 8 6 4 2 7 5 3[+++++---]1000000100 0(S-D-2)
 1(D-I-2) 1 11 10 9 8 7 5 3 2 6 4 (89)
 87 1.9994 1 11 10 9 8 7 5 2 6 3 4[+++++---]1000000101 0(S-I-3)
 1(D-D-3) 1 11 10 9 8 7 6 3 4 2 5 (88)
 88 1.99957 1 11 10 9 8 7 6 3 4 2 5[+++++---]1000000111 0(D-D-3) 1 11 10 9 8 7 5 2 6 3 4 (87)
 1(S-I-3)
 89 1.99971 1 11 10 9 8 7 5 3 2 6 4[+++++---]1000000110 0(D-I-2) 1 11 10 9 8 6 4 2 7 5 3 (86)
 1(S-D-2)
 90 1.99983 1 11 10 9 8 7 6 4 2 5 3[+++++---]1000000010 0(S-D-2)
 1(D-I-2) 1 11 10 9 8 7 6 5 3 2 4 (91)
 91 1.99991 1 11 10 9 8 7 6 5 3 2 4[+++++---]1000000011 0(D-I-2) 1 11 10 9 8 7 6 4 2 5 3 (90)
 1(S-D-2)
 92 1.99997 1 11 10 9 8 7 6 5 4 2 3[+++++---]1000000001 0(S-D-2) 1(S-I-2)
 93 2 1 11 10 9 8 7 6 5 4 3 2[+++++---]1000000000 0(S-I-1) 1(S-D-1)

----- Order of rotation sequence = 12 , Number of rotation sequences = 170 -----

1 1.41698 1 12 6 7 3 10 4 9 2 11 5 8[+---+---]10111010101 0(S-I-6) 1(S-D-6)
 2 1.48093 1 12 6 7 4 9 2 11 5 8 3 10[+---+---]10111110111 0(D-I-6) 1 12 6 7 5 8 3 10 2 11 4 9 (3)
 1(S-D-6)
 3 1.51245 1 12 6 7 5 8 3 10 2 11 4 9[+---+---]10111110101 0(S-D-6)
 1(D-I-6) 1 12 6 7 4 9 2 11 5 8 3 10 (2)
 4 1.53006 1 12 6 7 5 8 4 9 2 11 3 10[+---+---]10111111101 0(S-I-6) 1(S-D-6)
 5 1.54109 1 12 6 7 5 8 4 9 3 10 2 11[+---+---]10111111111 0(S-D-6) 1(S-I-6)
 6 1.61297 1 12 7 4 9 2 11 6 5 8 3 10[+---+---]10111101111 0(S-I-5) 1(S-D-5)
 7 1.64128 1 12 8 3 10 2 11 6 5 7 4 9[+---+---]10110101111 0(S-D-5)
 1(D-I-5) 1 12 9 2 11 6 5 7 4 8 3 10 (10)
 8 1.66964 1 12 7 3 10 4 9 2 11 6 5 8[+---+---]10110101011 0(S-I-5)
 1(D-D-5) 1 12 8 2 11 6 5 7 3 10 4 9 (11)
 9 1.67877 1 12 7 3 10 5 8 2 11 6 4 9[+---+---]10110111011 0(S-D-5)
 1(D-I-5) 1 12 8 2 11 6 5 7 3 10 4 9 (11)
 10 1.69885 1 12 9 2 11 6 5 7 4 8 3 10[+---+---]10110111111 0(D-I-5) 1 12 8 3 10 2 11 6 5 7 4 9 (7)
 1(S-D-5)
 11 1.70484 1 12 8 2 11 6 5 7 3 10 4 9[+---+---]10110111101 0(D-D-5) 1 12 7 3 10 4 9 2 11 6 5 8 (8)
 1(D-I-5) 1 12 7 3 10 5 8 2 11 6 4 9 (9)
 12 1.71797 1 12 7 2 11 6 4 9 3 10 5 8[+---+---]10110110101 0(S-I-5)
 1(D-D-5) 1 12 8 2 11 7 3 10 5 6 4 9 (13)
 13 1.72598 1 12 8 2 11 7 3 10 5 6 4 9[+---+---]10110110111 0(D-D-5) 1 12 7 2 11 6 4 9 3 10 5 8 (12)
 1(S-I-5)
 14 1.77827 1 12 8 4 9 5 2 11 7 3 10 6[+---+---]10010110010 0(D-I-4) 1 12 9 5 4 7 2 11 8 3 10 6 (47)
 1(D-D-4) 1 12 10 6 3 8 2 11 9 5 4 7 (46)
 15 1.78918 1 12 8 4 9 5 3 10 6 2 11 7[+---+---]10010110110 0(D-D-4) 1 12 10 6 3 9 5 4 8 2 11 7 (54)
 1(D-I-4) 1 12 11 7 2 10 6 3 9 5 4 8 (55)
 16 1.79975 1 12 9 2 11 7 3 10 5 6 4 8[+---+---]10010110111 0(D-I-5) 1 12 9 3 10 5 7 2 11 6 4 8 (22)
 1(D-D-5) 1 12 10 5 6 4 8 2 11 7 3 9 (37)
 17 1.80495 1 12 8 2 11 6 4 9 3 10 5 7[+---+---]10010110101 0(D-D-5) 1 12 9 3 10 4 8 2 11 6 5 7 (23)
 1(D-I-5) 1 12 10 5 7 3 9 2 11 6 4 8 (34)

18 1.81448 1 12 9 2 11 6 5 7 3 10 4 8[+-+-----]10010111101 0(D-I-5) 1 12 10 3 9 2 11 6 5 7 4 8 (26)
 1(D-D-5) 1 12 10 4 8 2 11 6 5 7 3 9 (31)
 19 1.81797 1 12 10 2 11 6 5 7 4 8 3 9[+-+-----]10010111111 0(S-D-5)
 1(D-I-5) 1 12 11 6 5 7 4 8 3 9 2 10 (40)
 20 1.82192 1 12 9 3 10 5 6 4 7 2 11 8[+-+-----]10010111110 0(D-I-5) 1 12 10 5 6 4 7 3 9 2 11 8 (38)
 1(D-D-5) 1 12 11 8 2 10 5 6 4 7 3 9 (52)
 21 1.82361 1 12 9 3 10 5 6 4 8 2 11 7[+-+-----]10010111010 0(S-D-5)
 1(D-I-5) 1 12 11 7 3 9 2 10 5 6 4 8 (49)
 22 1.82759 1 12 9 3 10 5 7 2 11 6 4 8[+-+-----]10010111011 0(D-I-5) 1 12 9 2 11 7 3 10 5 6 4 8 (16)
 1(D-D-5) 1 12 11 6 4 8 2 10 5 7 3 9 (43)
 23 1.83697 1 12 9 3 10 4 8 2 11 6 5 7[+-+-----]10010101011 0(D-D-5) 1 12 8 2 11 6 4 9 3 10 5 7 (17)
 1(D-I-5) 1 12 11 6 5 7 3 9 2 10 4 8 (42)
 24 1.84047 1 12 9 4 8 3 10 5 7 2 11 6[+-+-----]10010101010 0(S-I-5)
 1(D-D-5) 1 12 11 6 3 9 4 8 2 10 5 7 (50)
 25 1.84211 1 12 9 4 8 3 10 5 6 2 11 7[+-+-----]10010101110 0(D-D-5) 1 12 10 5 6 3 9 4 8 2 11 7 (33)
 1(D-I-5) 1 12 11 7 2 10 5 6 3 9 4 8 (51)
 26 1.84528 1 12 10 3 9 2 11 6 5 7 4 8[+-+-----]10010101111 0(D-I-5) 1 12 9 2 11 6 5 7 3 10 4 8 (18)
 1(D-D-5) 1 12 11 6 5 7 4 8 2 10 3 9 (41)
 27 1.84804 1 12 9 4 8 2 11 6 3 10 5 7[+-+-----]10010101101 0(S-D-5)
 1(D-I-5) 1 12 10 5 7 2 11 6 3 9 4 8 (30)
 28 1.85644 1 12 9 4 7 2 11 8 3 10 5 6[+-+-----]10010100101 0(S-I-5)
 1(D-D-5) 1 12 10 5 6 3 8 2 11 9 4 7 (35)
 29 1.86572 1 12 10 5 6 2 11 8 3 9 4 7[+-+-----]10011100101 0(S-D-5)
 1(D-I-5) 1 12 10 5 6 3 8 2 11 9 4 7 (35)
 30 1.87318 1 12 10 5 7 2 11 6 3 9 4 8[+-+-----]10011101101 0(D-I-5) 1 12 9 4 8 2 11 6 3 10 5 7 (27)
 1(S-D-5)
 31 1.87537 1 12 10 4 8 2 11 6 5 7 3 9[+-+-----]10011101111 0(D-D-5) 1 12 9 2 11 6 5 7 3 10 4 8 (18)
 1(D-I-5) 1 12 11 6 5 7 4 8 2 10 3 9 (41)
 32 1.87768 1 12 10 5 6 3 9 4 7 2 11 8[+-+-----]10011101110 0(S-I-5)
 1(D-D-5) 1 12 11 7 2 10 5 6 3 9 4 8 (51)
 33 1.87909 1 12 10 5 6 3 9 4 8 2 11 7[+-+-----]10011101010 0(D-D-5) 1 12 9 4 8 3 10 5 6 2 11 7 (25)
 1(D-I-5) 1 12 11 6 3 9 4 8 2 10 5 7 (50)
 34 1.88134 1 12 10 5 7 3 9 2 11 6 4 8[+-+-----]10011101011 0(D-I-5) 1 12 8 2 11 6 4 9 3 10 5 7 (17)
 1(D-D-5) 1 12 11 6 5 7 3 9 2 10 4 8 (42)
 35 1.8838 1 12 10 5 6 3 8 2 11 9 4 7[+-+-----]10011101001 0(D-D-5) 1 12 9 4 7 2 11 8 3 10 5 6 (28)
 1(D-I-5) 1 12 10 5 6 2 11 8 3 9 4 7 (29)
 36 1.88584 1 12 10 5 6 4 7 2 11 9 3 8[+-+-----]10011111001 0(S-I-5) 1(S-D-5)
 37 1.88817 1 12 10 5 6 4 8 2 11 7 3 9[+-+-----]10011111011 0(D-D-5) 1 12 9 2 11 7 3 10 5 6 4 8 (16)
 1(D-I-5) 1 12 11 6 4 8 2 10 5 7 3 9 (43)
 38 1.89015 1 12 10 5 6 4 7 3 9 2 11 8[+-+-----]10011111010 0(D-I-5) 1 12 9 3 10 5 6 4 7 2 11 8 (20)
 1(D-D-5) 1 12 11 7 3 9 2 10 5 6 4 8 (49)
 39 1.8914 1 12 10 5 6 4 7 3 8 2 11 9[+-+-----]10011111110 0(S-D-5)
 1(D-I-5) 1 12 11 8 2 10 5 6 4 7 3 9 (52)
 40 1.89321 1 12 11 6 5 7 4 8 3 9 2 10[+-+-----]10011111111 0(D-I-5) 1 12 10 2 11 6 5 7 4 8 3 9 (19)
 1(S-D-5)
 41 1.89481 1 12 11 6 5 7 4 8 2 10 3 9[+-+-----]10011111101 0(D-D-5) 1 12 10 3 9 2 11 6 5 7 4 8 (26)
 1(D-I-5) 1 12 10 4 8 2 11 6 5 7 3 9 (31)
 42 1.89903 1 12 11 6 5 7 3 9 2 10 4 8[+-+-----]10011110101 0(D-I-5) 1 12 9 3 10 4 8 2 11 6 5 7 (23)
 1(D-D-5) 1 12 10 5 7 3 9 2 11 6 4 8 (34)
 43 1.90063 1 12 11 6 4 8 2 10 5 7 3 9[+-+-----]10011110111 0(D-D-5) 1 12 9 3 10 5 7 2 11 6 4 8 (22)
 1(D-I-5) 1 12 10 5 6 4 8 2 11 7 3 9 (37)
 44 1.90244 1 12 9 5 4 6 3 10 7 2 11 8[+-+-----]10011110110 0(D-I-4) 1 12 10 6 3 9 5 4 7 2 11 8 (53)
 1(D-D-4) 1 12 11 7 2 10 6 3 9 5 4 8 (55)
 45 1.90384 1 12 9 5 4 6 2 11 8 3 10 7[+-+-----]10011110010 0(S-D-4)
 1(D-I-4) 1 12 10 6 3 8 2 11 9 5 4 7 (46)

46	1.9074	1 12 10 6 3 8 2 11 9 5 4	7[+---+---]	10011010011	0(D-D-4)	1 12 8 4 9 5 2 11 7 3 10 6 (14)
					1(D-I-4)	1 12 9 5 4 6 2 11 8 3 10 7 (45)
47	1.91074	1 12 9 5 4 7 2 11 8 3 10	6[+---+---]	10011010010	0(D-I-4)	1 12 8 4 9 5 2 11 7 3 10 6 (14)
					1(S-D-4)	
48	1.9121	1 12 9 5 4 8 3 10 6 2 11	7[+---+---]	10011010110	0(S-D-4)	
					1(D-I-4)	1 12 10 6 3 9 5 4 8 2 11 7 (54)
49	1.91376	1 12 11 7 3 9 2 10 5 6 4	8[+---+---]	10011010111	0(D-I-5)	1 12 9 3 10 5 6 4 8 2 11 7 (21)
					1(D-D-5)	1 12 10 5 6 4 7 3 9 2 11 8 (38)
50	1.9152	1 12 11 6 3 9 4 8 2 10 5	7[+---+---]	10011010101	0(D-D-5)	1 12 9 4 8 3 10 5 7 2 11 6 (24)
					1(D-I-5)	1 12 10 5 6 3 9 4 8 2 11 7 (33)
51	1.91896	1 12 11 7 2 10 5 6 3 9 4	8[+---+---]	10011011101	0(D-I-5)	1 12 9 4 8 3 10 5 6 2 11 7 (25)
					1(D-D-5)	1 12 10 5 6 3 9 4 7 2 11 8 (32)
52	1.9203	1 12 11 8 2 10 5 6 4 7 3	9[+---+---]	10011011111	0(D-D-5)	1 12 9 3 10 5 6 4 7 2 11 8 (20)
					1(D-I-5)	1 12 10 5 6 4 7 3 8 2 11 9 (39)
53	1.92173	1 12 10 6 3 9 5 4 7 2 11	8[+---+---]	10011011110	0(D-I-4)	1 12 9 5 4 6 3 10 7 2 11 8 (44)
					1(S-D-4)	
54	1.92284	1 12 10 6 3 9 5 4 8 2 11	7[+---+---]	10011011010	0(D-D-4)	1 12 8 4 9 5 3 10 6 2 11 7 (15)
					1(D-I-4)	1 12 9 5 4 8 3 10 6 2 11 7 (48)
55	1.92431	1 12 11 7 2 10 6 3 9 5 4	8[+---+---]	10011011011	0(D-I-4)	1 12 8 4 9 5 3 10 6 2 11 7 (15)
					1(D-D-4)	1 12 9 5 4 6 3 10 7 2 11 8 (44)
56	1.92585	1 12 9 5 3 10 6 2 11 8 4	7[+---+---]	10011011001	0(S-D-4)	1(S-I-4)
57	1.92849	1 12 9 5 3 10 7 2 11 8 4	6[+---+---]	10011001001	0(D-I-4)	1 12 9 5 2 11 8 4 7 3 10 6 (59)
					1(D-D-4)	1 12 9 6 2 11 8 4 5 3 10 7 (60)
58	1.93007	1 12 10 6 2 11 8 3 9 5 4	7[+---+---]	10011001011	0(S-D-4)	
					1(D-I-4)	1 12 10 7 2 11 9 5 4 6 3 8 (61)
59	1.93162	1 12 9 5 2 11 8 4 7 3 10	6[+---+---]	10011001010	0(D-I-4)	1 12 9 5 3 10 7 2 11 8 4 6 (57)
					1(D-D-4)	1 12 10 6 2 11 9 5 3 8 4 7 (62)
60	1.93288	1 12 9 6 2 11 8 4 5 3 10	7[+---+---]	10011001110	0(D-D-4)	1 12 9 5 3 10 7 2 11 8 4 6 (57)
					1(D-I-4)	1 12 10 6 2 11 9 5 3 8 4 7 (62)
61	1.93455	1 12 10 7 2 11 9 5 4 6 3	8[+---+---]	10011001111	0(D-I-4)	1 12 10 6 2 11 8 3 9 5 4 7 (58)
					1(S-D-4)	
62	1.93632	1 12 10 6 2 11 9 5 3 8 4	7[+---+---]	10011001101	0(D-D-4)	1 12 9 5 2 11 8 4 7 3 10 6 (59)
					1(D-I-4)	1 12 9 6 2 11 8 4 5 3 10 7 (60)
63	1.94252	1 12 9 6 3 10 7 4 2 11 8	5[+---+---]	10001001100	0(D-D-3)	1 12 10 7 4 3 9 6 2 11 8 5 (104)
					1(D-I-3)	1 12 11 8 5 2 10 7 4 3 9 6 (107)
64	1.94604	1 12 10 7 2 11 9 5 3 8 4	6[+---+---]	10001001101	0(D-I-4)	1 12 11 8 4 7 3 9 5 2 10 6 (80)
					1(D-D-4)	1 12 11 8 4 5 3 9 6 2 10 7 (86)
65	1.94762	1 12 10 8 2 11 9 5 4 6 3	7[+---+---]	10001001111	0(D-D-4)	1 12 11 8 3 9 5 4 6 2 10 7 (73)
					1(D-I-4)	1 12 11 9 5 4 6 3 7 2 10 8 (93)
66	1.94902	1 12 10 7 2 11 8 4 5 3 9	6[+---+---]	10001001110	0(S-I-4)	
					1(D-D-4)	1 12 11 9 5 3 8 4 6 2 10 7 (100)
67	1.95011	1 12 10 6 2 11 8 4 7 3 9	5[+---+---]	10001001010	0(S-D-4)	
					1(D-I-4)	1 12 11 9 5 3 8 4 7 2 10 6 (99)
68	1.95133	1 12 10 7 2 11 8 3 9 5 4	6[+---+---]	10001001011	0(D-I-4)	1 12 11 8 3 9 5 4 7 2 10 6 (72)
					1(D-D-4)	1 12 11 9 5 4 6 3 8 2 10 7 (94)
69	1.95249	1 12 10 7 3 9 6 2 11 8 4	5[+---+---]	10001001001	0(D-D-4)	1 12 11 8 4 6 2 10 7 3 9 5 (81)
					1(D-I-4)	1 12 11 8 4 5 2 10 7 3 9 6 (85)
70	1.95489	1 12 10 7 3 9 5 2 11 8 4	6[+---+---]	10001011001	0(D-I-4)	1 12 10 8 3 7 2 11 9 5 4 6 (82)
					1(D-D-4)	1 12 10 8 4 6 2 11 9 5 3 7 (84)
71	1.95592	1 12 11 8 2 10 6 3 9 5 4	7[+---+---]	10001011011	0(S-D-4)	
					1(D-I-4)	1 12 11 9 5 4 7 2 10 6 3 8 (95)
72	1.95691	1 12 11 8 3 9 5 4 7 2 10	6[+---+---]	10001011010	0(D-I-4)	1 12 10 7 2 11 8 3 9 5 4 6 (68)
					1(D-D-4)	1 12 11 10 6 3 8 2 9 5 4 7 (98)
73	1.95774	1 12 11 8 3 9 5 4 6 2 10	7[+---+---]	10001011110	0(D-D-4)	1 12 10 8 2 11 9 5 4 6 3 7 (65)
					1(D-I-4)	1 12 11 10 7 2 9 5 4 6 3 8 (101)

74 1.95866 1 12 11 9 2 10 5 6 4 7 3 8[+++-----]10001011111 0(S-I-5)
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 75 1.95953 1 12 11 8 2 10 5 6 3 9 4 7[+++-----]10001011101 0(D-D-5) 1 12 11 9 3 8 2 10 5 6 4 7 (79)
 1(D-I-5) 1 12 11 9 4 7 2 10 5 6 3 8 (87)
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 1(D-D-4) 1 12 11 9 6 2 10 8 4 5 3 7 (106)
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 1(D-I-4) 1 12 11 9 5 2 10 7 3 8 4 6 (105)
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 135 1.99529 1 12 11 10 7 4 3 8 5 2 9 6[++++--+-+]10000110110 0(D-I-3) 1 12 11 9 6 2 10 7 4 3 8 5 (112)
 1(S-D-3)
 136 1.99555 1 12 11 10 7 4 2 9 6 3 8 5[++++--+-+]10000110010 0(D-D-3) 1 12 11 9 6 3 8 5 2 10 7 4 (115)
 1(D-I-3) 1 12 11 9 7 4 3 6 2 10 8 5 (132)
 137 1.9958 1 12 11 10 8 5 2 9 7 4 3 6[++++--+-]10000110011 0(D-I-3) 1 12 11 9 6 3 7 4 2 10 8 5 (116)
 1(D-D-3) 1 12 11 9 7 4 3 5 2 10 8 6 (131)
 138 1.99605 1 12 11 9 7 4 2 10 8 6 3 5[++++--+-]10000110001 0(D-D-3) 1 12 10 8 6 3 5 2 11 9 7 4 (123)
 1(D-I-3) 1 12 10 8 6 3 4 2 11 9 7 5 (124)
 139 1.99638 1 12 10 8 6 4 2 11 9 7 5 3[+++++----]10000010000 0(S-D-2)
 1(D-I-2) 1 12 11 9 7 5 3 2 10 8 6 4 (154)
 140 1.99669 1 12 11 9 7 5 2 10 8 6 3 4[+++++----]10000010001 0(D-I-3) 1 12 11 10 8 6 3 5 2 9 7 4 (146)
 1(D-D-3) 1 12 11 10 8 6 3 4 2 9 7 5 (147)
 141 1.99691 1 12 11 10 8 6 2 9 7 4 3 5[+++++----]10000010011 0(D-D-3) 1 12 11 10 9 6 3 7 4 2 8 5 (143)
 1(D-I-3) 1 12 11 10 9 7 4 3 5 2 8 6 (150)
 142 1.99712 1 12 11 10 8 5 2 9 6 3 7 4[+++++----]10000010010 0(S-I-3)
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 143 1.99732 1 12 11 10 9 6 3 7 4 2 8 5[+++++----]10000010110 0(D-D-3) 1 12 11 10 8 6 2 9 7 4 3 5 (141)
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 144 1.99751 1 12 11 10 9 7 2 8 4 5 3 6[+++++----]10000010111 0(S-I-4)
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 145 1.9977 1 12 11 10 9 7 3 6 2 8 4 5[+++++----]10000010101 0(S-D-4)
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 148 1.99821 1 12 11 10 9 8 4 5 2 7 3 6[+++++----]10000011101 0(D-I-4) 1 12 11 10 9 7 3 6 2 8 4 5 (145)
 1(S-D-4)
 149 1.99837 1 12 11 10 9 8 4 5 3 6 2 7[+++++----]10000011111 0(D-D-4) 1 12 11 10 9 7 2 8 4 5 3 6 (144)
 1(S-I-4)
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 1(D-D-3) 1 12 11 10 9 8 5 2 7 4 3 6 (152)
 151 1.99866 1 12 11 10 9 7 4 3 6 2 8 5[+++++----]10000011010 0(D-D-3) 1 12 11 10 8 5 2 9 6 3 7 4 (142)
 1(S-I-3)
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 1(D-D-3) 1 12 11 10 9 7 4 3 5 2 8 6 (150)
 153 1.99892 1 12 11 10 9 7 4 2 8 6 3 5[+++++----]10000011001 0(D-D-3) 1 12 11 10 8 6 3 5 2 9 7 4 (146)
 1(D-I-3) 1 12 11 10 8 6 3 4 2 9 7 5 (147)
 154 1.99904 1 12 11 9 7 5 3 2 10 8 6 4[+++++----]10000011000 0(D-I-2) 1 12 10 8 6 4 2 11 9 7 5 3 (139)
 1(S-D-2)
 155 1.99915 1 12 11 10 8 6 4 2 9 7 5 3[+++++----]10000001000 0(S-D-2)
 1(D-I-2) 1 12 11 10 9 7 5 3 2 8 6 4 (162)

156 1.99926 1 12 11 10 9 7 5 2 8 6 3 4[+++++--+]10000001001 0(D-I-3) 1 12 11 10 9 8 6 3 5 2 7 4 (158)
 1(D-D-3) 1 12 11 10 9 8 6 3 4 2 7 5 (159)
 157 1.99936 1 12 11 10 9 8 6 2 7 4 3 5[+++++--+]10000001011 0(S-D-3)
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 158 1.99945 1 12 11 10 9 8 6 3 5 2 7 4[+++++--+]10000001010 0(D-I-3) 1 12 11 10 9 7 5 2 8 6 3 4 (156)
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 1(D-I-3) 1 12 11 10 9 8 6 3 4 2 7 5 (159)
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 1(S-D-2)
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 164 1.99985 1 12 11 10 9 8 7 5 2 6 3 4[+++++--+]10000000101 0(S-I-3)
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 165 1.99989 1 12 11 10 9 8 7 6 3 4 2 5[+++++--+]10000000111 0(D-D-3) 1 12 11 10 9 8 7 5 2 6 3 4 (164)
 1(S-I-3)
 166 1.99993 1 12 11 10 9 8 7 5 3 2 6 4[+++++--+]10000000110 0(D-I-2) 1 12 11 10 9 8 6 4 2 7 5 3 (163)
 1(S-D-2)
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 168 1.99998 1 12 11 10 9 8 7 6 5 3 2 4[+++++--+]10000000011 0(D-I-2) 1 12 11 10 9 8 7 6 4 2 5 3 (167)
 1(S-D-2)
 169 1.99999 1 12 11 10 9 8 7 6 5 4 2 3[+++++--+]10000000001 0(S-D-2) 1(S-I-2)
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