PROOF OF THE CONTINUED FRACTION CONJECTURE FOR $(a, b) = (z, z^4 + z + 1)$

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Abstract. The continued fraction conjecture claims that the continued fraction defined by the (a, b)-Thue-Morse sequence is algebraic over $\mathbb{F}_2(x)$ for all pairs of distinct elements (a, b) in $\mathbb{F}_2[x] \setminus \mathbb{F}_2$. In this paper we prove the conjecture for $(a, b) = (z, z^4 + z + 1)$.

1. Introduction

Let $\mathbb{F}_2$ be the finite field of cardinality 2. Given a sequence of polynomials $\mathbf{a} = (a_0(z), a_1(z), a_2(z), \ldots)$ of elements from $\mathbb{F}_2[z] \setminus \mathbb{F}_2$, we define the infinite continued fraction

$$\mathrm{CF}(\mathbf{a}(z)) = \cfrac{1}{a_0(z) + \cfrac{1}{a_1(z) + \cfrac{1}{a_2(z) + \cfrac{1}{\ddots}}}} \tag{1.1}$$

as the limit of the finite continued fractions

$$\mathrm{CF}_n(\mathbf{a}(z)) = \cfrac{1}{a_0(z) + \cfrac{1}{a_1(z) + \cfrac{1}{\ddots + \cfrac{1}{a_n(z)}}}} \in \mathbb{F}_2((1/z)). \tag{1.2}$$

Conversely, each power series in $\mathbb{F}_2[[1/z]]$ without constant term

$$c_{-1}z^{-1} + c_{-2}z^{-2} + c_{-3}z^{-3} + \cdots \tag{1.3}$$

admits a continued fraction expansion of form (1.1).

Let a and b be two distinct elements from $\mathbb{F}_2[z] \setminus \mathbb{F}_2$. We consider the continued fraction (1.1) associated with the (a, b)-Thue-Morse sequence

$$\mathbf{t} = (t_0(z), t_1(z), t_2(z), \ldots) = (a, b, b, a, b, a, a, b, \ldots)$$

that we shall denote

$$\mathrm{CF}(a, b) := \mathrm{CF}(\mathbf{t}). \tag{1.4}$$

Date: 9/04/2020 07:18:11 .
2010 *Mathematics Subject Classification.* 11B85, 11J70, 11B50, 11Y65, 05A15.
Key words and phrases. automatic sequence, continued fraction, Thue-Morse sequence.
* This paper was automatically generated from a computer program developed by the authors, with 43.3 minutes CPU time used.

Theorem 1.1. *When* $(a, b) = (z, z^4 + z + 1)$*, the two power series* $\mathrm{CF}(a, b)$ *and* $\mathrm{CF}(b, a)$ *are algebraic over* $\mathbb{F}_2(z)$*, with minimal polynomials of the form*

$$p_4(z)y^4 + p_3(z)y^3 + p_2(z)y^2 + p_1(z)y + p_0(z) = 0$$

where, for $\mathrm{CF}(a, b)$*,*

$$\begin{aligned}
p_0(z) &= z^{16} + z^{15} + z^{13} + z^{12} + z^{11} + z^7 + z^6 + z^4 + z^3 + z + 1,\\
p_1(z) &= z^{19} + z^{17} + z^{16} + z^{14} + z^{13} + z^{12} + z^8 + z^5 + z^4 + z^3 + z^2 + z,\\
p_2(z) &= z^{20} + z^{18} + z^{12} + z^8 + z^2,\\
p_3(z) &= z^{19} + z^{17} + z^{16} + z^{14} + z^{13} + z^{12} + z^8 + z^5 + z^4 + z^3 + z^2 + z,\\
p_4(z) &= z^{18} + z^{15} + z^{13} + z^{11} + z^7 + z^6 + z^3 + z^2 + z,
\end{aligned}$$

and for $\mathrm{CF}(b, a)$*,*

$$\begin{aligned}
p_0(z) &= z^{15} + z^{13} + z^{12} + z^{11} + z^7 + z^6 + z^4 + z^3 + z,\\
p_1(z) &= z^{19} + z^{17} + z^{16} + z^{14} + z^{13} + z^{12} + z^8 + z^5 + z^4 + z^3 + z^2 + z,\\
p_2(z) &= z^{20} + z^{18} + z^{12} + z^8 + z^2,\\
p_3(z) &= z^{19} + z^{17} + z^{16} + z^{14} + z^{13} + z^{12} + z^8 + z^5 + z^4 + z^3 + z^2 + z,\\
p_4(z) &= z^{18} + z^{16} + z^{15} + z^{13} + z^{11} + z^7 + z^6 + z^3 + z^2 + z + 1.
\end{aligned}$$

2. Proof

Define the sequences of polynomials $(P_n(z))_{n\geq 0}$ and $(Q_n(z))_{n\geq 0}$ by

$$\begin{pmatrix} P_n(z) & Q_n(z)\\ P_{n-1}(z) & Q_{n-1}(z)\end{pmatrix} := \begin{pmatrix} t_n(z) & 1\\ 1 & 0\end{pmatrix}\begin{pmatrix} t_{n-1}(z) & 1\\ 1 & 0\end{pmatrix}\cdots\begin{pmatrix} t_0(z) & 1\\ 1 & 0\end{pmatrix}\begin{pmatrix} 0 & 1\\ 1 & 0\end{pmatrix}.$$

By the basic properties of continued fractions, we have

$$\mathrm{CF}_n(a, b) = \frac{P_n(z)}{Q_n(z)} \in \mathbb{F}_2((1/z)). \tag{2.1}$$

As formula (2.1) is not efficient for calculating $\mathrm{CF}_n(a, b)$, a fast method is to be derived and described as follows. Define

$$\begin{aligned}
M_n(x) = x^{\deg(t_{2^n-1})}&\begin{pmatrix} t_{2^n-1}(1/x) & 1\\ 1 & 0\end{pmatrix} \times x^{\deg(t_{2^n-2})}\begin{pmatrix} t_{2^n-2}(1/x) & 1\\ 1 & 0\end{pmatrix}\times\\
&\cdots\times x^{\deg(t_0)}\begin{pmatrix} t_0(1/x) & 1\\ 1 & 0\end{pmatrix},\\
W_n(x) = x^{\deg(\bar t_{2^n-1})}&\begin{pmatrix} \bar t_{2^n-1}(1/x) & 1\\ 1 & 0\end{pmatrix} \times x^{\deg(\bar t_{2^n-2})}\begin{pmatrix} \bar t_{2^n-2}(1/x) & 1\\ 1 & 0\end{pmatrix}\times\\
&\cdots\times x^{\deg(\bar t_0)}\begin{pmatrix} \bar t_0(1/x) & 1\\ 1 & 0\end{pmatrix},
\end{aligned}$$

where $\bar{\mathbf{t}}$ is the (b, a)-Thue-Morse sequence. By the properties of the Thue-Morse sequence, we have for $n \geq 0$

$$\begin{aligned}
M_{n+1}(x) &= W_n(x)\cdot M_n(x),\\
W_{n+1}(x) &= M_n(x)\cdot W_n(x).
\end{aligned}$$

Let $x := 1/z$. For each non-zero polynomial $P(z)$, define $\tilde{P}(x)$ to be $P(1/x)$. Then,

$$\mathrm{CF}_n(a,b) = \frac{P_n(z)}{Q_n(z)} = \frac{\tilde{P}_n(x)}{\tilde{Q}_n(x)} \in \mathbb{F}_2((x)) = \mathbb{F}_2((1/z)).$$

Comparing the definition of $M_n(x)$ with the definition of $P_n(x)$ and $Q_n(x)$, we see that

$$M_n(x)_{0,1} = x^{d_n}\tilde{P}_{2^n-1}(x),$$
$$M_n(x)_{0,0} = x^{d_n}\tilde{Q}_{2^n-1}(x),$$

for some positive integer d_n. Hence,

$$\mathrm{CF}_{2^{2n}-1}(a,b) = \frac{\tilde{P}_{2^{2n}-1}(x)}{\tilde{Q}_{2^{2n}-1}(x)} = \frac{M_{2n}(x)_{0,1}}{M_{2n}(x)_{0,0}}. \tag{2.2}$$

Therefore, by the convergence theorem of continued fraction, the algebraicity of $\mathrm{CF}(a,b)$ will be established if it is shown that both $M_{2n}(x)_{0,1}$ and $M_{2n}(x)_{0,0}$ converge to algebraic series in $\mathbb{F}_2[[x]]$.

Actually, we will prove that for all $0 \le i,j \le 1$ the four sequences $(M_{2n}(x)_{i,j})_n$, $(M_{2n+1}(x)_{i,j})_n$, $(W_{2n}(x)_{i,j})_n$, and $(W_{2n+1}(x)_{i,j})_n$ converge to algebraic series in $\mathbb{F}_2[[x]]$. For this purpose, we define four 2×2 matrices M^e, M^o, W^e, W^o as follows: For each $T \in \{M^e, M^o, W^e, W^o\}$ and $0 \le i,j \le 1$, $T_{i,j}$ is defined to be the unique solution in $\mathbb{F}_2[[x]]$ of the polynomial $\phi(T,i,j)$ under certain initial conditions; the polynomials $\phi(T,i,j)$ and initial conditions are given in Section 3. We will prove that these four matrices, whose components are algebraic by definition, are the limits of $(M_{2n}(x))_n$, $(M_{2n+1}(x))_n$, $(W_{2n}(x))_n$, and $(W_{2n+1}(x))_n$.

Let us explain how the polynomials $\phi(T,i,j)$ and initial conditions are found, and why the solutions exist and are unique. For $0 \le i,j \le 1$, the the coefficients of the polynomial $\phi(M^e,i,j)$ (resp. $\phi(M^o,i,j)$, $\phi(W^e,i,j)$, and $\phi(W^o,i,j)$) are the Padé-Hermite approximants of type

$$(125, 125, 125, 125, 125)$$

of the vector

$$(1, T^3, T^6, T^9, T^{12}),$$

where $T = M_{12,i,j}$ (resp. $M_{11,i,j}$, $W_{12,i,j}$, and $W_{11,i,j}$), found by the Derksen algorithm. We take the first 8 terms of $M_{12,i,j}$ (resp. $M_{11,i,j}$, $W_{12,i,j}$, and $W_{11,i,j}$) as initial conditions for $\phi(M^e,i,j)$ (resp. $\phi(M^o,i,j)$, $\phi(W^e,i,j)$, and $\phi(W^o,i,j)$). The following fact will be used to ensure that the solution exists and is unique: let $P(x,y) \in \mathbb{F}_2[x,y]$ and for each series $f(x) = \sum_{n=0}^{\infty} a_n x^n \in \mathbb{F}_2[[x]]$ denote the partial sum $\sum_{j=0}^{n-1} a_j x^j$ by $f_n(x)$ for $n \ge 0$. If for some $n \ge 0$ and $a_0, a_1, \ldots, a_{n-1} \in \mathbb{F}_2$ $P(x, \sum_{j=0}^{n-1} a_j x^j) = O(x^n)$ and $Q(x,y) := P(x, \sum_{j=0}^{n-1} a_j x^j + x^n y)$ can be written as $x^m \sum_{j=0}^{\infty} q_j(x) y^j$ where $q_j(x)$ are polynomials for $j \ge 0$, $q_1(0) = 1$, and $q_j(0) = 0$ for $j > 1$, then there exists a unique solution $f(x) \in \mathbb{F}_2[[x]]$ of $P(x, f(x)) = 0$ that satisfies the initial condition $f_n(x) = \sum_{j=0}^{n-1} a_j x^j$.

We state two lemmas concerning the four matrices M^e, M^o, W^e, W^o. The first one is about relations between them; the second, about the structure of the each matrix.

Lemma 2.1. *We have*

$$M^e = W^o \cdot M^o, \tag{2.3}$$

$$M^o = W^e \cdot M^e, \tag{2.4}$$

$$W^e = M^o \cdot W^o, \tag{2.5}$$

$$W^o = M^e \cdot W^e. \tag{2.6}$$

Proof. We give the proof of the identity

$$M^e_{0,0} = W^o_{0,0}M^o_{0,0} + W^o_{0,1}M^o_{1,0},$$

the proofs of the others being similar.

First, we compute the minimal polynomials of $W^o_{0,0}M^o_{0,0}$ and $W^o_{0,1}M^o_{1,0}$. We know that

$$P(x, y) = \mathrm{Res}_z \left(\phi(W^o, 0, 0)(x, z),\ z^{12} \cdot \phi(M^o, 0, 0)(x, y/z)\right)$$

is an annihilating polynomial of $W^o_{0,0}M^o_{0,0}$. We use Padé-Hermite approximation to find a candidate for the minimal polynomial of $W^o_{0,0}M^o_{0,0}$, that will be called $\phi_0(x, y)$. To prove that $\phi_0(x, y)$ is indeed the minimal polynomial, it suffices to prove that it is an irreducible factor of $P(x, y)$ of multiplicity m and that $Q(x, y) := P(x, y)/\phi_0(x, y)^m$ is not an annihilating polynomial of $W^o_{0,0}M^o_{0,0}$. We verify the first point directly. For the second point, we truncate $W^o_{0,0}M^o_{0,0}$ to order 450 and substitute it for y in $Q(x, y)$. We get a series of valuation less than 450, which proves that $Q(x, y)$ is not an annihilating polynomial of $W^o_{0,0}M^o_{0,0}$. We find the minimal polynomial $\phi_1(x, y)$ of $W^o_{0,1}M^o_{1,0}$ in a similar way.

Now we prove that $\phi(M^e, 0, 0)$ is the minimal polynomial of $W^o_{0,0}M^o_{0,0}+W^o_{0,1}M^o_{1,0}$. We know that

$$S(x, y) = \mathrm{Res}_z \left(\phi_0(x, z),\ \phi_1(x, y + z)\right)$$

is an annihilating of $W^o_{0,0}M^o_{0,0} + W^o_{0,1}M^o_{1,0}$. We verify that $\phi(M^e, 0, 0)$ is an irreducible factor of $S(x, y)$ of multiplicity μ, and that $Q(x, y) := S(x, y)/\phi(M^e, 0, 0)^\mu$ is not an annihilating polynomial of $W^o_{0,0}M^o_{0,0}+W^o_{0,1}M^o_{1,0}$. To see the last point, we truncate $W^o_{0,0}M^o_{0,0} + W^o_{0,1}M^o_{1,0}$ to order 550 and substitute it for y in $Q(x, y)$. We get a series of valuation less than 550, and therefore $Q(x, y)$ is not an annihilating polynomial of $W^o_{0,0}M^o_{0,0} + W^o_{0,1}M^o_{1,0}$.

Finally, the first 16 terms of $M^e_{0,0}$ and $W^o_{0,0}M^o_{0,0} + W^o_{0,1}M^o_{1,0}$ coincide. As these first terms determine a unique solution of $\phi(M^e, 0, 0)$, we know that the two series are one and the same. □

Define

$$R^e = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \qquad \text{and} \qquad R^o = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}.$$

Lemma 2.2. *For all integers $k \ge 2$ and $u = 2^{2k-1}$, the following identities hold.*

$$\begin{aligned} M^e[:10u] &= M^e[:5u] + x^{2u}M^e[:3u] + x^{3u}M^e[:2u] + x^{2u}M^e[:5u] + x^{4u}M^e[:3u] \\ &\quad + x^{5u}M^e[:2u] + x^{3u}M^e[:5u] + x^{5u}M^e[:3u] + x^{6u}M^e[:2u] \\ &\quad + x^{4u}M^e[:5u] + x^{6u}M^e[:3u] + x^{7u}M^e[:2u] + x^{5u}M^e[:5u] \\ &\quad + x^{7u}M^e[:3u] + x^{8u}M^e[:2u] + x^{9u}M^e[:u] \\ &\quad + (x^{5u} + x^{7u} + x^{8u} + x^{9u})R^e, \\ W^e[:10u] &= W^e[:5u] + x^{2u}W^e[:3u] + x^{3u}W^e[:2u] + x^{2u}W^e[:5u] + x^{4u}W^e[:3u] \end{aligned}$$

$$
\begin{aligned}
&+ x^{5u}W^e[:2u] + x^{3u}W^e[:5u] + x^{5u}W^e[:3u] + x^{6u}W^e[:2u]\\
&+ x^{4u}W^e[:5u] + x^{6u}W^e[:3u] + x^{7u}W^e[:2u] + x^{5u}W^e[:5u]\\
&+ x^{7u}W^e[:3u] + x^{8u}W^e[:2u] + x^{9u}W^e[:u]\\
&+ (x^{5u} + x^{7u} + x^{8u} + x^{9u})R^e.
\end{aligned}
$$

For all integers $k \geq 2$ and $u = 2^{2k}$, the following identities hold.

$$
\begin{aligned}
M^o[:10u] &= M^o[:5u] + x^{2u}M^o[:3u] + x^{3u}M^o[:2u] + x^{2u}M^o[:5u] + x^{4u}M^o[:3u]\\
&+ x^{5u}M^o[:2u] + x^{3u}M^o[:5u] + x^{5u}M^o[:3u] + x^{6u}M^o[:2u]\\
&+ x^{4u}M^o[:5u] + x^{6u}M^o[:3u] + x^{7u}M^o[:2u] + x^{5u}M^o[:5u]\\
&+ x^{7u}M^o[:3u] + x^{8u}M^o[:2u] + x^{9u}M^o[:u]\\
&+ (x^{5u} + x^{7u} + x^{8u} + x^{9u})R^o,\\
W^o[:10u] &= W^o[:5u] + x^{2u}W^o[:3u] + x^{3u}W^o[:2u] + x^{2u}W^o[:5u] + x^{4u}W^o[:3u]\\
&+ x^{5u}W^o[:2u] + x^{3u}W^o[:5u] + x^{5u}W^o[:3u] + x^{6u}W^o[:2u]\\
&+ x^{4u}W^o[:5u] + x^{6u}W^o[:3u] + x^{7u}W^o[:2u] + x^{5u}W^o[:5u]\\
&+ x^{7u}W^o[:3u] + x^{8u}W^o[:2u] + x^{9u}W^o[:u]\\
&+ (x^{5u} + x^{7u} + x^{8u} + x^{9u})R^o.
\end{aligned}
$$

Proof. To prove Lemma 2.2 we first construct an automaton for each sequence concerned, and then transform the conditions on infinitely many k's into finitely many conditions on the states of the automaton. In the following, we will prove that for $T = M^o_{0,0}$, for all integer $k \geq 2$ and $u = 2^{2k}$,

$$
\begin{aligned}
T[:10u] &= T[:5u] + x^{2u}T[:3u] + x^{3u}T[:2u] + x^{2u}T[:5u] + x^{4u}T[:3u] + x^{5u}T[:2u]\\
&+ x^{3u}T[:5u] + x^{5u}T[:3u] + x^{6u}T[:2u] + x^{4u}T[:5u] + x^{6u}T[:3u]\\
&+ x^{7u}T[:2u] + x^{5u}T[:5u] + x^{7u}T[:3u] + x^{8u}T[:2u] + x^{9u}T[:u].
\end{aligned}
$$

The proof of the other 15 cases are similar. We break down the above identity into 5 parts:

$$
\begin{aligned}
0 &= x^{5u}T[:u] + x^{3u}T[2u:3u] + x^{2u}T[3u:4u] + T[5u:6u],\\
0 &= x^{5u}T[u:2u] + x^{3u}T[3u:4u] + x^{2u}T[4u:5u] + T[6u:7u],\\
0 &= x^{4u}T[3u:4u] + x^{3u}T[4u:5u] + T[7u:8u],\\
0 &= x^{8u}T[:u] + x^{6u}T[2u:3u] + x^{5u}T[3u:4u] + x^{4u}T[4u:5u] + T[8u:9u],\\
0 &= x^{9u}T[:u] + x^{8u}T[u:2u] + x^{7u}T[2u:3u] + x^{5u}T[4u:5u] + T[9u:10u],
\end{aligned}
$$

which can be rewritten as

$$0 = T[[w]_2] + T[[10w]_2] + T[[11w]_2] + T[[101w]_2], \tag{2.7}$$

$$0 = T[[1w]_2] + T[[11w]_2] + T[[100w]_2] + T[[110w]_2], \tag{2.8}$$

$$0 = T[[11w]_2] + T[[100w]_2] + T[[111w]_2], \tag{2.9}$$

$$0 = T[[w]_2] + T[[10w]_2] + T[[11w]_2] + T[[100w]_2] + T[[1000w]_2], \tag{2.10}$$

$$0 = T[[w]_2] + T[[1w]_2] + T[[10w]_2] + T[[100w]_2] + T[[1001w]_2], \tag{2.11}$$

for all binary word w of length $2k$ and $w \neq 0^{2k}$, and

$$0 = T[[w]_2] + T[[10w]_2] + T[[11w]_2] + T[[101w]_2], \tag{2.12}$$

$$0 = T[[1w]_2] + T[[11w]_2] + T[[100w]_2] + T[[110w]_2], \tag{2.13}$$

$$0 = T[[11w]_2] + T[[100w]_2] + T[[111w]_2], \tag{2.14}$$

$$0 = T[[w]_2] + T[[10w]_2] + T[[11w]_2] + T[[100w]_2] + T[[1000w]_2], \tag{2.15}$$

$$0 = T[[w]_2] + T[[1w]_2] + T[[10w]_2] + T[[100w]_2] + T[[1001w]_2], \tag{2.16}$$

for $w = 0^{2k}$.

First we calculate an 2-automaton that generates T from its minimal polynomial and its first terms. This automaton has 2046 states; its transition function and output function can be found in the annex. Let $A(s, w)$ denote the state reached after reading w from right to left starting from the state s, and τ the output function. Define

$$E_{2k} = \{A(i, w) : |w| = 2k, w \neq 0^{2k}\}.$$

Identities (2.7) through (2.16) can be written as

$$0 = \tau(A(s, \epsilon)) + \tau(A(s, 10)) + \tau(A(s, 11)) + \tau(A(s, 101)), \tag{2.17}$$

$$0 = \tau(A(s, 1)) + \tau(A(s, 11)) + \tau(A(s, 100)) + \tau(A(s, 110)), \tag{2.18}$$

$$0 = \tau(A(s, 11)) + \tau(A(s, 100)) + \tau(A(s, 111)), \tag{2.19}$$

$$\begin{aligned} 0 = {} & \tau(A(s, \epsilon)) + \tau(A(s, 10)) + \tau(A(s, 11)) + \tau(A(s, 100)) \\ & + \tau(A(s, 1000)), \end{aligned} \tag{2.20}$$

$$\begin{aligned} 0 = {} & \tau(A(s, \epsilon)) + \tau(A(s, 1)) + \tau(A(s, 10)) + \tau(A(s, 100)) \\ & + \tau(A(s, 1001)), \end{aligned} \tag{2.21}$$

for all $s \in E_{2k}$, and

$$0 = \tau(A(s, \epsilon)) + \tau(A(s, 10)) + \tau(A(s, 11)) + \tau(A(s, 101)), \tag{2.22}$$

$$0 = \tau(A(s, 1)) + \tau(A(s, 11)) + \tau(A(s, 100)) + \tau(A(s, 110)), \tag{2.23}$$

$$0 = \tau(A(s, 11)) + \tau(A(s, 100)) + \tau(A(s, 111)), \tag{2.24}$$

$$\begin{aligned} 0 = {} & \tau(A(s, \epsilon)) + \tau(A(s, 10)) + \tau(A(s, 11)) + \tau(A(s, 100)) \\ & + \tau(A(s, 1000)), \end{aligned} \tag{2.25}$$

$$\begin{aligned} 0 = {} & \tau(A(s, \epsilon)) + \tau(A(s, 1)) + \tau(A(s, 10)) + \tau(A(s, 100)) \\ & + \tau(A(s, 1001)), \end{aligned} \tag{2.26}$$

for $s = A(i, 0^{2k})$. We find that $(A(i, 0^{40}), E_{40}) = (A(i, 0^{20}), E_{20})$, so that we only have to verify that identities (2.17) through (2.26) hold for $2 \leq k \leq 20$, which turns out to be true. $\square$

In the following lemma, we express M_{2k}, M_{2k+1}, W_{2k}, and W_{2k+1} in terms of M^e, M^o, W^e, and W^o.

Lemma 2.3. *For all integer $k \geq 2$, and $u = 2^{2k-1}$,*

$$M_{2k} = M^e[:5u] + x^{2u} M^e[:3u] + x^{3u} M^e[:2u] + x^{5u} R^e,$$
$$W_{2k} = W^e[:5u] + x^{2u} W^e[:3u] + x^{3u} W^e[:2u] + x^{5u} R^e.$$

For all integer $k \geq 2$, and $u = 2^{2k}$,

$$M_{2k+1} = M^o[:5u] + x^{2u} M^o[:3u] + x^{3u} M^o[:2u] + x^{5u} R^o,$$

$$W_{2k+1} = W^o[:5u] + x^{2u}W^o[:3u] + x^{3u}W^o[:2u] + x^{5u}R^o.$$

Proof. We call the four identities in Lemma 2.3 also by the name M_{2k}, W_{2k}, M_{2k+1}, and W_{2k+1}. For $n = 2$, the identities can be verified directly. For $n \geq 2$, we claim that

$$M_{2k} \wedge W_{2k} \Rightarrow M_{2k+1} \wedge W_{2k+1},$$
$$M_{2k+1} \wedge W_{2k+1} \Rightarrow M_{2k+2} \wedge W_{2k+2}.$$

We give the proof of

$$M_{2k} \wedge W_{2k} \Rightarrow M_{2k+1},$$

the other ones being similar. Set $u = 2^{2k}$ and $v = 2^{2k-1}$. By definition and induction hypothesis, the left side of identity M_{2k+1} is equal to

$$\begin{aligned} W_{2k}M_{2k} = \big(W^e[:5v] + x^{2v}W^e[:3v] + x^{3v}W^e[:2v] + x^{5u}R^e\big) \times \big(M^e[:5v] \\ + x^{2v}M^e[:3v] + x^{3v}M^e[:2v] + x^{5u}R^e\big); \end{aligned} \tag{2.27}$$

Call this expression lhs. Note that both sides of identity M_{2k+1} have the same term of highest degree $x^{10v}R^o$. Therefore we only need to prove that their difference is $O(x^{10v})$. Using Lemma 2.1 it can be seen that the right side of identity M_{2k+1} is congruent, modulo x^{10v}, to

$$W^e[:10v]M^e[:10v] + x^{4v}W^e[:6v]M^e[:6v] + x^{6v}W^e[:4v]M^e[:4v].$$

For all $n \leq 10$, replace the occurrences of $W^e[:n \cdot v]$ and $M^e[:n \cdot v]$ in the above expression by the reduction modulo $x^{n \cdot v}$ of the right side of the corresponding identity in Lemma 2.2 and get a new expression, which we call rhs. Define

$$\begin{aligned} X &:= x^v, \\ a_n &:= W^e[n \cdot v : (n+1) \cdot v]/X^n, \\ b_n &:= M^e[n \cdot v : (n+1) \cdot v]/X^n, \\ c &:= R^e. \end{aligned}$$

Using the notation introduced above, we can represent the expressions lhs (2.27) and rhs as polynomials in $\mathbb{F}_2[a_1, ..., a_{10}, b_1, ..., b_{10}, c][X]$. Note that it is not a problem that a_j commutes with b_k while W^e does not commute with M^e, because in the expressions concerned, the products of W^e-terms and M^e-terms are always in the same order. We let the computer do the simplification and check that the difference between these two polynomials is indeed $O(X^{10})$, which completes the proof. $\square$

Proof of Theorem 1.1. We prove the theorem for $\mathrm{CF}(a, b)$; for $\mathrm{CF}(b, a)$, the proof is similar. By Lemma 2.3, we have For all $0 \leq j, k \leq 1$,

$$\begin{aligned} \lim_{n\to\infty} M_{2n,j,k} &= M^e_{j,k}, \\ \lim_{n\to\infty} M_{2n+1,j,k} &= M^o_{j,k}, \\ \lim_{n\to\infty} W_{2n,j,k} &= W^e_{j,k}, \\ \lim_{n\to\infty} W_{2n+1,j,k} &= W^o_{j,k}. \end{aligned}$$

Let $z = 1/x$. By the convergence theorem and identity (2.2),

$$\mathrm{CF}(a, b) = \frac{M^e_{0,1}(x)}{M^e_{0,0}(x)}.$$

By definition, $\phi(M^e,0,1)$ and $\phi(M^e,0,0)$ are minimal polynomials of $M^e_{0,1}$ and $M^e_{0,0}$. Therefore

$$P(x,y)=\mathrm{Res}_t\left(\phi(M^e,0,1)(x,t),y^{12}\phi(M^e,0,1)(x,t/y)\right)$$

is an annihilating polynomial of $f(x)=M^e_{0,1}/M^e_{0,0}$.

Define

$$Q(x,y)=q_4(x)y^4+q_3(x)y^3+q_2(x)y^2+q_1(x)y+q_0(x),$$

where

$$\begin{aligned}
q_0(x)&=x^{20}+x^{19}+x^{17}+x^{16}+x^{14}+x^{13}+x^9+x^8+x^7+x^5+x^4,\\
q_1(x)&=x^{19}+x^{18}+x^{17}+x^{16}+x^{15}+x^{12}+x^8+x^7+x^6+x^4+x^3+x,\\
q_2(x)&=x^{18}+x^{12}+x^8+x^2+1,\\
q_3(x)&=x^{19}+x^{18}+x^{17}+x^{16}+x^{15}+x^{12}+x^8+x^7+x^6+x^4+x^3+x,\\
q_4(x)&=x^{19}+x^{18}+x^{17}+x^{14}+x^{13}+x^9+x^7+x^5+x^2.
\end{aligned}$$

The polynomial $Q(x,y)$ is the candidate for the minimal polynomial of $f(x)$ found by Padé-Hermite approximation. To prove that it is indeed the minimal polynomial of $f(x)$, we only need to prove that it is an irreducible factor of $P(x,y)$ of multiplicity m and $R(x,y):=P(x,y)/Q(x,y)^m$ is not an annihilating polynomial of $f(x)$. We verify the first point directly. For the second point, we find that when we truncate $f(x)$ to order 156, and substitute it for y in $R(z,y)$, we get a series with valuation smaller than 156, which proves that $R(z,y)$ is not an annihilating polynomial of $f(x)$. Finally, $z^{12}Q(1/z,y)$ is the minimal polynomial of $\mathrm{CF}(a,b)=f(1/z)$. □

3. Annexe

All 16 polynomials are of the form

$$p_0(x)+p_3(x)y^3+p_6(x)y^6+p_9(x)y^9+p_{12}(x)y^{12}.$$

The coefficients $p_j(x)$ and the 16 initial terms to determine the solutions uniquely are given below.

For $\phi(M^e,0,0)$:

$$\begin{aligned}
p_0(x)&=x^{114}+x^{112}+x^{108}+x^{100}+x^{98}+x^{96}+x^{94}+x^{92}+x^{88}+x^{84}+x^{82}\\
&\quad+x^{76}+x^{70}+x^{66}+x^{62}+x^{60}+x^{58}+x^{56}+x^{54}+x^{50}+x^{48}+x^{44}\\
&\quad+x^{40}+x^{36}+x^{32}+x^{30}+x^{26}+x^{24}+x^{22}+x^{18}+x^{12},\\
p_3(x)&=x^{110}+x^{106}+x^{104}+x^{102}+x^{100}+x^{98}+x^{92}+x^{90}+x^{86}+x^{84}+x^{78}\\
&\quad+x^{76}+x^{72}+x^{62}+x^{60}+x^{58}+x^{56}+x^{48}+x^{44}+x^{42}+x^{38}+x^{34}\\
&\quad+x^{30}+x^{28}+x^{24}+x^{22}+x^{12}+x^8,\\
p_6(x)&=x^{108}+x^{106}+x^{104}+x^{100}+x^{88}+x^{82}+x^{80}+x^{70}+x^{66}+x^{64}+x^{60}\\
&\quad+x^{58}+x^{48}+x^{46}+x^{40}+x^{38}+x^{34}+x^{32}+x^{22}+x^{20}+x^8+x^4+x^2\\
&\quad+1,\\
p_9(x)&=x^{112}+x^{110}+x^{106}+x^{102}+x^{96}+x^{88}+x^{84}+x^{82}+x^{76}+x^{74}+x^{70}\\
&\quad+x^{66}+x^{60}+x^{56}+x^{54}+x^{52}+x^{50}+x^{48}+x^{44}+x^{42}+x^{40}+x^{38}\\
&\quad+x^{36}+x^{32}+x^{30}+x^{24}+x^{22}+x^{20}+x^{10}+x^6+x^4+x^2,
\end{aligned}$$

$$p_{12}(x) = x^{112} + x^{104} + x^{96} + x^{88} + x^{72} + x^{64} + x^{40} + x^{32} + x^{24} + x^{16} + 1,$$

and the initial terms are [1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0].

For $\phi(M^e, 0, 1)$:

$$\begin{aligned}
p_0(x) &= x^{105} + x^{104} + x^{99} + x^{98} + x^{96} + x^{95} + x^{93} + x^{92} + x^{91} + x^{90} + x^{85} \\
&\quad + x^{84} + x^{79} + x^{78} + x^{76} + x^{73} + x^{72} + x^{71} + x^{65} + x^{64} + x^{61} + x^{60} \\
&\quad + x^{59} + x^{58} + x^{54} + x^{51} + x^{50} + x^{45} + x^{43} + x^{41} + x^{40} + x^{39} + x^{37} \\
&\quad + x^{35} + x^{33} + x^{29} + x^{26} + x^{25} + x^{20} + x^{19} + x^{18}, \\
p_3(x) &= x^{103} + x^{99} + x^{97} + x^{95} + x^{91} + x^{85} + x^{81} + x^{79} + x^{77} + x^{75} + x^{71} \\
&\quad + x^{69} + x^{67} + x^{65} + x^{55} + x^{51} + x^{49} + x^{41} + x^{37} + x^{31} + x^{27} + x^{23} \\
&\quad + x^{21} + x^{19} + x^{15} + x^{13} + x^{11} + x^{9}, \\
p_6(x) &= x^{102} + x^{101} + x^{100} + x^{99} + x^{97} + x^{95} + x^{94} + x^{91} + x^{90} + x^{89} + x^{88} \\
&\quad + x^{85} + x^{82} + x^{74} + x^{73} + x^{72} + x^{71} + x^{69} + x^{67} + x^{65} + x^{64} + x^{62} \\
&\quad + x^{60} + x^{59} + x^{56} + x^{54} + x^{53} + x^{49} + x^{48} + x^{47} + x^{45} + x^{43} + x^{42} \\
&\quad + x^{39} + x^{35} + x^{31} + x^{27} + x^{26} + x^{25} + x^{24} + x^{22} + x^{20} + x^{19} + x^{18} \\
&\quad + x^{17} + x^{15} + x^{13} + x^{12} + x^{9} + x^{6}, \\
p_9(x) &= x^{101} + x^{99} + x^{95} + x^{91} + x^{83} + x^{81} + x^{75} + x^{69} + x^{65} + x^{63} + x^{53} \\
&\quad + x^{51} + x^{49} + x^{45} + x^{43} + x^{41} + x^{39} + x^{35} + x^{33} + x^{27} + x^{25} + x^{23} \\
&\quad + x^{21} + x^{19} + x^{17} + x^{9} + x^{5} + x^{3}, \\
p_{12}(x) &= x^{100} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} + x^{52} \\
&\quad + x^{51} + x^{48} + x^{36} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} + x^{12} + x^{4} + x^{3} + 1,
\end{aligned}$$

and the initial terms are [0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0].

For $\phi(M^e, 1, 0)$:

$$\begin{aligned}
p_0(x) &= x^{105} + x^{104} + x^{99} + x^{98} + x^{96} + x^{95} + x^{93} + x^{92} + x^{91} + x^{90} + x^{85} \\
&\quad + x^{84} + x^{79} + x^{78} + x^{76} + x^{73} + x^{72} + x^{71} + x^{65} + x^{64} + x^{61} + x^{60} \\
&\quad + x^{59} + x^{58} + x^{54} + x^{51} + x^{50} + x^{45} + x^{43} + x^{41} + x^{40} + x^{39} + x^{37} \\
&\quad + x^{35} + x^{33} + x^{29} + x^{26} + x^{25} + x^{20} + x^{19} + x^{18}, \\
p_3(x) &= x^{103} + x^{99} + x^{97} + x^{95} + x^{91} + x^{85} + x^{81} + x^{79} + x^{77} + x^{75} + x^{71} \\
&\quad + x^{69} + x^{67} + x^{65} + x^{55} + x^{51} + x^{49} + x^{41} + x^{37} + x^{31} + x^{27} + x^{23} \\
&\quad + x^{21} + x^{19} + x^{15} + x^{13} + x^{11} + x^{9}, \\
p_6(x) &= x^{102} + x^{101} + x^{100} + x^{99} + x^{97} + x^{95} + x^{94} + x^{91} + x^{90} + x^{89} + x^{88} \\
&\quad + x^{85} + x^{82} + x^{74} + x^{73} + x^{72} + x^{71} + x^{69} + x^{67} + x^{65} + x^{64} + x^{62} \\
&\quad + x^{60} + x^{59} + x^{56} + x^{54} + x^{53} + x^{49} + x^{48} + x^{47} + x^{45} + x^{43} + x^{42} \\
&\quad + x^{39} + x^{35} + x^{31} + x^{27} + x^{26} + x^{25} + x^{24} + x^{22} + x^{20} + x^{19} + x^{18} \\
&\quad + x^{17} + x^{15} + x^{13} + x^{12} + x^{9} + x^{6}, \\
p_9(x) &= x^{101} + x^{99} + x^{95} + x^{91} + x^{83} + x^{81} + x^{75} + x^{69} + x^{65} + x^{63} + x^{53}
\end{aligned}$$

$$
\begin{aligned}
&+ x^{51} + x^{49} + x^{45} + x^{43} + x^{41} + x^{39} + x^{35} + x^{33} + x^{27} + x^{25} + x^{23}\\
&+ x^{21} + x^{19} + x^{17} + x^{9} + x^{5} + x^{3},\\
p_{12}(x) &= x^{100} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} + x^{52}\\
&+ x^{51} + x^{48} + x^{36} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} + x^{12} + x^{4} + x^{3} + 1,
\end{aligned}
$$

and the initial terms are [0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0].

For $\phi(M^e, 1, 1)$:

$$
\begin{aligned}
p_0(x) &= x^{96} + x^{90} + x^{88} + x^{86} + x^{84} + x^{78} + x^{74} + x^{66} + x^{62} + x^{46} + x^{44}\\
&+ x^{42} + x^{38} + x^{36} + x^{32} + x^{30} + x^{28} + x^{26} + x^{24},\\
p_3(x) &= x^{90} + x^{84} + x^{76} + x^{70} + x^{68} + x^{66} + x^{64} + x^{62} + x^{56} + x^{54} + x^{46}\\
&+ x^{42} + x^{40} + x^{36} + x^{34} + x^{26} + x^{24} + x^{20} + x^{16} + x^{14} + x^{12} + x^{10}\\
&+ x^{8} + x^{6},\\
p_6(x) &= x^{90} + x^{88} + x^{80} + x^{78} + x^{76} + x^{74} + x^{72} + x^{70} + x^{66} + x^{62} + x^{60}\\
&+ x^{52} + x^{50} + x^{48} + x^{46} + x^{44} + x^{42} + x^{40} + x^{38} + x^{36} + x^{26} + x^{12}\\
&+ x^{2} + 1,\\
p_9(x) &= x^{88} + x^{84} + x^{82} + x^{80} + x^{62} + x^{60} + x^{56} + x^{54} + x^{48} + x^{38} + x^{36}\\
&+ x^{32} + x^{28} + x^{24} + x^{22} + x^{20} + x^{18} + x^{16} + x^{14} + x^{10} + x^{8} + x^{6} + x^{4}\\
&+ x^{2},\\
p_{12}(x) &= x^{88} + x^{86} + x^{80} + x^{72} + x^{70} + x^{64} + x^{56} + x^{54} + x^{48} + x^{24} + x^{22}\\
&+ x^{16} + x^{8} + x^{6} + 1,
\end{aligned}
$$

and the initial terms are [0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0].

For $\phi(W^e, 0, 0)$:

$$
\begin{aligned}
p_0(x) &= x^{96} + x^{92} + x^{86} + x^{80} + x^{78} + x^{72} + x^{70} + x^{68} + x^{66} + x^{64} + x^{62}\\
&+ x^{60} + x^{56} + x^{54} + x^{52} + x^{48} + x^{46} + x^{38} + x^{32} + x^{30} + x^{28} + x^{16}\\
&+ x^{12},\\
p_3(x) &= x^{90} + x^{86} + x^{84} + x^{82} + x^{76} + x^{70} + x^{68} + x^{64} + x^{58} + x^{56} + x^{54}\\
&+ x^{50} + x^{46} + x^{40} + x^{38} + x^{36} + x^{34} + x^{30} + x^{26} + x^{24} + x^{22} + x^{20}\\
&+ x^{18} + x^{16} + x^{14} + x^{12} + x^{10} + x^{8},\\
p_6(x) &= x^{90} + x^{88} + x^{86} + x^{84} + x^{76} + x^{72} + x^{66} + x^{64} + x^{58} + x^{56} + x^{54}\\
&+ x^{52} + x^{46} + x^{44} + x^{38} + x^{34} + x^{28} + x^{26} + x^{20} + x^{16} + x^{12} + x^{10}\\
&+ x^{6} + x^{4} + x^{2} + 1,\\
p_9(x) &= x^{88} + x^{84} + x^{82} + x^{80} + x^{62} + x^{60} + x^{56} + x^{54} + x^{48} + x^{38} + x^{36}\\
&+ x^{32} + x^{28} + x^{24} + x^{22} + x^{20} + x^{18} + x^{16} + x^{14} + x^{10} + x^{8} + x^{6} + x^{4}\\
&+ x^{2},\\
p_{12}(x) &= x^{88} + x^{86} + x^{80} + x^{72} + x^{70} + x^{64} + x^{56} + x^{54} + x^{48} + x^{24} + x^{22}\\
&+ x^{16} + x^{8} + x^{6} + 1,
\end{aligned}
$$

and the initial terms are [1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0].

For $\phi(W^e, 0, 1)$:

$$\begin{aligned}
p_0(x) &= x^{105} + x^{102} + x^{100} + x^{98} + x^{96} + x^{94} + x^{93} + x^{92} + x^{91} + x^{88} + x^{85} \\
&+ x^{83} + x^{82} + x^{79} + x^{75} + x^{74} + x^{73} + x^{72} + x^{70} + x^{68} + x^{66} + x^{65} \\
&+ x^{63} + x^{62} + x^{61} + x^{60} + x^{56} + x^{54} + x^{53} + x^{52} + x^{50} + x^{48} + x^{46} \\
&+ x^{45} + x^{43} + x^{42} + x^{41} + x^{40} + x^{37} + x^{36} + x^{35} + x^{34} + x^{33} + x^{29} \\
&+ x^{28} + x^{26} + x^{25} + x^{24} + x^{21}, \\
p_3(x) &= x^{103} + x^{99} + x^{97} + x^{95} + x^{91} + x^{85} + x^{81} + x^{79} + x^{77} + x^{75} + x^{71} \\
&+ x^{69} + x^{67} + x^{65} + x^{55} + x^{51} + x^{49} + x^{41} + x^{37} + x^{31} + x^{27} + x^{23} \\
&+ x^{21} + x^{19} + x^{15} + x^{13} + x^{11} + x^{9}, \\
p_6(x) &= x^{102} + x^{101} + x^{100} + x^{99} + x^{97} + x^{95} + x^{94} + x^{91} + x^{90} + x^{89} + x^{88} \\
&+ x^{85} + x^{82} + x^{74} + x^{73} + x^{72} + x^{71} + x^{69} + x^{67} + x^{65} + x^{64} + x^{62} \\
&+ x^{60} + x^{59} + x^{56} + x^{54} + x^{53} + x^{49} + x^{48} + x^{47} + x^{45} + x^{43} + x^{42} \\
&+ x^{39} + x^{35} + x^{31} + x^{27} + x^{26} + x^{25} + x^{24} + x^{22} + x^{20} + x^{19} + x^{18} \\
&+ x^{17} + x^{15} + x^{13} + x^{12} + x^{9} + x^{6}, \\
p_9(x) &= x^{101} + x^{99} + x^{95} + x^{91} + x^{83} + x^{81} + x^{75} + x^{69} + x^{65} + x^{63} + x^{53} \\
&+ x^{51} + x^{49} + x^{45} + x^{43} + x^{41} + x^{39} + x^{35} + x^{33} + x^{27} + x^{25} + x^{23} \\
&+ x^{21} + x^{19} + x^{17} + x^{9} + x^{5} + x^{3}, \\
p_{12}(x) &= x^{100} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} + x^{52} \\
&+ x^{51} + x^{48} + x^{36} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} + x^{12} + x^{4} + x^{3} + 1,
\end{aligned}$$

and the initial terms are [0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1].

For $\phi(W^e, 1, 0)$:

$$\begin{aligned}
p_0(x) &= x^{105} + x^{102} + x^{100} + x^{98} + x^{96} + x^{94} + x^{93} + x^{92} + x^{91} + x^{88} + x^{85} \\
&+ x^{83} + x^{82} + x^{79} + x^{75} + x^{74} + x^{73} + x^{72} + x^{70} + x^{68} + x^{66} + x^{65} \\
&+ x^{63} + x^{62} + x^{61} + x^{60} + x^{56} + x^{54} + x^{53} + x^{52} + x^{50} + x^{48} + x^{46} \\
&+ x^{45} + x^{43} + x^{42} + x^{41} + x^{40} + x^{37} + x^{36} + x^{35} + x^{34} + x^{33} + x^{29} \\
&+ x^{28} + x^{26} + x^{25} + x^{24} + x^{21}, \\
p_3(x) &= x^{103} + x^{99} + x^{97} + x^{95} + x^{91} + x^{85} + x^{81} + x^{79} + x^{77} + x^{75} + x^{71} \\
&+ x^{69} + x^{67} + x^{65} + x^{55} + x^{51} + x^{49} + x^{41} + x^{37} + x^{31} + x^{27} + x^{23} \\
&+ x^{21} + x^{19} + x^{15} + x^{13} + x^{11} + x^{9}, \\
p_6(x) &= x^{102} + x^{101} + x^{100} + x^{99} + x^{97} + x^{95} + x^{94} + x^{91} + x^{90} + x^{89} + x^{88} \\
&+ x^{85} + x^{82} + x^{74} + x^{73} + x^{72} + x^{71} + x^{69} + x^{67} + x^{65} + x^{64} + x^{62} \\
&+ x^{60} + x^{59} + x^{56} + x^{54} + x^{53} + x^{49} + x^{48} + x^{47} + x^{45} + x^{43} + x^{42} \\
&+ x^{39} + x^{35} + x^{31} + x^{27} + x^{26} + x^{25} + x^{24} + x^{22} + x^{20} + x^{19} + x^{18} \\
&+ x^{17} + x^{15} + x^{13} + x^{12} + x^{9} + x^{6},
\end{aligned}$$

$$\begin{aligned}
p_9(x) &= x^{101} + x^{99} + x^{95} + x^{91} + x^{83} + x^{81} + x^{75} + x^{69} + x^{65} + x^{63} + x^{53} \\
&\quad + x^{51} + x^{49} + x^{45} + x^{43} + x^{41} + x^{39} + x^{35} + x^{33} + x^{27} + x^{25} + x^{23} \\
&\quad + x^{21} + x^{19} + x^{17} + x^{9} + x^{5} + x^{3}, \\
p_{12}(x) &= x^{100} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} + x^{52} \\
&\quad + x^{51} + x^{48} + x^{36} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} + x^{12} + x^{4} + x^{3} + 1,
\end{aligned}$$

and the initial terms are [0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1].

For $\phi(W^e, 1, 1)$:

$$\begin{aligned}
p_0(x) &= x^{114} + x^{110} + x^{108} + x^{106} + x^{104} + x^{102} + x^{100} + x^{98} + x^{94} + x^{88} \\
&\quad + x^{86} + x^{84} + x^{82} + x^{78} + x^{74} + x^{72} + x^{62} + x^{56} + x^{54} + x^{44} + x^{36} \\
&\quad + x^{34} + x^{30}, \\
p_3(x) &= x^{108} + x^{106} + x^{104} + x^{102} + x^{98} + x^{90} + x^{84} + x^{72} + x^{70} + x^{62} + x^{60} \\
&\quad + x^{58} + x^{56} + x^{54} + x^{52} + x^{48} + x^{46} + x^{44} + x^{42} + x^{38} + x^{34} + x^{30} \\
&\quad + x^{28} + x^{24} + x^{22} + x^{14} + x^{8} + x^{6}, \\
p_6(x) &= x^{110} + x^{108} + x^{106} + x^{92} + x^{86} + x^{84} + x^{82} + x^{78} + x^{68} + x^{66} + x^{64} \\
&\quad + x^{60} + x^{58} + x^{54} + x^{44} + x^{38} + x^{34} + x^{24} + x^{22} + x^{20} + x^{16} + x^{14} \\
&\quad + x^{8} + x^{6} + x^{2} + 1, \\
p_9(x) &= x^{112} + x^{110} + x^{106} + x^{102} + x^{96} + x^{88} + x^{84} + x^{82} + x^{76} + x^{74} + x^{70} \\
&\quad + x^{66} + x^{60} + x^{56} + x^{54} + x^{52} + x^{50} + x^{48} + x^{44} + x^{42} + x^{40} + x^{38} \\
&\quad + x^{36} + x^{32} + x^{30} + x^{24} + x^{22} + x^{20} + x^{10} + x^{6} + x^{4} + x^{2}, \\
p_{12}(x) &= x^{112} + x^{104} + x^{96} + x^{88} + x^{72} + x^{64} + x^{40} + x^{32} + x^{24} + x^{16} + 1,
\end{aligned}$$

and the initial terms are [0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0].

For $\phi(M^o, 0, 0)$:

$$\begin{aligned}
p_0(x) &= x^{105} + x^{104} + x^{103} + x^{99} + x^{98} + x^{97} + x^{95} + x^{94} + x^{92} + x^{91} + x^{90} \\
&\quad + x^{89} + x^{87} + x^{84} + x^{77} + x^{76} + x^{74} + x^{73} + x^{71} + x^{70} + x^{68} + x^{67} \\
&\quad + x^{66} + x^{64} + x^{63} + x^{60} + x^{59} + x^{57} + x^{55} + x^{54} + x^{51} + x^{48} + x^{47} \\
&\quad + x^{46} + x^{45} + x^{42} + x^{41} + x^{40} + x^{38} + x^{35} + x^{33} + x^{29} + x^{28} + x^{27} \\
&\quad + x^{25} + x^{24} + x^{21} + x^{18} + x^{15} + x^{14} + x^{12}, \\
p_3(x) &= x^{104} + x^{102} + x^{101} + x^{100} + x^{96} + x^{94} + x^{93} + x^{92} + x^{89} + x^{84} + x^{83} \\
&\quad + x^{81} + x^{76} + x^{74} + x^{73} + x^{72} + x^{70} + x^{69} + x^{68} + x^{62} + x^{61} + x^{58} \\
&\quad + x^{56} + x^{51} + x^{50} + x^{48} + x^{46} + x^{45} + x^{42} + x^{41} + x^{38} + x^{37} + x^{34} \\
&\quad + x^{32} + x^{30} + x^{29} + x^{27} + x^{25} + x^{22} + x^{21} + x^{20} + x^{17} + x^{16} + x^{11} \\
&\quad + x^{10} + x^{8}, \\
p_6(x) &= x^{104} + x^{102} + x^{101} + x^{100} + x^{99} + x^{98} + x^{97} + x^{96} + x^{95} + x^{90} + x^{86} \\
&\quad + x^{83} + x^{80} + x^{78} + x^{75} + x^{74} + x^{72} + x^{70} + x^{69} + x^{65} + x^{63} + x^{62} \\
&\quad + x^{61} + x^{59} + x^{54} + x^{50} + x^{48} + x^{47} + x^{45} + x^{42} + x^{41} + x^{38} + x^{37}
\end{aligned}$$

$$
\begin{aligned}
&+ x^{36} + x^{35} + x^{34} + x^{31} + x^{30} + x^{28} + x^{27} + x^{26} + x^{25} + x^{24} + x^{23} \\
&+ x^{22} + x^{20} + x^{19} + x^{15} + x^{13} + x^{11} + x^{10} + x^{8} + x^{7} + x^{6} + x^{3} + 1, \\
p_9(x) &= x^{104} + x^{103} + x^{100} + x^{56} + x^{55} + x^{52} + x^{40} + x^{39} + x^{36} + x^{8} + x^{7} \\
&+ x^{4}, \\
p_{12}(x) &= x^{104} + x^{103} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} \\
&+ x^{56} + x^{55} + x^{51} + x^{48} + x^{40} + x^{39} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} \\
&+ x^{12} + x^{8} + x^{7} + x^{3} + 1,
\end{aligned}
$$

and the initial terms are [1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 0, 1].
For $\phi(M^o, 0, 1)$:

$$
\begin{aligned}
p_0(x) &= x^{104} + x^{101} + x^{98} + x^{94} + x^{92} + x^{91} + x^{90} + x^{89} + x^{88} + x^{86} + x^{85} \\
&+ x^{82} + x^{80} + x^{79} + x^{75} + x^{74} + x^{71} + x^{66} + x^{65} + x^{61} + x^{60} + x^{59} \\
&+ x^{58} + x^{56} + x^{55} + x^{51} + x^{50} + x^{49} + x^{46} + x^{45} + x^{43} + x^{41} + x^{40} \\
&+ x^{38} + x^{35} + x^{34} + x^{32} + x^{27} + x^{26} + x^{24} + x^{23} + x^{19} + x^{18}, \\
p_3(x) &= x^{97} + x^{96} + x^{95} + x^{94} + x^{92} + x^{90} + x^{89} + x^{86} + x^{82} + x^{78} + x^{74} \\
&+ x^{73} + x^{72} + x^{71} + x^{68} + x^{65} + x^{49} + x^{48} + x^{47} + x^{46} + x^{44} + x^{42} \\
&+ x^{40} + x^{39} + x^{36} + x^{32} + x^{31} + x^{30} + x^{28} + x^{26} + x^{25} + x^{22} + x^{18} \\
&+ x^{17} + x^{16} + x^{15} + x^{12} + x^{9}, \\
p_6(x) &= x^{98} + x^{96} + x^{94} + x^{92} + x^{88} + x^{86} + x^{82} + x^{70} + x^{68} + x^{66} + x^{64} \\
&+ x^{62} + x^{56} + x^{50} + x^{46} + x^{44} + x^{42} + x^{40} + x^{36} + x^{32} + x^{28} + x^{24} \\
&+ x^{22} + x^{16} + x^{14} + x^{12} + x^{10} + x^{6}, \\
p_9(x) &= x^{99} + x^{98} + x^{94} + x^{90} + x^{86} + x^{82} + x^{78} + x^{74} + x^{70} + x^{66} + x^{62} \\
&+ x^{58} + x^{54} + x^{51} + x^{35} + x^{34} + x^{30} + x^{26} + x^{22} + x^{18} + x^{14} + x^{10} \\
&+ x^{6} + x^{3}, \\
p_{12}(x) &= x^{100} + x^{96} + x^{92} + x^{76} + x^{60} + x^{52} + x^{48} + x^{36} + x^{32} + x^{28} + x^{12} \\
&+ x^{4} + 1,
\end{aligned}
$$

and the initial terms are [0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1].
For $\phi(M^o, 1, 0)$:

$$
\begin{aligned}
p_0(x) &= x^{114} + x^{113} + x^{112} + x^{111} + x^{109} + x^{108} + x^{104} + x^{100} + x^{99} + x^{98} \\
&+ x^{91} + x^{90} + x^{89} + x^{87} + x^{86} + x^{83} + x^{81} + x^{80} + x^{75} + x^{73} + x^{68} \\
&+ x^{67} + x^{66} + x^{64} + x^{61} + x^{60} + x^{59} + x^{56} + x^{55} + x^{52} + x^{51} + x^{49} \\
&+ x^{47} + x^{46} + x^{44} + x^{42} + x^{38} + x^{37} + x^{35} + x^{34} + x^{33} + x^{32} + x^{31} \\
&+ x^{30} + x^{28} + x^{23} + x^{21}, \\
p_3(x) &= x^{113} + x^{112} + x^{111} + x^{110} + x^{109} + x^{107} + x^{105} + x^{104} + x^{101} + x^{97} \\
&+ x^{96} + x^{95} + x^{94} + x^{92} + x^{90} + x^{88} + x^{87} + x^{85} + x^{83} + x^{82} + x^{81} \\
&+ x^{80} + x^{78} + x^{77} + x^{74} + x^{73} + x^{72} + x^{71} + x^{68} + x^{64} + x^{63} + x^{62}
\end{aligned}
$$

$$
\begin{aligned}
&+ x^{61} + x^{59} + x^{55} + x^{54} + x^{51} + x^{49} + x^{48} + x^{44} + x^{43} + x^{42} + x^{41}\\
&+ x^{39} + x^{37} + x^{36} + x^{33} + x^{29} + x^{28} + x^{27} + x^{26} + x^{24} + x^{22} + x^{21}\\
&+ x^{18} + x^{17} + x^{16} + x^{15} + x^{12} + x^{9},\\
p_6(x) &= x^{114} + x^{112} + x^{106} + x^{102} + x^{100} + x^{98} + x^{96} + x^{92} + x^{88} + x^{84} + x^{82}\\
&+ x^{76} + x^{74} + x^{72} + x^{70} + x^{64} + x^{62} + x^{60} + x^{56} + x^{54} + x^{50} + x^{46}\\
&+ x^{44} + x^{42} + x^{40} + x^{38} + x^{34} + x^{30} + x^{28} + x^{22} + x^{18} + x^{16} + x^{14}\\
&+ x^{12} + x^{10} + x^{6},\\
p_9(x) &= x^{115} + x^{114} + x^{111} + x^{99} + x^{98} + x^{94} + x^{90} + x^{86} + x^{82} + x^{78} + x^{74}\\
&+ x^{70} + x^{67} + x^{63} + x^{62} + x^{58} + x^{54} + x^{50} + x^{47} + x^{35} + x^{34} + x^{30}\\
&+ x^{26} + x^{22} + x^{19} + x^{15} + x^{14} + x^{10} + x^{6} + x^{3},\\
p_{12}(x) &= x^{116} + x^{104} + x^{100} + x^{96} + x^{88} + x^{72} + x^{68} + x^{48} + x^{40} + x^{36} + x^{32}\\
&+ x^{24} + x^{20} + x^{4} + 1,
\end{aligned}
$$

and the initial terms are [0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0].
For $\phi(M^o, 1, 1)$:

$$
\begin{aligned}
p_0(x) &= x^{105} + x^{103} + x^{100} + x^{97} + x^{96} + x^{95} + x^{91} + x^{90} + x^{89} + x^{84} + x^{83}\\
&+ x^{82} + x^{80} + x^{79} + x^{77} + x^{76} + x^{75} + x^{70} + x^{69} + x^{68} + x^{66} + x^{63}\\
&+ x^{61} + x^{54} + x^{53} + x^{52} + x^{51} + x^{45} + x^{44} + x^{40} + x^{39} + x^{38} + x^{37}\\
&+ x^{34} + x^{33} + x^{31} + x^{30} + x^{28} + x^{27},\\
p_3(x) &= x^{104} + x^{100} + x^{98} + x^{95} + x^{92} + x^{91} + x^{90} + x^{89} + x^{87} + x^{83} + x^{81}\\
&+ x^{80} + x^{79} + x^{78} + x^{77} + x^{73} + x^{72} + x^{67} + x^{66} + x^{64} + x^{62} + x^{61}\\
&+ x^{58} + x^{56} + x^{54} + x^{53} + x^{51} + x^{47} + x^{46} + x^{45} + x^{43} + x^{42} + x^{41}\\
&+ x^{40} + x^{38} + x^{37} + x^{36} + x^{35} + x^{34} + x^{32} + x^{31} + x^{26} + x^{25} + x^{23}\\
&+ x^{18} + x^{17} + x^{16} + x^{14} + x^{13} + x^{12},\\
p_6(x) &= x^{104} + x^{100} + x^{99} + x^{98} + x^{94} + x^{92} + x^{89} + x^{88} + x^{87} + x^{86} + x^{85}\\
&+ x^{84} + x^{83} + x^{82} + x^{80} + x^{78} + x^{76} + x^{73} + x^{70} + x^{63} + x^{61} + x^{60}\\
&+ x^{56} + x^{53} + x^{52} + x^{51} + x^{50} + x^{49} + x^{47} + x^{44} + x^{43} + x^{41} + x^{40}\\
&+ x^{38} + x^{37} + x^{34} + x^{30} + x^{27} + x^{24} + x^{23} + x^{20} + x^{19} + x^{18} + x^{17}\\
&+ x^{15} + x^{12} + x^{10} + x^{9} + x^{8} + x^{4} + x^{3} + 1,\\
p_9(x) &= x^{104} + x^{103} + x^{100} + x^{56} + x^{55} + x^{52} + x^{40} + x^{39} + x^{36} + x^{8} + x^{7}\\
&+ x^{4},\\
p_{12}(x) &= x^{104} + x^{103} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60}\\
&+ x^{56} + x^{55} + x^{51} + x^{48} + x^{40} + x^{39} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15}\\
&+ x^{12} + x^{8} + x^{7} + x^{3} + 1,
\end{aligned}
$$

and the initial terms are [0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1].

For $\phi(W^o, 0, 0)$:

$$\begin{aligned}
p_0(x) &= x^{105} + x^{104} + x^{103} + x^{99} + x^{98} + x^{97} + x^{95} + x^{94} + x^{92} + x^{91} + x^{90} \\
&\quad + x^{89} + x^{87} + x^{84} + x^{77} + x^{76} + x^{74} + x^{73} + x^{71} + x^{70} + x^{68} + x^{67} \\
&\quad + x^{66} + x^{64} + x^{63} + x^{60} + x^{59} + x^{57} + x^{55} + x^{54} + x^{51} + x^{48} + x^{47} \\
&\quad + x^{46} + x^{45} + x^{42} + x^{41} + x^{40} + x^{38} + x^{35} + x^{33} + x^{29} + x^{28} + x^{27} \\
&\quad + x^{25} + x^{24} + x^{21} + x^{18} + x^{15} + x^{14} + x^{12}, \\
p_3(x) &= x^{104} + x^{102} + x^{101} + x^{100} + x^{96} + x^{94} + x^{93} + x^{92} + x^{89} + x^{84} + x^{83} \\
&\quad + x^{81} + x^{76} + x^{74} + x^{73} + x^{72} + x^{70} + x^{69} + x^{68} + x^{62} + x^{61} + x^{58} \\
&\quad + x^{56} + x^{51} + x^{50} + x^{48} + x^{46} + x^{45} + x^{42} + x^{41} + x^{38} + x^{37} + x^{34} \\
&\quad + x^{32} + x^{30} + x^{29} + x^{27} + x^{25} + x^{22} + x^{21} + x^{20} + x^{17} + x^{16} + x^{11} \\
&\quad + x^{10} + x^{8}, \\
p_6(x) &= x^{104} + x^{102} + x^{101} + x^{100} + x^{99} + x^{98} + x^{97} + x^{96} + x^{95} + x^{90} + x^{86} \\
&\quad + x^{83} + x^{80} + x^{78} + x^{75} + x^{74} + x^{72} + x^{70} + x^{69} + x^{65} + x^{63} + x^{62} \\
&\quad + x^{61} + x^{59} + x^{54} + x^{50} + x^{48} + x^{47} + x^{45} + x^{42} + x^{41} + x^{38} + x^{37} \\
&\quad + x^{36} + x^{35} + x^{34} + x^{31} + x^{30} + x^{28} + x^{27} + x^{26} + x^{25} + x^{24} + x^{23} \\
&\quad + x^{22} + x^{20} + x^{19} + x^{15} + x^{13} + x^{11} + x^{10} + x^{8} + x^{7} + x^{6} + x^{3} + 1, \\
p_9(x) &= x^{104} + x^{103} + x^{100} + x^{56} + x^{55} + x^{52} + x^{40} + x^{39} + x^{36} + x^{8} + x^{7} \\
&\quad + x^{4}, \\
p_{12}(x) &= x^{104} + x^{103} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} \\
&\quad + x^{56} + x^{55} + x^{51} + x^{48} + x^{40} + x^{39} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} \\
&\quad + x^{12} + x^{8} + x^{7} + x^{3} + 1,
\end{aligned}$$

and the initial terms are [1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 0, 1].

For $\phi(W^o, 0, 1)$:

$$\begin{aligned}
p_0(x) &= x^{114} + x^{113} + x^{112} + x^{111} + x^{109} + x^{108} + x^{104} + x^{100} + x^{99} + x^{98} \\
&\quad + x^{91} + x^{90} + x^{89} + x^{87} + x^{86} + x^{83} + x^{81} + x^{80} + x^{75} + x^{73} + x^{68} \\
&\quad + x^{67} + x^{66} + x^{64} + x^{61} + x^{60} + x^{59} + x^{56} + x^{55} + x^{52} + x^{51} + x^{49} \\
&\quad + x^{47} + x^{46} + x^{44} + x^{42} + x^{38} + x^{37} + x^{35} + x^{34} + x^{33} + x^{32} + x^{31} \\
&\quad + x^{30} + x^{28} + x^{23} + x^{21}, \\
p_3(x) &= x^{113} + x^{112} + x^{111} + x^{110} + x^{109} + x^{107} + x^{105} + x^{104} + x^{101} + x^{97} \\
&\quad + x^{96} + x^{95} + x^{94} + x^{92} + x^{90} + x^{88} + x^{87} + x^{85} + x^{83} + x^{82} + x^{81} \\
&\quad + x^{80} + x^{78} + x^{77} + x^{74} + x^{73} + x^{72} + x^{71} + x^{68} + x^{64} + x^{63} + x^{62} \\
&\quad + x^{61} + x^{59} + x^{55} + x^{54} + x^{51} + x^{49} + x^{48} + x^{44} + x^{43} + x^{42} + x^{41} \\
&\quad + x^{39} + x^{37} + x^{36} + x^{33} + x^{29} + x^{28} + x^{27} + x^{26} + x^{24} + x^{22} + x^{21} \\
&\quad + x^{18} + x^{17} + x^{16} + x^{15} + x^{12} + x^{9}, \\
p_6(x) &= x^{114} + x^{112} + x^{106} + x^{102} + x^{100} + x^{98} + x^{96} + x^{92} + x^{88} + x^{84} + x^{82}
\end{aligned}$$

$$
\begin{aligned}
&+x^{76}+x^{74}+x^{72}+x^{70}+x^{64}+x^{62}+x^{60}+x^{56}+x^{54}+x^{50}+x^{46}\\
&+x^{44}+x^{42}+x^{40}+x^{38}+x^{34}+x^{30}+x^{28}+x^{22}+x^{18}+x^{16}+x^{14}\\
&+x^{12}+x^{10}+x^{6},\\
p_9(x)=&\,x^{115}+x^{114}+x^{111}+x^{99}+x^{98}+x^{94}+x^{90}+x^{86}+x^{82}+x^{78}+x^{74}\\
&+x^{70}+x^{67}+x^{63}+x^{62}+x^{58}+x^{54}+x^{50}+x^{47}+x^{35}+x^{34}+x^{30}\\
&+x^{26}+x^{22}+x^{19}+x^{15}+x^{14}+x^{10}+x^{6}+x^{3},\\
p_{12}(x)=&\,x^{116}+x^{104}+x^{100}+x^{96}+x^{88}+x^{72}+x^{68}+x^{48}+x^{40}+x^{36}+x^{32}\\
&+x^{24}+x^{20}+x^{4}+1,
\end{aligned}
$$

and the initial terms are [0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0].

For $\phi(W^o,1,0)$:

$$
\begin{aligned}
p_0(x)=&\,x^{104}+x^{101}+x^{98}+x^{94}+x^{92}+x^{91}+x^{90}+x^{89}+x^{88}+x^{86}+x^{85}\\
&+x^{82}+x^{80}+x^{79}+x^{75}+x^{74}+x^{71}+x^{66}+x^{65}+x^{61}+x^{60}+x^{59}\\
&+x^{58}+x^{56}+x^{55}+x^{51}+x^{50}+x^{49}+x^{46}+x^{45}+x^{43}+x^{41}+x^{40}\\
&+x^{38}+x^{35}+x^{34}+x^{32}+x^{27}+x^{26}+x^{24}+x^{23}+x^{19}+x^{18},\\
p_3(x)=&\,x^{97}+x^{96}+x^{95}+x^{94}+x^{92}+x^{90}+x^{89}+x^{86}+x^{82}+x^{78}+x^{74}\\
&+x^{73}+x^{72}+x^{71}+x^{68}+x^{65}+x^{49}+x^{48}+x^{47}+x^{46}+x^{44}+x^{42}\\
&+x^{40}+x^{39}+x^{36}+x^{32}+x^{31}+x^{30}+x^{28}+x^{26}+x^{25}+x^{22}+x^{18}\\
&+x^{17}+x^{16}+x^{15}+x^{12}+x^{9},\\
p_6(x)=&\,x^{98}+x^{96}+x^{94}+x^{92}+x^{88}+x^{86}+x^{82}+x^{70}+x^{68}+x^{66}+x^{64}\\
&+x^{62}+x^{56}+x^{50}+x^{46}+x^{44}+x^{42}+x^{40}+x^{36}+x^{32}+x^{28}+x^{24}\\
&+x^{22}+x^{16}+x^{14}+x^{12}+x^{10}+x^{6},\\
p_9(x)=&\,x^{99}+x^{98}+x^{94}+x^{90}+x^{86}+x^{82}+x^{78}+x^{74}+x^{70}+x^{66}+x^{62}\\
&+x^{58}+x^{54}+x^{51}+x^{35}+x^{34}+x^{30}+x^{26}+x^{22}+x^{18}+x^{14}+x^{10}\\
&+x^{6}+x^{3},\\
p_{12}(x)=&\,x^{100}+x^{96}+x^{92}+x^{76}+x^{60}+x^{52}+x^{48}+x^{36}+x^{32}+x^{28}+x^{12}\\
&+x^{4}+1,
\end{aligned}
$$

and the initial terms are [0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1].

For $\phi(W^o,1,1)$:

$$
\begin{aligned}
p_0(x)=&\,x^{105}+x^{103}+x^{100}+x^{97}+x^{96}+x^{95}+x^{91}+x^{90}+x^{89}+x^{84}+x^{83}\\
&+x^{82}+x^{80}+x^{79}+x^{77}+x^{76}+x^{75}+x^{70}+x^{69}+x^{68}+x^{66}+x^{63}\\
&+x^{61}+x^{54}+x^{53}+x^{52}+x^{51}+x^{45}+x^{44}+x^{40}+x^{39}+x^{38}+x^{37}\\
&+x^{34}+x^{33}+x^{31}+x^{30}+x^{28}+x^{27},\\
p_3(x)=&\,x^{104}+x^{100}+x^{98}+x^{95}+x^{92}+x^{91}+x^{90}+x^{89}+x^{87}+x^{83}+x^{81}\\
&+x^{80}+x^{79}+x^{78}+x^{77}+x^{73}+x^{72}+x^{67}+x^{66}+x^{64}+x^{62}+x^{61}\\
&+x^{58}+x^{56}+x^{54}+x^{53}+x^{51}+x^{47}+x^{46}+x^{45}+x^{43}+x^{42}+x^{41}
\end{aligned}
$$

$$+ x^{40} + x^{38} + x^{37} + x^{36} + x^{35} + x^{34} + x^{32} + x^{31} + x^{26} + x^{25} + x^{23} + x^{18} + x^{17} + x^{16} + x^{14} + x^{13} + x^{12},$$

$$p_6(x) = x^{104} + x^{100} + x^{99} + x^{98} + x^{94} + x^{92} + x^{89} + x^{88} + x^{87} + x^{86} + x^{85} + x^{84} + x^{83} + x^{82} + x^{80} + x^{78} + x^{76} + x^{73} + x^{70} + x^{63} + x^{61} + x^{60} + x^{56} + x^{53} + x^{52} + x^{51} + x^{50} + x^{49} + x^{47} + x^{44} + x^{43} + x^{41} + x^{40} + x^{38} + x^{37} + x^{34} + x^{30} + x^{27} + x^{24} + x^{23} + x^{20} + x^{19} + x^{18} + x^{17} + x^{15} + x^{12} + x^{10} + x^{9} + x^{8} + x^{4} + x^{3} + 1,$$

$$p_9(x) = x^{104} + x^{103} + x^{100} + x^{56} + x^{55} + x^{52} + x^{40} + x^{39} + x^{36} + x^{8} + x^{7} + x^{4},$$

$$p_{12}(x) = x^{104} + x^{103} + x^{99} + x^{95} + x^{92} + x^{80} + x^{79} + x^{76} + x^{64} + x^{63} + x^{60} + x^{56} + x^{55} + x^{51} + x^{48} + x^{40} + x^{39} + x^{35} + x^{31} + x^{28} + x^{16} + x^{15} + x^{12} + x^{8} + x^{7} + x^{3} + 1,$$

and the initial terms are [0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1].

Below is the transition function and output function of an 2-automaton that generates $T = M^o_{0,0}$:

Transition function $(n, j) \mapsto \delta(n, j)$ $(\Lambda(n) := [\delta(n, 0), \delta(n, 1)])$:

n	$\Lambda(n)$	n	$\Lambda(n)$	n	$\Lambda(n)$	n	$\Lambda(n)$
0	[1, 2]	512	[829, 830]	1024	[1380, 1114]	1536	[1243, 613]
1	[3, 4]	513	[831, 832]	1025	[1381, 609]	1537	[1191, 1293]
2	[5, 6]	514	[833, 250]	1026	[558, 1382]	1538	[1199, 1140]
3	[7, 8]	515	[85, 834]	1027	[1383, 146]	1539	[1755, 1262]
4	[9, 10]	516	[741, 835]	1028	[1384, 1179]	1540	[1756, 436]
5	[11, 12]	517	[836, 837]	1029	[1385, 1386]	1541	[1114, 1277]
6	[13, 14]	518	[838, 839]	1030	[1387, 207]	1542	[1757, 1338]
7	[15, 16]	519	[840, 841]	1031	[696, 1388]	1543	[1758, 213]
8	[17, 18]	520	[842, 814]	1032	[1389, 1390]	1544	[1759, 557]
9	[19, 20]	521	[298, 380]	1033	[1391, 1193]	1545	[1760, 604]
10	[21, 22]	522	[403, 843]	1034	[482, 578]	1546	[1761, 133]
11	[23, 24]	523	[91, 63]	1035	[1392, 654]	1547	[1762, 1167]
12	[25, 26]	524	[844, 252]	1036	[1393, 540]	1548	[1763, 539]
13	[27, 28]	525	[845, 764]	1037	[1394, 616]	1549	[1764, 126]
14	[29, 30]	526	[846, 769]	1038	[1395, 568]	1550	[1146, 203]
15	[31, 32]	527	[847, 77]	1039	[60, 1169]	1551	[481, 207]
16	[33, 34]	528	[848, 849]	1040	[675, 1227]	1552	[1279, 1170]
17	[35, 36]	529	[850, 261]	1041	[1396, 1383]	1553	[1732, 1292]
18	[37, 38]	530	[777, 313]	1042	[1397, 650]	1554	[1765, 650]
19	[39, 40]	531	[851, 88]	1043	[1398, 554]	1555	[1202, 467]
20	[41, 42]	532	[852, 727]	1044	[1399, 1400]	1556	[1766, 190]
21	[43, 44]	533	[853, 854]	1045	[1401, 511]	1557	[1370, 222]
22	[45, 46]	534	[855, 856]	1046	[1402, 512]	1558	[1307, 1087]

23	[47, 48]	535	[857, 858]	1047	[1403, 495]	1559	[1767, 204]
24	[49, 50]	536	[64, 859]	1048	[1404, 1084]	1560	[1768, 1769]
25	[51, 52]	537	[97, 860]	1049	[1405, 561]	1561	[1770, 691]
26	[53, 54]	538	[292, 246]	1050	[1406, 547]	1562	[1771, 642]
27	[55, 56]	539	[861, 850]	1051	[1225, 1407]	1563	[589, 698]
28	[57, 58]	540	[862, 777]	1052	[643, 1165]	1564	[1772, 1115]
29	[59, 60]	541	[863, 864]	1053	[1408, 668]	1565	[1728, 1302]
30	[61, 62]	542	[865, 403]	1054	[1097, 1409]	1566	[1154, 638]
31	[63, 64]	543	[866, 867]	1055	[1410, 222]	1567	[489, 1750]
32	[65, 66]	544	[868, 782]	1056	[1411, 203]	1568	[1773, 1177]
33	[67, 68]	545	[809, 869]	1057	[1130, 512]	1569	[1390, 1108]
34	[69, 68]	546	[811, 870]	1058	[1077, 1354]	1570	[1774, 1190]
35	[70, 71]	547	[871, 872]	1059	[1412, 1260]	1571	[1143, 1136]
36	[72, 73]	548	[873, 309]	1060	[1413, 1407]	1572	[1217, 195]
37	[74, 75]	549	[874, 311]	1061	[1262, 1414]	1573	[1775, 1255]
38	[76, 77]	550	[875, 241]	1062	[1415, 1416]	1574	[1776, 490]
39	[78, 79]	551	[384, 876]	1063	[1417, 714]	1575	[1777, 702]
40	[80, 81]	552	[877, 878]	1064	[1418, 465]	1576	[1221, 1080]
41	[82, 83]	553	[879, 880]	1065	[1419, 32]	1577	[1778, 61]
42	[84, 85]	554	[881, 882]	1066	[1420, 1421]	1578	[1779, 483]
43	[86, 87]	555	[883, 373]	1067	[1422, 464]	1579	[1107, 560]
44	[88, 89]	556	[884, 885]	1068	[698, 157]	1580	[1364, 1110]
45	[90, 91]	557	[886, 887]	1069	[1423, 1199]	1581	[179, 649]
46	[92, 93]	558	[888, 411]	1070	[1424, 635]	1582	[536, 1322]
47	[94, 95]	559	[6, 277]	1071	[1425, 546]	1583	[1780, 1345]
48	[96, 97]	560	[889, 87]	1072	[626, 544]	1584	[1781, 461]
49	[98, 99]	561	[890, 891]	1073	[474, 1365]	1585	[149, 1421]
50	[100, 101]	562	[892, 877]	1074	[1426, 842]	1586	[1782, 536]
51	[102, 103]	563	[893, 249]	1075	[1427, 1070]	1587	[1783, 1376]
52	[104, 105]	564	[894, 858]	1076	[1428, 1429]	1588	[711, 1312]
53	[106, 20]	565	[895, 360]	1077	[1006, 1430]	1589	[1784, 1409]
54	[107, 108]	566	[896, 897]	1078	[345, 954]	1590	[1785, 504]
55	[109, 110]	567	[898, 899]	1079	[737, 787]	1591	[1786, 1787]
56	[111, 112]	568	[900, 901]	1080	[1431, 21]	1592	[1788, 443]
57	[113, 114]	569	[786, 902]	1081	[782, 416]	1593	[189, 1386]
58	[115, 116]	570	[903, 390]	1082	[942, 1432]	1594	[1789, 437]
59	[117, 118]	571	[247, 904]	1083	[1433, 1434]	1595	[1312, 12]
60	[119, 120]	572	[905, 323]	1084	[972, 284]	1596	[1790, 45]
61	[121, 122]	573	[118, 242]	1085	[1435, 909]	1597	[1791, 1341]
62	[123, 110]	574	[906, 907]	1086	[1436, 337]	1598	[1792, 590]
63	[124, 125]	575	[908, 862]	1087	[1437, 1003]	1599	[1793, 1280]
64	[126, 127]	576	[869, 731]	1088	[1438, 6]	1600	[221, 600]
65	[128, 129]	577	[909, 910]	1089	[253, 752]	1601	[1794, 1732]
66	[130, 131]	578	[255, 911]	1090	[1439, 1440]	1602	[1795, 1092]

67	[132, 133]	579	[912, 913]	1091	[356, 236]	1603	[1796, 486]
68	[134, 135]	580	[435, 385]	1092	[1441, 992]	1604	[1797, 621]
69	[136, 137]	581	[914, 324]	1093	[308, 1429]	1605	[1407, 1330]
70	[138, 139]	582	[915, 88]	1094	[1442, 817]	1606	[1798, 628]
71	[140, 141]	583	[916, 917]	1095	[1443, 1056]	1607	[541, 704]
72	[142, 143]	584	[66, 918]	1096	[1444, 267]	1608	[1799, 178]
73	[144, 145]	585	[919, 413]	1097	[286, 1445]	1609	[443, 710]
74	[146, 147]	586	[75, 256]	1098	[913, 99]	1610	[1769, 490]
75	[148, 149]	587	[920, 921]	1099	[336, 1446]	1611	[1237, 1356]
76	[150, 131]	588	[922, 868]	1100	[1447, 899]	1612	[1800, 1122]
77	[151, 152]	589	[923, 916]	1101	[1448, 1449]	1613	[1801, 484]
78	[153, 154]	590	[924, 332]	1102	[763, 875]	1614	[1176, 1764]
79	[155, 156]	591	[925, 926]	1103	[1450, 866]	1615	[1802, 460]
80	[157, 158]	592	[927, 66]	1104	[1451, 1452]	1616	[1803, 710]
81	[159, 160]	593	[110, 928]	1105	[1453, 930]	1617	[471, 167]
82	[161, 162]	594	[929, 930]	1106	[1454, 889]	1618	[1183, 1769]
83	[163, 164]	595	[931, 326]	1107	[1455, 1456]	1619	[1804, 453]
84	[165, 166]	596	[932, 933]	1108	[1457, 1458]	1620	[1805, 1334]
85	[167, 168]	597	[934, 790]	1109	[1459, 347]	1621	[1806, 57]
86	[169, 170]	598	[935, 936]	1110	[1460, 391]	1622	[1807, 1396]
87	[171, 172]	599	[937, 100]	1111	[796, 1461]	1623	[1808, 1125]
88	[173, 174]	600	[938, 421]	1112	[81, 1012]	1624	[1809, 126]
89	[175, 176]	601	[793, 371]	1113	[1462, 1463]	1625	[1810, 553]
90	[177, 124]	602	[939, 940]	1114	[1464, 815]	1626	[578, 1811]
91	[178, 179]	603	[245, 896]	1115	[243, 1463]	1627	[12, 1190]
92	[168, 180]	604	[941, 942]	1116	[30, 1465]	1628	[1416, 1122]
93	[181, 182]	605	[816, 766]	1117	[1466, 787]	1629	[1812, 186]
94	[183, 184]	606	[943, 414]	1118	[398, 1040]	1630	[1813, 1165]
95	[185, 186]	607	[944, 945]	1119	[1467, 350]	1631	[1814, 1382]
96	[156, 187]	608	[424, 321]	1120	[366, 274]	1632	[166, 486]
97	[188, 189]	609	[946, 836]	1121	[416, 83]	1633	[1815, 653]
98	[190, 191]	610	[947, 948]	1122	[1468, 1469]	1634	[1811, 709]
99	[192, 172]	611	[949, 91]	1123	[1470, 318]	1635	[1139, 1765]
100	[193, 194]	612	[950, 729]	1124	[899, 1471]	1636	[1816, 195]
101	[195, 161]	613	[951, 952]	1125	[114, 1472]	1637	[1817, 1169]
102	[196, 197]	614	[953, 954]	1126	[780, 898]	1638	[1818, 1281]
103	[198, 132]	615	[955, 250]	1127	[1473, 1474]	1639	[1819, 470]
104	[199, 200]	616	[956, 848]	1128	[1475, 76]	1640	[569, 1289]
105	[201, 202]	617	[957, 920]	1129	[306, 829]	1641	[1820, 1821]
106	[203, 204]	618	[430, 958]	1130	[268, 926]	1642	[232, 1694]
107	[205, 206]	619	[20, 832]	1131	[748, 850]	1643	[1822, 50]
108	[207, 208]	620	[959, 960]	1132	[303, 26]	1644	[1823, 1751]
109	[209, 210]	621	[961, 962]	1133	[1476, 314]	1645	[1824, 1686]
110	[211, 212]	622	[963, 402]	1134	[876, 1004]	1646	[1825, 1149]

111	[139, 213]	623	[930, 964]	1135	[1477, 342]	1647	[562, 139]
112	[214, 215]	624	[116, 965]	1136	[1478, 417]	1648	[1258, 1351]
113	[216, 217]	625	[312, 868]	1137	[1479, 881]	1649	[1333, 189]
114	[218, 219]	626	[731, 810]	1138	[1480, 79]	1650	[1826, 1195]
115	[220, 221]	627	[966, 967]	1139	[1481, 103]	1651	[1827, 1828]
116	[222, 223]	628	[968, 969]	1140	[979, 1482]	1652	[686, 56]
117	[224, 225]	629	[970, 937]	1141	[1472, 1483]	1653	[530, 725]
118	[226, 227]	630	[971, 972]	1142	[783, 1484]	1654	[688, 594]
119	[228, 229]	631	[973, 256]	1143	[986, 805]	1655	[1223, 1127]
120	[230, 54]	632	[974, 975]	1144	[1485, 1486]	1656	[1829, 1117]
121	[231, 232]	633	[976, 939]	1145	[1487, 380]	1657	[1830, 706]
122	[233, 163]	634	[977, 810]	1146	[370, 303]	1658	[1831, 1696]
123	[234, 235]	635	[978, 979]	1147	[1488, 1489]	1659	[1832, 1811]
124	[236, 237]	636	[980, 969]	1148	[1490, 426]	1660	[1297, 1176]
125	[238, 239]	637	[981, 749]	1149	[1491, 769]	1661	[1833, 669]
126	[240, 241]	638	[982, 983]	1150	[1051, 1492]	1662	[1286, 539]
127	[242, 243]	639	[984, 833]	1151	[772, 301]	1663	[1834, 1734]
128	[244, 245]	640	[985, 986]	1152	[1493, 1494]	1664	[1835, 1185]
129	[246, 247]	641	[987, 988]	1153	[89, 880]	1665	[1157, 632]
130	[248, 249]	642	[989, 958]	1154	[237, 1495]	1666	[160, 57]
131	[250, 251]	643	[990, 825]	1155	[1496, 805]	1667	[501, 190]
132	[252, 253]	644	[95, 328]	1156	[1497, 385]	1668	[1836, 1267]
133	[254, 255]	645	[991, 64]	1157	[1498, 976]	1669	[1837, 1319]
134	[256, 257]	646	[992, 401]	1158	[1499, 773]	1670	[1838, 1327]
135	[258, 92]	647	[993, 994]	1159	[333, 1500]	1671	[1382, 1281]
136	[259, 260]	648	[995, 309]	1160	[360, 1450]	1672	[709, 1728]
137	[261, 262]	649	[996, 834]	1161	[1501, 829]	1673	[1356, 620]
138	[263, 264]	650	[997, 117]	1162	[99, 375]	1674	[1388, 654]
139	[265, 266]	651	[940, 998]	1163	[1502, 1025]	1675	[194, 695]
140	[267, 268]	652	[999, 770]	1164	[1503, 312]	1676	[1376, 1839]
141	[269, 270]	653	[1000, 408]	1165	[1504, 917]	1677	[204, 1370]
142	[271, 272]	654	[1001, 1002]	1166	[825, 272]	1678	[1840, 1171]
143	[273, 274]	655	[834, 1003]	1167	[1505, 410]	1679	[1841, 1204]
144	[275, 276]	656	[1004, 1005]	1168	[1506, 1041]	1680	[48, 1821]
145	[277, 278]	657	[960, 854]	1169	[1507, 434]	1681	[1842, 1128]
146	[279, 280]	658	[910, 1006]	1170	[1508, 798]	1682	[567, 1719]
147	[281, 282]	659	[1007, 964]	1171	[1509, 433]	1683	[476, 1416]
148	[283, 284]	660	[1008, 1009]	1172	[872, 331]	1684	[952, 352]
149	[285, 286]	661	[1010, 394]	1173	[761, 871]	1685	[358, 65]
150	[287, 288]	662	[1011, 275]	1174	[1072, 873]	1686	[1458, 997]
151	[289, 102]	663	[343, 363]	1175	[1510, 1511]	1687	[1843, 871]
152	[290, 95]	664	[301, 785]	1176	[1512, 78]	1688	[1844, 1596]
153	[291, 292]	665	[1012, 378]	1177	[1513, 1043]	1689	[733, 1634]
154	[293, 294]	666	[814, 988]	1178	[1024, 425]	1690	[967, 1522]

155	[295, 296]	667	[1013, 1014]	1179	[1514, 1515]	1691	[1649, 434]
156	[297, 298]	668	[1015, 1016]	1180	[1516, 993]	1692	[314, 78]
157	[299, 293]	669	[1017, 1018]	1181	[1486, 245]	1693	[1845, 1438]
158	[300, 301]	670	[907, 754]	1182	[1517, 855]	1694	[1846, 69]
159	[302, 303]	671	[414, 746]	1183	[1518, 1060]	1695	[1847, 1848]
160	[16, 304]	672	[1019, 754]	1184	[969, 905]	1696	[828, 1464]
161	[305, 306]	673	[1020, 873]	1185	[1519, 905]	1697	[858, 1440]
162	[307, 308]	674	[1021, 1022]	1186	[1520, 767]	1698	[1849, 428]
163	[309, 310]	675	[1023, 993]	1187	[1033, 123]	1699	[1850, 1005]
164	[311, 312]	676	[418, 1024]	1188	[1521, 89]	1700	[1851, 268]
165	[313, 314]	677	[1025, 1026]	1189	[1522, 1459]	1701	[1852, 1643]
166	[315, 264]	678	[1027, 1028]	1190	[1523, 990]	1702	[1446, 255]
167	[316, 260]	679	[1029, 882]	1191	[1524, 1525]	1703	[1853, 811]
168	[317, 318]	680	[1030, 327]	1192	[928, 796]	1704	[1489, 324]
169	[319, 74]	681	[428, 763]	1193	[918, 1023]	1705	[1854, 1565]
170	[320, 321]	682	[746, 1031]	1194	[1526, 325]	1706	[1855, 1041]
171	[322, 323]	683	[1009, 976]	1195	[1527, 1514]	1707	[954, 1601]
172	[324, 325]	684	[1032, 1033]	1196	[321, 411]	1708	[1856, 951]
173	[326, 327]	685	[71, 1034]	1197	[1528, 1456]	1709	[1857, 918]
174	[328, 329]	686	[1035, 1036]	1198	[1529, 907]	1710	[1858, 409]
175	[330, 331]	687	[1037, 815]	1199	[1530, 875]	1711	[341, 1859]
176	[332, 333]	688	[1038, 931]	1200	[79, 732]	1712	[1859, 1474]
177	[334, 238]	689	[1039, 806]	1201	[1434, 986]	1713	[1860, 1471]
178	[335, 336]	690	[1040, 883]	1202	[958, 1531]	1714	[1861, 870]
179	[337, 338]	691	[1041, 259]	1203	[1532, 799]	1715	[1862, 290]
180	[339, 28]	692	[1042, 1043]	1204	[1533, 1534]	1716	[288, 1064]
181	[340, 341]	693	[1044, 257]	1205	[1535, 1536]	1717	[1863, 1024]
182	[342, 343]	694	[375, 933]	1206	[1537, 830]	1718	[1864, 262]
183	[344, 345]	695	[1045, 1046]	1207	[1538, 1010]	1719	[1865, 328]
184	[346, 347]	696	[364, 1014]	1208	[864, 1539]	1720	[1866, 1867]
185	[348, 118]	697	[1047, 1048]	1209	[1540, 1538]	1721	[1868, 1459]
186	[349, 350]	698	[1049, 1010]	1210	[849, 119]	1722	[1869, 972]
187	[351, 352]	699	[1050, 431]	1211	[1541, 1542]	1723	[1870, 800]
188	[353, 354]	700	[891, 951]	1212	[1543, 377]	1724	[1657, 421]
189	[355, 356]	701	[854, 1051]	1213	[1544, 1535]	1725	[778, 737]
190	[357, 358]	702	[1052, 803]	1214	[1545, 349]	1726	[1871, 898]
191	[359, 360]	703	[1053, 1040]	1215	[1546, 315]	1727	[1872, 1016]
192	[361, 362]	704	[1054, 1055]	1216	[1547, 1477]	1728	[1873, 1484]
193	[354, 107]	705	[767, 1056]	1217	[1548, 305]	1729	[1874, 1430]
194	[363, 364]	706	[770, 1057]	1218	[1549, 1550]	1730	[260, 822]
195	[365, 366]	707	[1058, 939]	1219	[1551, 107]	1731	[1875, 872]
196	[367, 368]	708	[1059, 282]	1220	[1552, 1072]	1732	[276, 290]
197	[369, 370]	709	[1060, 1061]	1221	[1028, 74]	1733	[1876, 894]
198	[371, 355]	710	[1062, 874]	1222	[1553, 835]	1734	[1877, 288]

199	[372, 373]	711	[1034, 1063]	1223	[262, 1554]	1735	[1878, 382]
200	[374, 375]	712	[1064, 1065]	1224	[249, 405]	1736	[1879, 818]
201	[376, 377]	713	[1066, 117]	1225	[1555, 1539]	1737	[1445, 817]
202	[378, 379]	714	[1067, 252]	1226	[412, 1453]	1738	[1880, 1522]
203	[380, 381]	715	[1068, 401]	1227	[1022, 1438]	1739	[1881, 1495]
204	[18, 382]	716	[1069, 251]	1228	[1556, 1557]	1740	[1882, 967]
205	[383, 384]	717	[379, 1070]	1229	[1461, 758]	1741	[933, 779]
206	[385, 386]	718	[83, 366]	1230	[1003, 920]	1742	[1463, 960]
207	[387, 388]	719	[1071, 761]	1231	[1558, 381]	1743	[1883, 370]
208	[389, 390]	720	[274, 1072]	1232	[77, 1559]	1744	[1579, 937]
209	[391, 392]	721	[73, 280]	1233	[1560, 1561]	1745	[807, 1033]
210	[393, 394]	722	[800, 802]	1234	[1559, 1434]	1746	[1884, 329]
211	[395, 396]	723	[388, 851]	1235	[1562, 823]	1747	[1885, 836]
212	[397, 398]	724	[420, 881]	1236	[1563, 1071]	1748	[1492, 923]
213	[399, 400]	725	[1073, 910]	1237	[1536, 1564]	1749	[1886, 1472]
214	[401, 402]	726	[1074, 519]	1238	[122, 1071]	1750	[1429, 1511]
215	[396, 403]	727	[1075, 212]	1239	[870, 874]	1751	[1887, 878]
216	[404, 405]	728	[1076, 1077]	1240	[24, 1002]	1752	[1888, 1446]
217	[406, 392]	729	[1078, 492]	1241	[101, 1565]	1753	[1889, 22]
218	[407, 398]	730	[1079, 1080]	1242	[1566, 856]	1754	[1482, 1506]
219	[408, 409]	731	[1081, 1082]	1243	[1511, 15]	1755	[1056, 400]
220	[390, 410]	732	[154, 538]	1244	[788, 841]	1756	[1890, 298]
221	[411, 412]	733	[1083, 1084]	1245	[835, 1567]	1757	[1891, 311]
222	[382, 413]	734	[1085, 1086]	1246	[1568, 1564]	1758	[1892, 356]
223	[294, 414]	735	[1087, 45]	1247	[1569, 296]	1759	[1893, 1464]
224	[415, 416]	736	[1088, 146]	1248	[1570, 928]	1760	[1894, 816]
225	[417, 418]	737	[1089, 223]	1249	[1571, 851]	1761	[318, 790]
226	[419, 420]	738	[522, 1090]	1250	[1572, 100]	1762	[1895, 85]
227	[421, 422]	739	[213, 1091]	1251	[965, 258]	1763	[1525, 862]
228	[423, 424]	740	[1092, 660]	1252	[1573, 353]	1764	[1896, 1852]
229	[425, 269]	741	[1093, 489]	1253	[1574, 425]	1765	[1897, 940]
230	[270, 426]	742	[1094, 1095]	1254	[1575, 427]	1766	[409, 839]
231	[427, 428]	743	[1096, 1097]	1255	[1576, 1050]	1767	[1494, 743]
232	[429, 430]	744	[1098, 1099]	1256	[882, 1018]	1768	[1898, 911]
233	[431, 432]	745	[1100, 1101]	1257	[1567, 396]	1769	[1899, 837]
234	[433, 292]	746	[1102, 1103]	1258	[251, 1538]	1770	[1634, 1025]
235	[434, 435]	747	[1104, 568]	1259	[1430, 427]	1771	[1014, 990]
236	[436, 44]	748	[1105, 474]	1260	[1577, 29]	1772	[1900, 371]
237	[437, 438]	749	[1106, 1107]	1261	[1578, 363]	1773	[897, 1872]
238	[439, 440]	750	[1108, 197]	1262	[362, 1579]	1774	[1901, 896]
239	[441, 206]	751	[1109, 1110]	1263	[1484, 1550]	1775	[1902, 422]
240	[442, 443]	752	[1111, 523]	1264	[1580, 1065]	1776	[1903, 802]
241	[444, 182]	753	[438, 1112]	1265	[272, 1036]	1777	[837, 1042]
242	[445, 446]	754	[1113, 1114]	1266	[901, 1050]	1778	[1904, 123]

243	[447, 448]	755	[1115, 1116]	1267	[1581, 1494]	1779	[1905, 785]
244	[449, 450]	756	[180, 174]	1268	[1582, 1064]	1780	[105, 1028]
245	[451, 452]	757	[1117, 170]	1269	[1583, 845]	1781	[1848, 980]
246	[453, 454]	758	[215, 1118]	1270	[752, 894]	1782	[1534, 112]
247	[455, 456]	759	[1119, 488]	1271	[1584, 867]	1783	[1906, 120]
248	[457, 458]	760	[225, 232]	1272	[1495, 391]	1784	[304, 978]
249	[459, 229]	761	[1120, 1121]	1273	[1585, 30]	1785	[911, 105]
250	[460, 42]	762	[1122, 217]	1274	[103, 803]	1786	[1907, 247]
251	[461, 462]	763	[1123, 1124]	1275	[841, 1458]	1787	[1908, 1859]
252	[463, 38]	764	[1125, 1103]	1276	[373, 1586]	1788	[1565, 775]
253	[464, 465]	765	[1126, 166]	1277	[1587, 895]	1789	[1909, 1012]
254	[466, 467]	766	[1127, 488]	1278	[1588, 1432]	1790	[1910, 92]
255	[468, 455]	767	[556, 525]	1279	[1440, 842]	1791	[1449, 1455]
256	[147, 469]	768	[1128, 463]	1280	[1589, 16]	1792	[773, 1594]
257	[470, 471]	769	[1129, 1130]	1281	[1590, 1453]	1793	[1911, 1649]
258	[472, 473]	770	[1131, 623]	1282	[1591, 237]	1794	[1018, 1542]
259	[469, 474]	771	[1132, 1133]	1283	[1592, 1004]	1795	[1912, 1515]
260	[475, 476]	772	[1134, 135]	1284	[282, 1469]	1796	[68, 877]
261	[477, 478]	773	[504, 571]	1285	[1593, 1450]	1797	[1913, 313]
262	[170, 479]	774	[1135, 1136]	1286	[1594, 846]	1798	[994, 848]
263	[480, 481]	775	[1137, 520]	1287	[1542, 966]	1799	[860, 337]
264	[133, 482]	776	[1138, 1139]	1288	[386, 90]	1800	[1914, 397]
265	[483, 484]	777	[1140, 1141]	1289	[1595, 1455]	1801	[1915, 921]
266	[485, 463]	778	[666, 202]	1290	[1469, 983]	1802	[1916, 386]
267	[486, 487]	779	[1142, 1141]	1291	[822, 1596]	1803	[1917, 1034]
268	[488, 489]	780	[514, 1143]	1292	[1597, 978]	1804	[402, 97]
269	[490, 491]	781	[42, 1144]	1293	[1598, 1461]	1805	[1918, 952]
270	[492, 194]	782	[549, 163]	1294	[108, 24]	1806	[1055, 115]
271	[493, 211]	783	[1145, 1146]	1295	[1599, 1500]	1807	[1919, 843]
272	[494, 495]	784	[597, 1147]	1296	[1474, 936]	1808	[410, 1867]
273	[62, 496]	785	[135, 656]	1297	[1600, 1601]	1809	[1920, 242]
274	[497, 498]	786	[534, 701]	1298	[257, 349]	1810	[1921, 756]
275	[499, 476]	787	[1148, 10]	1299	[1602, 1586]	1811	[1922, 779]
276	[500, 501]	788	[1149, 1150]	1300	[1603, 423]	1812	[1923, 1465]
277	[502, 438]	789	[1151, 614]	1301	[1604, 1482]	1813	[962, 1645]
278	[14, 503]	790	[1152, 1143]	1302	[1061, 1605]	1814	[1924, 1026]
279	[129, 504]	791	[554, 666]	1303	[1606, 269]	1815	[1925, 1531]
280	[505, 440]	792	[628, 61]	1304	[1607, 788]	1816	[1926, 904]
281	[506, 458]	793	[1153, 1154]	1305	[1432, 901]	1817	[394, 433]
282	[507, 508]	794	[532, 612]	1306	[1471, 1452]	1818	[964, 1486]
283	[509, 510]	795	[1155, 181]	1307	[1608, 90]	1819	[1927, 735]
284	[208, 31]	796	[212, 215]	1308	[1609, 106]	1820	[1928, 278]
285	[511, 34]	797	[1156, 1157]	1309	[1610, 755]	1821	[1929, 1872]
286	[512, 156]	798	[1158, 595]	1310	[1611, 869]	1822	[1930, 966]

287	[513, 514]	799	[1159, 1160]	1311	[422, 389]	1823	[368, 73]
288	[515, 516]	800	[1161, 685]	1312	[1612, 1067]	1824	[917, 729]
289	[517, 518]	801	[1162, 1104]	1313	[1613, 971]	1825	[413, 1657]
290	[519, 520]	802	[1163, 676]	1314	[755, 102]	1826	[1456, 864]
291	[145, 453]	803	[1164, 589]	1315	[1614, 304]	1827	[743, 369]
292	[508, 455]	804	[1165, 1166]	1316	[1615, 1493]	1828	[1931, 906]
293	[521, 522]	805	[1167, 459]	1317	[1036, 295]	1829	[878, 1047]
294	[46, 523]	806	[1168, 551]	1318	[1616, 270]	1830	[1932, 883]
295	[524, 525]	807	[1169, 234]	1319	[1617, 84]	1831	[26, 828]
296	[526, 125]	808	[1170, 1171]	1320	[902, 1534]	1832	[1539, 1060]
297	[527, 528]	809	[1172, 545]	1321	[750, 744]	1833	[1933, 1061]
298	[529, 530]	810	[1173, 1174]	1322	[1618, 115]	1834	[1065, 1055]
299	[531, 187]	811	[1082, 1121]	1323	[859, 946]	1835	[1016, 84]
300	[462, 532]	812	[635, 575]	1324	[1619, 897]	1836	[887, 248]
301	[533, 534]	813	[1175, 1176]	1325	[1620, 1492]	1837	[936, 1852]
302	[535, 450]	814	[1177, 129]	1326	[1621, 339]	1838	[1934, 916]
303	[479, 134]	815	[1178, 221]	1327	[1622, 1506]	1839	[1935, 1594]
304	[32, 536]	816	[690, 1179]	1328	[1048, 384]	1840	[1936, 1554]
305	[537, 538]	817	[1180, 1181]	1329	[120, 1623]	1841	[1515, 1535]
306	[539, 540]	818	[56, 593]	1330	[1057, 1557]	1842	[1937, 766]
307	[162, 541]	819	[1182, 1183]	1331	[327, 1525]	1843	[176, 1938]
308	[542, 543]	820	[1184, 1170]	1332	[1624, 63]	1844	[36, 1219]
309	[544, 498]	821	[1185, 519]	1333	[921, 889]	1845	[1787, 506]
310	[545, 546]	822	[1186, 1187]	1334	[1625, 775]	1846	[1686, 52]
311	[547, 548]	823	[1188, 1189]	1335	[1626, 306]	1847	[227, 1345]
312	[548, 549]	824	[1190, 1191]	1336	[1627, 728]	1848	[1939, 234]
313	[448, 442]	825	[1192, 1193]	1337	[867, 1477]	1849	[235, 178]
314	[550, 551]	826	[1194, 499]	1338	[765, 4]	1850	[1828, 439]
315	[229, 140]	827	[1118, 1195]	1339	[1628, 1629]	1851	[1940, 1293]
316	[552, 477]	828	[1196, 1178]	1340	[329, 1046]	1852	[1941, 1328]
317	[553, 464]	829	[1197, 487]	1341	[1630, 354]	1853	[1942, 1144]
318	[520, 554]	830	[540, 529]	1342	[1500, 388]	1854	[1943, 1087]
319	[555, 556]	831	[1198, 1199]	1343	[806, 408]	1855	[503, 1400]
320	[557, 558]	832	[40, 1200]	1344	[988, 1631]	1856	[603, 1133]
321	[559, 560]	833	[1201, 1202]	1345	[1632, 759]	1857	[1944, 1217]
322	[561, 562]	834	[1203, 1077]	1346	[1633, 1634]	1858	[621, 616]
323	[563, 564]	835	[660, 646]	1347	[1635, 998]	1859	[1945, 1750]
324	[565, 456]	836	[1204, 1205]	1348	[1636, 1559]	1860	[1946, 1688]
325	[566, 567]	837	[1206, 451]	1349	[1637, 753]	1861	[1947, 1938]
326	[568, 569]	838	[1207, 579]	1350	[832, 971]	1862	[1214, 185]
327	[570, 571]	839	[1208, 555]	1351	[1638, 923]	1863	[1948, 1269]
328	[572, 452]	840	[1209, 629]	1352	[1639, 876]	1864	[1949, 1765]
329	[186, 573]	841	[1210, 1116]	1353	[1640, 432]	1865	[1950, 1250]
330	[574, 575]	842	[1211, 1189]	1354	[1641, 75]	1866	[651, 1104]

331	[576, 164]	843	[1212, 507]	1355	[1605, 749]	1867	[1951, 1294]
332	[577, 578]	844	[1213, 1214]	1356	[1642, 1643]	1868	[1952, 510]
333	[579, 124]	845	[1215, 1126]	1357	[1644, 253]	1869	[1738, 48]
334	[580, 441]	846	[1216, 717]	1358	[1645, 417]	1870	[1953, 1163]
335	[581, 582]	847	[623, 1217]	1359	[1646, 965]	1871	[1954, 1264]
336	[583, 584]	848	[1218, 446]	1360	[1647, 778]	1872	[1955, 657]
337	[585, 454]	849	[1219, 230]	1361	[1063, 114]	1873	[1956, 562]
338	[586, 587]	850	[1220, 1221]	1362	[1643, 336]	1874	[1957, 1313]
339	[588, 589]	851	[1222, 1223]	1363	[1648, 750]	1875	[1958, 1339]
340	[465, 590]	852	[658, 1076]	1364	[284, 1649]	1876	[478, 1307]
341	[591, 471]	853	[1224, 1225]	1365	[1650, 1623]	1877	[1959, 639]
342	[592, 593]	854	[516, 724]	1366	[87, 1449]	1878	[141, 1751]
343	[594, 595]	855	[1226, 1227]	1367	[1651, 1483]	1879	[1960, 598]
344	[596, 597]	856	[1160, 1125]	1368	[1652, 804]	1880	[1961, 1694]
345	[598, 543]	857	[1228, 1191]	1369	[1043, 909]	1881	[1962, 1959]
346	[599, 600]	858	[523, 1229]	1370	[1653, 860]	1882	[1963, 185]
347	[601, 503]	859	[125, 1154]	1371	[1654, 342]	1883	[575, 1268]
348	[1, 445]	860	[1230, 586]	1372	[323, 741]	1884	[656, 1952]
349	[602, 603]	861	[664, 477]	1373	[1483, 353]	1885	[1698, 1163]
350	[604, 605]	862	[1231, 448]	1374	[1655, 116]	1886	[1839, 1720]
351	[606, 607]	863	[1232, 1233]	1375	[426, 1022]	1887	[1695, 557]
352	[608, 587]	864	[1234, 627]	1376	[1656, 1657]	1888	[1373, 1213]
353	[609, 132]	865	[1235, 1212]	1377	[1658, 727]	1889	[52, 1787]
354	[610, 569]	866	[619, 1202]	1378	[1659, 733]	1890	[1400, 1236]
355	[611, 462]	867	[1236, 1237]	1379	[1660, 376]	1891	[440, 1738]
356	[612, 437]	868	[1238, 1174]	1380	[1661, 119]	1892	[582, 436]
357	[613, 614]	869	[720, 1173]	1381	[1629, 885]	1893	[1187, 637]
358	[615, 130]	870	[1174, 547]	1382	[818, 345]	1894	[1964, 1127]
359	[616, 617]	871	[546, 1082]	1383	[843, 281]	1895	[223, 8]
360	[618, 619]	872	[1121, 720]	1384	[1531, 772]	1896	[1316, 553]
361	[620, 621]	873	[498, 545]	1385	[975, 266]	1897	[1965, 191]
362	[622, 219]	874	[1239, 548]	1386	[1662, 1658]	1898	[206, 1185]
363	[593, 584]	875	[1240, 1241]	1387	[1663, 1063]	1899	[1966, 594]
364	[595, 623]	876	[1084, 1241]	1388	[1046, 285]	1900	[1124, 1204]
365	[624, 2]	877	[1242, 1243]	1389	[1664, 246]	1901	[1967, 1952]
366	[625, 626]	878	[1244, 1245]	1390	[1665, 369]	1902	[1294, 1417]
367	[627, 628]	879	[1246, 1247]	1391	[728, 76]	1903	[1968, 674]
368	[629, 630]	880	[1248, 1166]	1392	[983, 962]	1904	[491, 211]
369	[631, 479]	881	[10, 619]	1393	[1666, 326]	1905	[1086, 1688]
370	[632, 633]	882	[1249, 1223]	1394	[1667, 285]	1906	[1414, 684]
371	[634, 635]	883	[677, 1178]	1395	[1668, 786]	1907	[1969, 1839]
372	[636, 637]	884	[1233, 1250]	1396	[1669, 1631]	1908	[518, 604]
373	[638, 154]	885	[1251, 134]	1397	[1670, 994]	1909	[1101, 1249]
374	[639, 640]	886	[1252, 680]	1398	[1564, 895]	1910	[1371, 181]

375	[641, 507]	887	[1253, 459]	1399	[804, 887]	1911	[1970, 449]
376	[642, 643]	888	[54, 1254]	1400	[1671, 1047]	1912	[1166, 1698]
377	[644, 180]	889	[1255, 1221]	1401	[885, 69]	1913	[1971, 1156]
378	[645, 646]	890	[1256, 1138]	1402	[830, 297]	1914	[1972, 157]
379	[647, 603]	891	[1257, 1258]	1403	[1601, 1514]	1915	[678, 1255]
380	[648, 161]	892	[1259, 532]	1404	[1672, 101]	1916	[646, 1267]
381	[649, 227]	893	[600, 1260]	1405	[1673, 849]	1917	[1973, 1417]
382	[650, 651]	894	[1110, 494]	1406	[310, 122]	1918	[571, 481]
383	[652, 653]	895	[1261, 664]	1407	[405, 315]	1919	[1974, 506]
384	[654, 149]	896	[633, 722]	1408	[926, 931]	1920	[510, 447]
385	[655, 656]	897	[452, 1262]	1409	[1674, 1048]	1921	[1975, 439]
386	[657, 658]	898	[1141, 1263]	1410	[1675, 294]	1922	[1976, 639]
387	[659, 660]	899	[1264, 534]	1411	[1554, 18]	1923	[1977, 1212]
388	[661, 529]	900	[1265, 496]	1412	[1676, 338]	1924	[1227, 1828]
389	[662, 663]	901	[1266, 1173]	1413	[1677, 1057]	1925	[1245, 668]
390	[614, 664]	902	[1267, 130]	1414	[400, 106]	1926	[1978, 1145]
391	[665, 666]	903	[1268, 1269]	1415	[904, 823]	1927	[1979, 447]
392	[667, 482]	904	[454, 1270]	1416	[1678, 287]	1928	[587, 1959]
393	[668, 669]	905	[1271, 1146]	1417	[1679, 946]	1929	[1980, 1300]
394	[670, 508]	906	[1272, 1270]	1418	[1005, 913]	1930	[1409, 1327]
395	[671, 672]	907	[1273, 1115]	1419	[1550, 1009]	1931	[694, 1341]
396	[673, 62]	908	[1080, 561]	1420	[1557, 1561]	1932	[1981, 638]
397	[674, 675]	909	[1274, 442]	1421	[1680, 424]	1933	[158, 1334]
398	[676, 677]	910	[1275, 1112]	1422	[1681, 239]	1934	[1179, 210]
399	[137, 678]	911	[467, 706]	1423	[1682, 979]	1935	[1982, 1216]
400	[679, 491]	912	[1276, 1277]	1424	[1683, 431]	1936	[1983, 1268]
401	[680, 14]	913	[1278, 1279]	1425	[331, 942]	1937	[1984, 556]
402	[681, 46]	914	[1280, 607]	1426	[538, 1177]	1938	[1985, 1042]
403	[672, 682]	915	[590, 175]	1427	[1684, 1161]	1939	[1986, 15]
404	[683, 684]	916	[1281, 1181]	1428	[1322, 1316]	1940	[1987, 108]
405	[458, 137]	917	[1282, 1150]	1429	[1685, 31]	1941	[1988, 1579]
406	[685, 686]	918	[1283, 694]	1430	[1112, 1686]	1942	[1452, 759]
407	[687, 688]	919	[1284, 1225]	1431	[496, 652]	1943	[1989, 902]
408	[689, 690]	920	[1285, 1286]	1432	[164, 626]	1944	[880, 992]
409	[551, 691]	921	[1287, 1099]	1433	[219, 40]	1945	[1070, 975]
410	[692, 647]	922	[1288, 1289]	1434	[1687, 1237]	1946	[1990, 435]
411	[693, 694]	923	[1290, 235]	1435	[691, 1299]	1947	[839, 358]
412	[560, 145]	924	[1091, 579]	1436	[1205, 1117]	1948	[1991, 780]
413	[38, 586]	925	[1291, 1292]	1437	[1688, 151]	1949	[1992, 997]
414	[695, 696]	926	[1293, 1294]	1438	[1095, 1689]	1950	[1993, 286]
415	[697, 698]	927	[200, 1283]	1439	[1690, 1211]	1951	[1994, 93]
416	[699, 544]	928	[210, 473]	1440	[1691, 613]	1952	[1995, 1645]
417	[700, 701]	929	[637, 1247]	1441	[1260, 680]	1953	[1996, 418]
418	[702, 663]	930	[1295, 58]	1442	[1692, 1076]	1954	[1002, 855]

419	[703, 704]	931	[1296, 1118]	1443	[1693, 1108]	1955	[1997, 791]
420	[8, 160]	932	[2, 1297]	1444	[1694, 1695]	1956	[1998, 364]
421	[705, 141]	933	[640, 514]	1445	[34, 1696]	1957	[1999, 807]
422	[706, 555]	934	[1298, 1299]	1446	[50, 627]	1958	[1031, 423]
423	[707, 147]	935	[1300, 445]	1447	[1697, 1698]	1959	[2000, 980]
424	[708, 709]	936	[1301, 1302]	1448	[1699, 640]	1960	[2001, 866]
425	[663, 492]	937	[1303, 152]	1449	[1700, 1689]	1961	[2002, 243]
426	[710, 711]	938	[1269, 200]	1450	[617, 528]	1962	[1631, 793]
427	[712, 658]	939	[143, 1279]	1451	[1701, 167]	1963	[2003, 259]
428	[713, 714]	940	[1304, 478]	1452	[1702, 1388]	1964	[998, 798]
429	[715, 652]	941	[605, 2]	1453	[1703, 176]	1965	[2004, 333]
430	[716, 717]	942	[1305, 948]	1454	[1704, 171]	1966	[2005, 1567]
431	[718, 549]	943	[1306, 1307]	1455	[1705, 675]	1967	[241, 833]
432	[719, 720]	944	[1308, 632]	1456	[1689, 1130]	1968	[2006, 1023]
433	[721, 722]	945	[1309, 1159]	1457	[722, 518]	1969	[2007, 1051]
434	[723, 724]	946	[1310, 605]	1458	[1706, 127]	1970	[1867, 748]
435	[725, 657]	947	[1311, 1312]	1459	[1328, 1168]	1971	[93, 1493]
436	[726, 276]	948	[948, 948]	1460	[1707, 1708]	1972	[2008, 236]
437	[727, 728]	949	[184, 1280]	1461	[1709, 1383]	1973	[768, 1067]
438	[729, 368]	950	[1313, 629]	1462	[1710, 1139]	1974	[2009, 758]
439	[730, 731]	951	[1314, 140]	1463	[446, 516]	1975	[2010, 732]
440	[732, 733]	952	[1133, 566]	1464	[1195, 690]	1976	[2011, 764]
441	[734, 295]	953	[1315, 1316]	1465	[1421, 1097]	1977	[2012, 783]
442	[381, 735]	954	[1317, 1168]	1466	[701, 1149]	1978	[945, 308]
443	[736, 737]	955	[525, 461]	1467	[487, 1161]	1979	[2013, 859]
444	[738, 739]	956	[1318, 1219]	1468	[1711, 581]	1980	[1586, 906]
445	[740, 741]	957	[573, 1319]	1469	[1712, 573]	1981	[22, 293]
446	[4, 420]	958	[1320, 677]	1470	[1713, 1214]	1982	[2014, 379]
447	[742, 743]	959	[1321, 1322]	1471	[1263, 1373]	1983	[2015, 846]
448	[744, 275]	960	[1323, 651]	1472	[714, 609]	1984	[856, 845]
449	[745, 746]	961	[1302, 1094]	1473	[564, 672]	1985	[1339, 1182]
450	[747, 748]	962	[1324, 696]	1474	[1714, 225]	1986	[2016, 695]
451	[749, 362]	963	[1325, 1157]	1475	[1715, 151]	1987	[1250, 49]
452	[296, 750]	964	[1247, 451]	1476	[1716, 1365]	1988	[2017, 1720]
453	[751, 752]	965	[1326, 168]	1477	[1717, 1205]	1989	[2018, 1380]
454	[278, 753]	966	[1277, 501]	1478	[182, 702]	1990	[58, 1235]
455	[754, 755]	967	[1327, 1328]	1479	[1718, 1249]	1991	[456, 1156]
456	[739, 756]	968	[152, 1211]	1480	[217, 1092]	1992	[1136, 224]
457	[757, 261]	969	[1329, 1330]	1481	[1386, 499]	1993	[2019, 1764]
458	[758, 339]	970	[1331, 1254]	1482	[1719, 1124]	1994	[2020, 1090]
459	[759, 267]	971	[1332, 208]	1483	[1720, 1286]	1995	[1147, 1101]
460	[760, 761]	972	[484, 1333]	1484	[1721, 179]	1996	[1696, 1380]
461	[762, 763]	973	[1334, 470]	1485	[1722, 1182]	1997	[1099, 1264]
462	[764, 765]	974	[1335, 612]	1486	[1723, 633]	1998	[2021, 1213]

463	[766, 767]	975	[1336, 1200]	1487	[1724, 649]	1999	[2022, 1198]
464	[756, 238]	976	[1337, 1224]	1488	[1725, 686]	2000	[1821, 1390]
465	[239, 768]	977	[1338, 1339]	1489	[1726, 566]	2001	[2023, 1236]
466	[769, 770]	978	[1340, 567]	1490	[1727, 1728]	2002	[2024, 620]
467	[771, 772]	979	[1341, 1107]	1491	[1729, 1348]	2003	[2025, 588]
468	[112, 341]	980	[1342, 1229]	1492	[724, 1245]	2004	[1270, 1734]
469	[280, 773]	981	[1343, 622]	1493	[1730, 530]	2005	[2026, 1424]
470	[774, 297]	982	[174, 511]	1494	[1731, 711]	2006	[2027, 1353]
471	[775, 317]	983	[1344, 1192]	1495	[44, 1732]	2007	[2028, 1235]
472	[776, 777]	984	[1319, 460]	1496	[1348, 674]	2008	[2029, 1085]
473	[392, 778]	985	[1345, 1167]	1497	[1733, 1371]	2009	[1351, 588]
474	[779, 780]	986	[1346, 685]	1498	[1090, 143]	2010	[630, 1083]
475	[781, 782]	987	[1347, 1283]	1499	[1359, 1128]	2011	[653, 1313]
476	[325, 783]	988	[1189, 1287]	1500	[1734, 564]	2012	[2030, 1719]
477	[784, 258]	989	[684, 1348]	1501	[1735, 1086]	2013	[2031, 224]
478	[785, 786]	990	[1349, 494]	1502	[1736, 558]	2014	[1292, 1424]
479	[787, 788]	991	[1350, 1351]	1503	[1737, 1738]	2015	[1938, 1085]
480	[338, 305]	992	[1352, 676]	1504	[1739, 158]	2016	[799, 891]
481	[789, 389]	993	[1353, 1338]	1505	[1740, 617]	2017	[2032, 768]
482	[790, 791]	994	[1354, 1187]	1506	[1741, 469]	2018	[1623, 1848]
483	[792, 793]	995	[1355, 1356]	1507	[1742, 725]	2019	[2033, 1006]
484	[794, 355]	996	[1357, 1147]	1508	[1743, 541]	2020	[1465, 945]
485	[795, 796]	997	[1116, 60]	1509	[1229, 581]	2021	[1026, 29]
486	[797, 277]	998	[191, 1159]	1510	[202, 449]	2022	[352, 1658]
487	[264, 71]	999	[1193, 1233]	1511	[543, 522]	2023	[2034, 1536]
488	[798, 799]	1000	[1358, 1359]	1512	[682, 1359]	2024	[2035, 317]
489	[350, 800]	1001	[1360, 582]	1513	[187, 36]	2025	[2036, 1605]
490	[801, 378]	1002	[1361, 1160]	1514	[1744, 1263]	2026	[2037, 1445]
491	[802, 397]	1003	[1362, 1287]	1515	[1708, 1243]	2027	[2038, 765]
492	[803, 804]	1004	[1363, 1091]	1516	[1745, 1354]	2028	[1561, 332]
493	[805, 287]	1005	[1241, 1364]	1517	[1103, 1138]	2029	[2039, 343]
494	[347, 806]	1006	[1365, 1126]	1518	[1200, 1300]	2030	[791, 1489]
495	[753, 807]	1007	[669, 598]	1519	[495, 622]	2031	[2040, 1031]
496	[808, 248]	1008	[1366, 678]	1520	[1746, 1695]	2032	[2041, 49]
497	[432, 809]	1009	[1367, 630]	1521	[1150, 441]	2033	[172, 1198]
498	[810, 811]	1010	[1368, 230]	1522	[1747, 1333]	2034	[127, 1772]
499	[812, 809]	1011	[473, 171]	1523	[1748, 1094]	2035	[1144, 184]
500	[813, 814]	1012	[1181, 647]	1524	[450, 1216]	2036	[2042, 1772]
501	[815, 816]	1013	[1369, 1370]	1525	[1749, 1140]	2037	[2043, 1083]
502	[817, 81]	1014	[584, 1192]	1526	[197, 1145]	2038	[2044, 9]
503	[28, 818]	1015	[704, 1371]	1527	[1750, 1708]	2039	[1289, 597]
504	[819, 65]	1016	[1372, 1373]	1528	[1299, 688]	2040	[528, 9]
505	[820, 310]	1017	[1374, 175]	1529	[1330, 642]	2041	[2045, 412]
506	[821, 822]	1018	[1375, 1364]	1530	[607, 1396]	2042	[735, 430]

507	[823, 376]	1019	[1171, 1376]	1531	[717, 1258]	2043	[266, 1629]
508	[377, 739]	1020	[1377, 162]	1532	[1751, 483]	2044	[1596, 21]
509	[824, 825]	1021	[1378, 1095]	1533	[1752, 1183]	2045	[1254, 1353]
510	[826, 744]	1022	[1379, 682]	1534	[1753, 643]		
511	[827, 828]	1023	[131, 1224]	1535	[1754, 1414]		

Output function $n \mapsto \tau(n)$:

n	$\tau(n)$	n	$\tau(n)$	n	$\tau(n)$	n	$\tau(n)$	n	$\tau(n)$	n	$\tau(n)$
0	0	342	0	684	1	1026	1	1368	1	1710	0
1	0	343	0	685	1	1027	0	1369	1	1711	0
2	0	344	0	686	1	1028	0	1370	1	1712	0
3	0	345	1	687	1	1029	0	1371	0	1713	0
4	0	346	1	688	0	1030	1	1372	1	1714	0
5	0	347	0	689	1	1031	0	1373	0	1715	0
6	0	348	0	690	1	1032	1	1374	1	1716	1
7	0	349	1	691	0	1033	1	1375	1	1717	1
8	1	350	1	692	1	1034	0	1376	0	1718	0
9	0	351	0	693	0	1035	1	1377	1	1719	1
10	1	352	0	694	1	1036	1	1378	0	1720	0
11	0	353	0	695	0	1037	1	1379	0	1721	0
12	0	354	1	696	0	1038	0	1380	1	1722	1
13	0	355	1	697	1	1039	1	1381	1	1723	0
14	1	356	0	698	0	1040	1	1382	1	1724	0
15	0	357	1	699	1	1041	0	1383	0	1725	0
16	1	358	0	700	1	1042	1	1384	0	1726	0
17	1	359	0	701	0	1043	1	1385	0	1727	1
18	0	360	0	702	0	1044	0	1386	1	1728	1
19	0	361	1	703	1	1045	0	1387	1	1729	0
20	0	362	0	704	0	1046	0	1388	0	1730	0
21	1	363	0	705	0	1047	1	1389	1	1731	0
22	0	364	0	706	1	1048	0	1390	0	1732	1
23	0	365	0	707	1	1049	0	1391	1	1733	1
24	1	366	0	708	0	1050	1	1392	1	1734	0
25	0	367	0	709	0	1051	1	1393	1	1735	1
26	1	368	0	710	1	1052	0	1394	1	1736	0
27	0	369	0	711	0	1053	1	1395	0	1737	0
28	1	370	1	712	0	1054	0	1396	0	1738	1
29	1	371	1	713	1	1055	0	1397	1	1739	0
30	0	372	0	714	0	1056	0	1398	1	1740	1
31	0	373	1	715	0	1057	1	1399	0	1741	0
32	1	374	0	716	0	1058	1	1400	1	1742	0
33	1	375	1	717	0	1059	0	1401	0	1743	1
34	0	376	1	718	1	1060	0	1402	0	1744	1
35	1	377	0	719	0	1061	0	1403	1	1745	0

36	1	378	1	720	0	1062	1	1404	0	1746	0
37	0	379	0	721	1	1063	0	1405	0	1747	1
38	1	380	1	722	1	1064	0	1406	1	1748	1
39	0	381	0	723	1	1065	1	1407	1	1749	0
40	1	382	0	724	1	1066	1	1408	1	1750	0
41	0	383	1	725	0	1067	0	1409	0	1751	0
42	0	384	0	726	0	1068	0	1410	0	1752	0
43	1	385	0	727	1	1069	0	1411	0	1753	0
44	0	386	1	728	1	1070	0	1412	0	1754	1
45	0	387	1	729	1	1071	0	1413	0	1755	0
46	1	388	1	730	1	1072	0	1414	0	1756	1
47	0	389	1	731	0	1073	0	1415	1	1757	1
48	0	390	0	732	1	1074	0	1416	0	1758	0
49	1	391	0	733	1	1075	1	1417	0	1759	1
50	1	392	1	734	0	1076	1	1418	0	1760	0
51	0	393	0	735	1	1077	1	1419	1	1761	0
52	0	394	0	736	1	1078	1	1420	1	1762	1
53	1	395	0	737	1	1079	1	1421	0	1763	0
54	1	396	1	738	1	1080	1	1422	0	1764	1
55	0	397	0	739	1	1081	0	1423	0	1765	0
56	1	398	0	740	0	1082	1	1424	0	1766	0
57	1	399	1	741	0	1083	1	1425	0	1767	0
58	0	400	0	742	1	1084	0	1426	0	1768	0
59	1	401	1	743	1	1085	0	1427	1	1769	1
60	1	402	1	744	0	1086	1	1428	1	1770	1
61	0	403	1	745	1	1087	1	1429	0	1771	0
62	1	404	1	746	0	1088	1	1430	0	1772	1
63	0	405	1	747	1	1089	1	1431	1	1773	1
64	0	406	1	748	1	1090	0	1432	1	1774	1
65	1	407	1	749	0	1091	0	1433	1	1775	1
66	0	408	1	750	1	1092	0	1434	1	1776	0
67	1	409	0	751	0	1093	0	1435	0	1777	1
68	1	410	1	752	0	1094	1	1436	1	1778	0
69	0	411	0	753	1	1095	1	1437	1	1779	1
70	1	412	0	754	0	1096	1	1438	1	1780	1
71	1	413	1	755	1	1097	0	1439	0	1781	1
72	1	414	0	756	1	1098	0	1440	1	1782	0
73	1	415	1	757	0	1099	1	1441	0	1783	0
74	0	416	1	758	1	1100	1	1442	1	1784	1
75	1	417	1	759	0	1101	1	1443	1	1785	1
76	1	418	0	760	1	1102	0	1444	1	1786	1
77	0	419	1	761	0	1103	1	1445	0	1787	1
78	0	420	1	762	0	1104	1	1446	1	1788	1
79	1	421	0	763	0	1105	1	1447	1	1789	1

80	1	422	1	764	1	1106	0	1448	1	1790	0
81	0	423	1	765	1	1107	1	1449	0	1791	0
82	0	424	0	766	1	1108	1	1450	1	1792	1
83	1	425	0	767	0	1109	0	1451	1	1793	0
84	0	426	1	768	0	1110	1	1452	1	1794	1
85	1	427	0	769	0	1111	0	1453	1	1795	0
86	1	428	1	770	1	1112	0	1454	0	1796	1
87	0	429	0	771	1	1113	0	1455	1	1797	0
88	0	430	0	772	0	1114	0	1456	1	1798	1
89	0	431	1	773	1	1115	1	1457	1	1799	0
90	0	432	0	774	1	1116	0	1458	1	1800	1
91	1	433	1	775	0	1117	0	1459	0	1801	0
92	1	434	1	776	1	1118	0	1460	1	1802	1
93	0	435	0	777	1	1119	0	1461	1	1803	0
94	0	436	0	778	0	1120	0	1462	0	1804	1
95	0	437	1	779	0	1121	1	1463	0	1805	0
96	0	438	1	780	1	1122	0	1464	0	1806	0
97	0	439	1	781	0	1123	0	1465	0	1807	0
98	1	440	1	782	0	1124	1	1466	0	1808	1
99	1	441	0	783	0	1125	1	1467	0	1809	0
100	1	442	0	784	1	1126	1	1468	0	1810	0
101	0	443	1	785	1	1127	1	1469	0	1811	1
102	0	444	1	786	0	1128	0	1470	0	1812	1
103	1	445	0	787	1	1129	0	1471	0	1813	1
104	0	446	0	788	0	1130	1	1472	0	1814	0
105	1	447	1	789	0	1131	1	1473	1	1815	0
106	1	448	0	790	0	1132	1	1474	0	1816	1
107	1	449	1	791	1	1133	1	1475	0	1817	0
108	1	450	1	792	1	1134	0	1476	1	1818	0
109	0	451	0	793	0	1135	1	1477	1	1819	1
110	0	452	1	794	0	1136	0	1478	0	1820	1
111	1	453	0	795	1	1137	0	1479	0	1821	0
112	1	454	1	796	0	1138	1	1480	1	1822	0
113	1	455	0	797	1	1139	1	1481	1	1823	0
114	1	456	1	798	1	1140	1	1482	1	1824	1
115	0	457	0	799	1	1141	0	1483	0	1825	1
116	0	458	1	800	1	1142	0	1484	0	1826	1
117	1	459	0	801	1	1143	0	1485	1	1827	1
118	1	460	1	802	0	1144	1	1486	0	1828	1
119	1	461	0	803	0	1145	0	1487	0	1829	0
120	0	462	1	804	0	1146	1	1488	0	1830	0
121	0	463	1	805	1	1147	0	1489	0	1831	1
122	1	464	1	806	0	1148	1	1490	1	1832	0
123	1	465	0	807	0	1149	0	1491	0	1833	1

124	0	466	0	808	1	1150	1	1492	1	1834	1
125	1	467	1	809	1	1151	0	1493	0	1835	1
126	0	468	1	810	0	1152	0	1494	0	1836	0
127	0	469	0	811	1	1153	0	1495	0	1837	0
128	1	470	1	812	1	1154	1	1496	1	1838	1
129	0	471	0	813	1	1155	1	1497	1	1839	0
130	0	472	1	814	0	1156	1	1498	0	1840	0
131	1	473	1	815	1	1157	0	1499	1	1841	0
132	1	474	0	816	1	1158	1	1500	0	1842	0
133	0	475	0	817	0	1159	1	1501	1	1843	1
134	1	476	0	818	1	1160	0	1502	0	1844	1
135	1	477	1	819	1	1161	1	1503	0	1845	1
136	0	478	1	820	0	1162	1	1504	0	1846	1
137	1	479	1	821	1	1163	0	1505	1	1847	0
138	1	480	1	822	0	1164	0	1506	0	1848	1
139	1	481	0	823	1	1165	0	1507	0	1849	1
140	1	482	0	824	1	1166	0	1508	1	1850	1
141	1	483	1	825	0	1167	1	1509	1	1851	0
142	1	484	0	826	0	1168	0	1510	1	1852	1
143	1	485	1	827	0	1169	0	1511	0	1853	1
144	1	486	1	828	0	1170	1	1512	0	1854	1
145	0	487	0	829	0	1171	1	1513	0	1855	1
146	0	488	1	830	0	1172	1	1514	1	1856	0
147	1	489	1	831	1	1173	0	1515	0	1857	1
148	1	490	1	832	1	1174	0	1516	0	1858	0
149	0	491	0	833	1	1175	1	1517	1	1859	0
150	1	492	0	834	0	1176	0	1518	1	1860	0
151	0	493	1	835	0	1177	0	1519	1	1861	0
152	1	494	0	836	0	1178	1	1520	0	1862	0
153	0	495	1	837	1	1179	1	1521	1	1863	1
154	1	496	1	838	1	1180	0	1522	1	1864	0
155	1	497	0	839	0	1181	0	1523	1	1865	1
156	0	498	0	840	1	1182	1	1524	1	1866	0
157	1	499	1	841	0	1183	1	1525	0	1867	0
158	1	500	1	842	0	1184	0	1526	0	1868	0
159	0	501	1	843	0	1185	1	1527	0	1869	1
160	1	502	0	844	1	1186	0	1528	0	1870	0
161	0	503	1	845	0	1187	1	1529	1	1871	0
162	0	504	1	846	1	1188	1	1530	1	1872	1
163	1	505	0	847	0	1189	1	1531	0	1873	1
164	1	506	1	848	1	1190	1	1532	0	1874	0
165	0	507	1	849	0	1191	1	1533	0	1875	0
166	0	508	0	850	1	1192	0	1534	0	1876	1
167	1	509	1	851	1	1193	1	1535	1	1877	0

168	1	510	0	852	0	1194	0	1536	0	1878	1
169	1	511	0	853	0	1195	0	1537	1	1879	0
170	1	512	0	854	0	1196	0	1538	1	1880	1
171	0	513	1	855	0	1197	0	1539	0	1881	0
172	1	514	1	856	0	1198	1	1540	1	1882	1
173	0	515	1	857	0	1199	1	1541	0	1883	1
174	1	516	0	858	1	1200	1	1542	1	1884	0
175	0	517	0	859	1	1201	1	1543	0	1885	1
176	1	518	1	860	0	1202	1	1544	1	1886	0
177	0	519	1	861	0	1203	0	1545	0	1887	0
178	1	520	0	862	0	1204	0	1546	0	1888	0
179	1	521	1	863	0	1205	1	1547	1	1889	0
180	1	522	1	864	0	1206	1	1548	0	1890	1
181	0	523	1	865	0	1207	1	1549	1	1891	1
182	0	524	1	866	0	1208	0	1550	1	1892	0
183	0	525	0	867	0	1209	1	1551	0	1893	1
184	1	526	1	868	1	1210	0	1552	1	1894	0
185	0	527	0	869	0	1211	0	1553	1	1895	1
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187	0	529	1	871	1	1213	1	1555	1	1897	0
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189	1	531	1	873	0	1215	0	1557	1	1899	1
190	1	532	0	874	0	1216	1	1558	0	1900	1
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192	1	534	0	876	0	1218	1	1560	0	1902	1
193	1	535	0	877	1	1219	0	1561	1	1903	0
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195	0	537	0	879	1	1221	0	1563	0	1905	1
196	0	538	0	880	1	1222	1	1564	1	1906	0
197	0	539	0	881	1	1223	1	1565	1	1907	1
198	1	540	0	882	0	1224	0	1566	1	1908	1
199	0	541	0	883	1	1225	1	1567	1	1909	1
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202	1	544	1	886	1	1228	0	1570	1	1912	0
203	1	545	1	887	0	1229	1	1571	0	1913	0
204	0	546	1	888	1	1230	0	1572	0	1914	1
205	1	547	1	889	0	1231	0	1573	1	1915	0
206	0	548	0	890	0	1232	0	1574	0	1916	1
207	1	549	0	891	1	1233	0	1575	1	1917	0
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209	0	551	0	893	1	1235	0	1577	0	1919	0
210	0	552	1	894	1	1236	0	1578	1	1920	0
211	0	553	1	895	1	1237	0	1579	1	1921	0

212	0	554	1	896	0	1238	1	1580	1	1922	1
213	1	555	1	897	1	1239	0	1581	1	1923	1
214	1	556	0	898	0	1240	1	1582	0	1924	0
215	1	557	1	899	1	1241	0	1583	1	1925	0
216	1	558	1	900	0	1242	1	1584	1	1926	1
217	1	559	0	901	1	1243	0	1585	0	1927	1
218	1	560	0	902	1	1244	0	1586	0	1928	1
219	1	561	0	903	0	1245	0	1587	0	1929	0
220	0	562	0	904	1	1246	1	1588	0	1930	0
221	0	563	1	905	1	1247	0	1589	1	1931	1
222	0	564	1	906	0	1248	1	1590	1	1932	0
223	1	565	1	907	0	1249	0	1591	1	1933	1
224	1	566	0	908	1	1250	0	1592	1	1934	1
225	1	567	0	909	1	1251	0	1593	1	1935	0
226	1	568	0	910	0	1252	1	1594	1	1936	0
227	0	569	0	911	1	1253	0	1595	1	1937	0
228	1	570	0	912	1	1254	1	1596	0	1938	0
229	0	571	0	913	0	1255	0	1597	0	1939	1
230	0	572	1	914	1	1256	0	1598	1	1940	0
231	0	573	1	915	0	1257	1	1599	0	1941	1
232	0	574	0	916	1	1258	0	1600	0	1942	1
233	1	575	1	917	1	1259	0	1601	1	1943	1
234	1	576	0	918	1	1260	0	1602	0	1944	1
235	1	577	1	919	1	1261	1	1603	1	1945	0
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237	1	579	1	921	1	1263	0	1605	1	1947	0
238	1	580	0	922	1	1264	1	1606	1	1948	1
239	0	581	1	923	0	1265	0	1607	0	1949	0
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241	1	583	1	925	0	1267	1	1609	1	1951	0
242	0	584	0	926	1	1268	0	1610	1	1952	0
243	1	585	1	927	0	1269	1	1611	0	1953	0
244	1	586	1	928	0	1270	0	1612	1	1954	0
245	0	587	1	929	0	1271	1	1613	0	1955	1
246	0	588	1	930	0	1272	0	1614	0	1956	1
247	0	589	0	931	0	1273	0	1615	1	1957	0
248	0	590	0	932	0	1274	1	1616	0	1958	0
249	0	591	0	933	0	1275	0	1617	0	1959	0
250	1	592	0	934	1	1276	1	1618	1	1960	0
251	0	593	0	935	1	1277	0	1619	1	1961	1
252	1	594	0	936	0	1278	0	1620	0	1962	0
253	1	595	0	937	1	1279	1	1621	0	1963	1
254	0	596	0	938	1	1280	1	1622	0	1964	0
255	1	597	1	939	1	1281	1	1623	1	1965	0

256	1	598	1	940	0	1282	1	1624	0	1966	1
257	1	599	1	941	1	1283	1	1625	0	1967	1
258	1	600	1	942	1	1284	1	1626	1	1968	0
259	0	601	0	943	0	1285	1	1627	0	1969	1
260	0	602	1	944	1	1286	1	1628	0	1970	0
261	1	603	0	945	1	1287	1	1629	1	1971	0
262	1	604	1	946	0	1288	1	1630	1	1972	1
263	1	605	1	947	1	1289	1	1631	0	1973	0
264	0	606	0	948	0	1290	0	1632	0	1974	0
265	1	607	1	949	1	1291	0	1633	0	1975	0
266	1	608	0	950	0	1292	0	1634	1	1976	1
267	1	609	0	951	1	1293	1	1635	1	1977	1
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276	1	618	0	960	1	1302	0	1644	0	1986	1
277	0	619	0	961	0	1303	1	1645	1	1987	0
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279	0	621	0	963	0	1305	1	1647	0	1989	1
280	0	622	0	964	0	1306	0	1648	0	1990	0
281	1	623	0	965	0	1307	0	1649	1	1991	1
282	1	624	0	966	0	1308	1	1650	1	1992	0
283	1	625	0	967	0	1309	1	1651	1	1993	1
284	1	626	0	968	1	1310	0	1652	1	1994	0
285	0	627	0	969	0	1311	1	1653	1	1995	0
286	0	628	1	970	0	1312	1	1654	0	1996	0
287	1	629	0	971	0	1313	0	1655	1	1997	1
288	1	630	0	972	0	1314	1	1656	0	1998	1
289	0	631	0	973	0	1315	0	1657	0	1999	0
290	1	632	1	974	1	1316	1	1658	1	2000	0
291	0	633	0	975	0	1317	1	1659	0	2001	0
292	0	634	1	976	0	1318	0	1660	0	2002	1
293	1	635	1	977	1	1319	0	1661	1	2003	1
294	1	636	0	978	1	1320	1	1662	1	2004	0
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299	1	641	1	983	1	1325	0	1667	1	2009	0

300	1	642	1	984	0	1326	0	1668	0	2010	0
301	0	643	0	985	0	1327	0	1669	0	2011	1
302	0	644	0	986	0	1328	0	1670	1	2012	1
303	1	645	1	987	1	1329	0	1671	1	2013	1
304	1	646	1	988	1	1330	1	1672	0	2014	0
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307	0	649	0	991	1	1333	1	1675	0	2017	1
308	0	650	0	992	1	1334	0	1676	0	2018	1
309	1	651	0	993	0	1335	1	1677	0	2019	1
310	1	652	1	994	1	1336	0	1678	0	2020	0
311	1	653	1	995	1	1337	0	1679	0	2021	1
312	0	654	0	996	0	1338	1	1680	0	2022	0
313	0	655	0	997	0	1339	0	1681	0	2023	0
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321	0	663	0	1005	0	1347	1	1689	1	2031	1
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323	1	665	0	1007	1	1349	0	1691	1	2033	1
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326	0	668	0	1010	1	1352	1	1694	1	2036	1
327	0	669	1	1011	1	1353	0	1695	0	2037	1
328	1	670	0	1012	0	1354	1	1696	0	2038	0
329	1	671	0	1013	1	1355	1	1697	1	2039	1
330	0	672	1	1014	0	1356	0	1698	1	2040	1
331	0	673	1	1015	0	1357	0	1699	1	2041	1
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333	1	675	1	1017	1	1359	1	1701	1	2043	1
334	0	676	0	1018	1	1360	0	1702	1	2044	0
335	1	677	1	1019	1	1361	0	1703	1	2045	1
336	1	678	0	1020	1	1362	0	1704	0		
337	1	679	0	1021	0	1363	0	1705	1		
338	1	680	1	1022	0	1364	1	1706	1		
339	1	681	1	1023	1	1365	1	1707	1		
340	0	682	0	1024	1	1366	0	1708	0		
341	0	683	1	1025	1	1367	1	1709	1		

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