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Polynomial Invariants of 2-Bridge Links through 20 Crossings

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In this paper, we calculate the homfly polynomial $P_L(v,z)$, Kauffman polynomial $F_L(a,z)$, Jones polynomial $V_L(t)$, Q polynomial $Q_L(z)$, 2-variable Conway polynomial $\nabla_L(t_1,t_2)$, and reduced Conway polynomial $\widetilde{\nabla}_L(z)$ of a 2-bridge link L with crossing number ≤ 20 and list all the pairs sharing the same polynomial invariants (Table 2). This paper is a continuation of [9], where these polynomial invariants except for the 2-variable Conway polynomial for 2-bridge knots through 22 crossings are calculated and all the pairs having the same polynomial invariants are listed. The total number of the links is 44,118, where we ignore the orientations of both a link and its ambient space. If we consider them, this amounts 175,788. The program is written in Turbo Pascal for the NEC PC-9801 Series as before.

We observe the following for 2-bridge links through 20 crossings:

Fact 1. *$P_L(v,z) = P_{L'}(v,z)$ iff $V_L(t) = V_{L'}(t)$ and $\widetilde{\nabla}_L(z) = \widetilde{\nabla}_{L'}(z)$.*

Fact 2. *If $P_L(v,z) = P_{L'}(v,z)$ and $P_{L^\wedge}(v,z) = P_{L'^\wedge}(v,z)$, then $\nabla_L(t_1,t_2) = \nabla_{L'}(t_1,t_2)$.*

Fact 3. *The number of links having the same homfly or Kauffman polynomial is at most two.*

Fact 4. *$P_L(v,z) = P_{L^\wedge}(v,z)$ iff $\nabla_L(t_1,t_2) = \nabla_{L^\wedge}(t_1,t_2)$ $\left(= -\nabla_L(t_1^{-1},t_2)\right)$.*

Here $L^\wedge$ is a 2-bridge link obtained from L by reversing the orientation of one of the 2 components. Facts 1 and 3 are the same as those in [9]. For Fact 3, we do not consider the pair of 2-bridge links L and

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L' which share the same Kauffman polynomial and have linking number zero (such as "3800 1669, 2429" of 19 crossing links in Table). For these links, it holds $F_L = F_{L'} = F_{L^\wedge} = F_{L'^\wedge}$. The "only if" part of Fact 4 cannot be deduced from only Table 2. We must check the 2-variable Conway polynomials. The example as in Fact 4 is constructed in [5, Theorem 9].

For the pair L and L', where $L \neq L', L'^\wedge$, sharing the same Q polynomial, the cases given in Table 1 occur, where the last column gives an example for each case from Table 2. For example, Case 5 indicates the pair such that $V_L = V_{L'}$ ($V_{L^\wedge} = V_{L'^\wedge}$), $P_L = P_{L'}$, $P_{L^\wedge} \neq P_{L'^\wedge}$, $F_L = F_{L'}$ ($F_{L^\wedge} = F_{L'^\wedge}$), $\nabla /= \nabla_{L'}$ ($\nabla_{L^\wedge} \neq \nabla_{L'^\wedge}$), $\widetilde{\nabla}_L = \widetilde{\nabla}_{L'}$, $\widetilde{\nabla}_{L^\wedge} \neq \widetilde{\nabla}_{L'^\wedge}$. Cases 3–5 explain Fact 2. Relating to Cases 2 and 3, we can construct the following examples:

(i) Arbitrarily many skein equivalent fibered 2-bridge links with the same 2-variable Conway polynomial ([5, Theorem 7]).

(ii) Arbitrarily many skein equivalent 2-bridge links which have mutually distinct 2-variable Conway polynomials ([6, Theorem 2]).

Relating to Cases 4–6, we can construct the following examples:

(iii) A pair of skein equivalent 2-bridge links with the same Kauffman polynomial but distinct 2-variable Conway polynomials ([6, Theorem 7]).

(iv) Arbitrarily many skein equivalent fibered 2-bridge links which have the same Kauffman and 2-variable Conway polynomial ([8, Theorem 2]).

Relating to Case 7, we can construct the following example:

(v) Arbitrarily many 2-bridge links which have the same Q and 2-variable Conway polynomial, but distinct Jones polynomials ([7, Theorem]).

Table 1

Case	V_L	P_L	$P_{L^\wedge}$	F_L	∇_L	$\widetilde{\nabla}_L$	$\widetilde{\nabla}_{L^\wedge}$	cr	p	q, r
1	$=$	$\neq$	$\neq$	$\neq$	$\neq$	$\neq$	$\neq$	14	196	69,−155
2	$=$	$=$	$\neq$	$\neq$	$\neq$	$=$	$\neq$	11	98	29,−55
3	$=$	$=$	$=$	$\neq$	$=$	$=$	$=$	15	392	139,−309
4	$=$	$=$	$=$	$=$	$=$	$=$	$=$	18	1010	313,293
5	$=$	$=$	$\neq$	$=$	$\neq$	$=$	$=$	17	1250	−799,−699
6	$=$	$\neq$	$\neq$	$=$	$\neq$	$\neq$	$\neq$	12	130	57,−47
7	$\neq$	$\neq$	$\neq$	$\neq$	$=$	$=$	$=$	15	504	181,197
8	$\neq$	$\neq$	$\neq$	$\neq$	$\neq$	$=$	$\neq$	17	930	421,601
9	$\neq$	$\neq$	$\neq$	$\neq$	$\neq$	$\neq$	$\neq$	9	24	5,11

§1. 2-bridge link

The 2-bridge links are classified in Schubert's normal form $S(p,q)$ [10], where $p > 0, -p < q < p$, and p and q are coprime integers.

Proposition 1. *$S(p,q)$ and $S(p',q')$ are isotopic as oriented (resp. unoriented) links if and only if:*

$$p = p',\ q^{\pm 1} \equiv q' \mod 2p \quad (\textit{resp.} \mod p).$$

The following properties are easily seen from Schubert's normal form (cf. [1, Proposition 12.5]):

Proposition 2. (1) *A 2-bridge link $L = K_1 \cup K_2$ is interchangeable, that is, there is an isotopy φ of S^3 such that $\varphi(K_i) = K_j$, $i \neq j$.*

(2) *A 2-bridge link $L = K_1 \cup K_2$ is invertible, that is, there is an isotopy ψ of S^3 such that $\psi(K_i) = -K_i$, $i = 1, 2$.*

Let L be an oriented 2-bridge link. Then we denote by $L^\wedge$ a 2-bridge link obtained by reversing the orientation of one of the two components of L, and by $\overline{L}$ a mirror image of L. So if $L = S(p, \pm q)$, $q > 0$, then $L^\wedge = S(p, \pm(q-p))$ and $\overline{L} = S(p, \mp q)$. Note that $\overline{(L^\wedge)} = (\overline{L})^\wedge = S(p, \pm(p-q))$, which we denote by $\overline{L}^\wedge$. Thus according as the isotopy types of the four oriented 2-bridge links $L, L^\wedge, \overline{L}$, and $\overline{L}^\wedge$, $L = S(p,q)$, there are three types for the 2-bridge link:

Type A: $L = \overline{L}^\wedge \neq \overline{L} = L^\wedge$, that is, $q(p-q) \equiv 1 \mod 2p$.

Type B: $L = L^\wedge \neq \overline{L} = \overline{L}^\wedge$, that is, $q(p-q) \equiv -1 \mod 2p$.

Type C: No two of $L, \overline{L}, L^\wedge$, and $\overline{L}^\wedge$ are isotopic, that is, $q(p-q) \not\equiv \pm 1 \mod 2p$.

Given a 2-bridge link in Schubert's normal form $S(p,q)$, it can be put in Conway's normal form $C(a_1, a_2, \ldots, a_k)$, (cf. [9, Fig. 3]), where

$$\frac{p}{q} = a_1 + \frac{1}{a_2 +} \cdots \frac{1}{+ a_k}. \tag{1}$$

Note that this is a normal form for an unoriented 2-bridge link.

Let $p, q > 0$ and $a_1, a_2, \ldots, a_k > 0$. Since $a_k = (a_k - 1) + 1/1$, if we suppose $a_k > 1$ or fix the parity of k, this expression is unique and the crossing number is $a_1 + a_2 + \cdots + a_k$.

Proposition 3. *Every 2-bridge link $S(p,q)$, $q > 0$, of Type A can be expressed as $C(a_1, a_2, \ldots, a_n, a_n, \ldots, a_2, a_1)$, $a_i > 0$, and vice versa.*

Proof. Suppose that

$$\frac{p}{q} = b_1 + \frac{1}{b_2 +} \cdots \frac{1}{+ b_\ell},$$

where $b_i > 0$ and ℓ is even. Then we have

$$\begin{pmatrix} s & q \\ r & p \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 1 & b_1 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & b_2 \end{pmatrix} \cdots \begin{pmatrix} 0 & 1 \\ 1 & b_\ell \end{pmatrix},$$

where $p > q > s > 0$, $p > r > s > 0$, and $ps - rq = 1$ (cf. [11]). Since $(q^2+1)/p \in \mathbb{Z}$,

$$\frac{r^2+1}{p} = \frac{r^2 + (ps - qr)^2}{p} = \frac{q^2+1}{p} r^2 - 2qrs + ps^2 \in \mathbb{Z}.$$

Let $x = (q^2+1)/p$ and $y = (r^2+1)/p$. Since $xp - qq = 1$ and $sp - rq = 1$, there exists an integer a such that $s - x = aq$ and $r - q = ap$. Since $yp - rr = 1$ and $sp - qr = 1$, there exists an integer b such that $s - y = br$ and $q - r = bp$. Then we have $a = b = 0$ and $q = r$. From the uniqueness of the continued fraction, we have $b_1 = b_\ell$, $b_2 = b_{\ell-1}$, $\ldots$, $b_{\ell/2} = b_{\ell/2+1}$. The converse is easy, and the proof is complete.

Proposition 4. *Every 2-bridge link $S(p,q)$, $q > 0$, of Type B can be expressed as $C(a_1, a_2, \ldots, a_n, 2a-1, a_n, \ldots, a_2, a_1)$, $a_i > 0$, $a > 0$, and vice versa.*

Proof. Since $q(p-q) \equiv -1 \mod 2p$, there is an integer b such that

$$q^2 - 1 = p(q + 2b). \tag{2}$$

First we show that there exist positive integers x, y, z, w satisfying:

(3) $$\begin{pmatrix} w & y \\ z & x \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} w & z \\ y & x \end{pmatrix} = \begin{pmatrix} q+2b & q \\ q & p \end{pmatrix}$$

and

(4) $$xw - yz = \varepsilon = \pm 1, \ x > y.$$

From (2), we have

$$\frac{q+1}{2}\frac{q-1}{2} = \frac{p}{4}(q+2b),$$

which is even, and thus $p/4$ is also even, that is, $p \equiv 0 \mod 8$. Let $p_\pm = \text{g.c.d.}(p/4, (q \pm 1)/2) > 0$. Since $\text{g.c.d.}((q+1)/2, (q-1)/2) = 1$, we have $p_+ p_- = p/4$. Let $z = p_+ + p_-$, which is an odd integer. Let

$$(x, y) = \begin{cases} (2p_+, (q-1)/2p_-) & \text{if } p_+ < p_-, \\ (2p_-, (q+1)/2p_+) & \text{if } p_- < p_+. \end{cases}$$

Since $\frac{q+1}{2p_+}\frac{q-1}{2p_-} = q + 2b$ is odd, both $(q+1)/2p_+$ and $(q-1)/2p_-$ are odd, so let $w = \frac{1}{2}(\frac{q+1}{2p_+} + \frac{q-1}{2p_-})$. Then x, y, z, w satisfy (3) and (4). Since $z > x > 0$, there are integers a and u such that $z = ax + u$, $a > 0$ and $x > u > 0$. Let $v = w - ay$. Then $xv - yu = \varepsilon$, and there exist positive integers $a_1, a_2, \ldots, a_n$ such that

$$\begin{pmatrix} v & y \\ u & x \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 1 & a_1 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & a_2 \end{pmatrix} \cdots \begin{pmatrix} 0 & 1 \\ 1 & a_n \end{pmatrix}.$$

Then $\varepsilon = (-1)^n$ and

$$\begin{pmatrix} v & y \\ u & x \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & 2a-1 \end{pmatrix} \begin{pmatrix} v & u \\ y & x \end{pmatrix} = \begin{pmatrix} q+2b & q \\ q & p \end{pmatrix},$$

and so $S(p,q)$ can be expressed as $C(a_1, a_2, \ldots, a_n, 2a-1, a_n, \ldots, a_2, a_1)$. Conversely, if n is odd, a rotation through π about the axis E as shown in Fig. 1, where $\alpha = S_2^{a_1} S_1^{-a_2} \ldots S_2^{a_n} S_1^{1-a}$ and $\alpha' = S_1^{1-a} S_2^{a_n} \ldots S_1^{-a_2} S_2^{a_1}$, gives an isotopy of S^3 which reverses the orientation of one of the two components. If n is even, we have a similar isotopy of S^3. This completes the proof.

Let $\mathcal{L}_n$ be the set of the unoriented 2-bridge links $C(a_1, a_2, \ldots, a_k)$'s satisfying the following:

(5) $$a_1, a_k \geq 2, \ a_2, \ldots, a_{k-1} \geq 1.$$

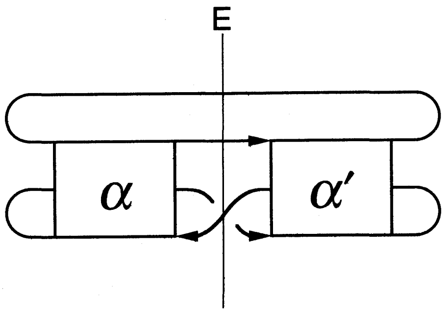

Fig. 1.

(6) Either $a_i = a_{k-i+1}$ for all $i \geq 1$ or $a_1 = a_k, a_2 = a_{k-1}, \ldots, a_{i-1} = a_{k+2-i}$, $a_i > a_{k+1-i}$ for some $i \geq 1$.

(7) $$a_1 + a_2 + \cdots + a_k = n.$$

In other words, this is the set of representatives of unoriented 2-bridge links with n crossings up to chirality. Let $\mathcal{AL}_n$ and $\mathcal{BL}_n$ be the subsets of $\mathcal{L}_n$ consisting of the unoriented 2-bridge links of the form $C(b_1, \ldots, b_\ell, b_\ell, \ldots, b_1)$ and $C(c_1, \ldots, c_\ell, 2c-1, c_\ell, \ldots, c_1)$, respectively. There is a bijective mapping

$$\psi\colon \mathcal{AL}_{2m} \longrightarrow \mathcal{BL}_{2m-1}$$

defined by

$$\psi(C(b_1, \ldots, b_\ell, b_\ell, \ldots, b_1)) = \begin{cases} C(b_1, \ldots, b_\ell - 1, 1, b_\ell - 1, \ldots, b_1) & \text{if } b_\ell > 1 \\ C(b_1, \ldots, b_{\ell-2}, 2b_{\ell-1} + 1, b_{\ell-2}, \ldots, b_1) & \text{if } b_\ell = 1. \end{cases}$$

The explicit numbers of $\mathcal{L}_n$ and $\mathcal{AL}_n$ are given by Ernst and Sumners [3], in which they are denoted by TL_n and ATL_n. Thus we can know the number of $\mathcal{BL}_n$, which equals ATL_n. Let TL_n^{**} denote the number of oriented 2-bridge links of n crossings up to isotopy. Since

$$TL_n^{**} = 4TL_n - 2ATL_{n+1} - 2ATL_n,$$

we have:

Proposition 5.

$$TL_n^{**} = \begin{cases} (2^{n-2} + 2^{\frac{n+2}{2}} - 2^{\frac{n-2}{2}} + 2)/3 & \text{if } n \equiv 0 \mod 2, \\ (2^{n-2} - 2)/3 & \text{if } n \equiv 1 \mod 2. \end{cases}$$

Remark. $TL_0^{**} = 2$ and $TL_1^{**} = 0$. $\sum_{n=0}^{20} TL_n = 44,118$ and $\sum_{n=0}^{20} TL_n^{**} = 175,788$.

§2. Conway polynomial

Let L be a 2-component link and $\nabla_L(t_1, t_2) \in \mathbb{Z}[t_1^{\pm 1}, t_2^{\pm 1}]$ its Conway polynomial, where the components correspond to the labels t_1 and t_2. This is a uniquely determined invariant of the isotopy type of an oriented link and is related to the 2-variable Alexander polynomial $\Delta(x_1, x_2)$ by

$$\Delta(t_1^2, t_2^2) = \pm t_1^{n_1} t_2^{n_2} \nabla(t_1, t_2),$$

where $\pm t_1^{n_1} t_2^{n_2}$ is a unit (cf. [2,4]). Let L_n, $n \in \mathbb{Z}$, be the 2-component links with labels t_1 and t_2, which contain a 2-braid σ_1^n and are identical except near the 2-braid. Let $\nabla_n(t_1, t_2)$ be the Conway polynomial of L_n.

(8) Suppose that the 2-braid consists of the different components with orientation not parallel. Then

$$\nabla_2(t_1, t_2) + \nabla_{-2}(t_1, t_2) = (t_1 t_2^{-1} + t_1^{-1} t_2) \nabla_0(t_1, t_2).$$

(9) Suppose that the 2-braid consists of the same component having label t_i and parallel orientation. Then

$$\nabla_1(t_1, t_2) = \nabla_{-1}(t_1, t_2) + (t_i - t_i^{-1}) \nabla_0(t_1, t_2).$$

(10) Let $L \sharp L'$ be the connected sum of two 2-component links L and L' such that the connection takes place between the components with the same label t_i. Then

$$\nabla_{L \sharp L'} = (t_i - t_i^{-1}) \nabla_L \nabla_{L'}.$$

(11) For the split 2-component link L, $\nabla_L = 0$.
(12) For the Hopf link L with linking number ± 1, $\nabla_L = \pm 1$.

Let $\nabla(b_1, b_2, \ldots, b_m)$ be the Conway polynomial of the 2-bridge link $D(b_1, b_2, \ldots, b_m)$, m odd (cf. [9, Fig. 2]). Hartley [4, (6.4)] shows that $\nabla(b_1, b_2, \ldots, b_m)$ is an integral polynomial in $f = t_1 t_2 + t_1^{-1} t_2^{-1}$ and $g = t_1 t_2^{-1} + t_1^{-1} t_2$. More precisely we have:

Proposition 6.

$$\nabla(b_1, b_2, \cdots, b_m) = (1,0)A^{b_m}B^{b_{m-1}}\cdots A^{b_3}B^{b_2}A^{b_1}\begin{pmatrix}0\\1\end{pmatrix},$$

where

$$A = \begin{pmatrix} g & -1 \\ 1 & 0 \end{pmatrix} \text{ and } B = \begin{pmatrix} 1 & 0 \\ f-g & 1 \end{pmatrix}.$$

Note that $z^{-1}\widetilde{\nabla}(z)$, where $\widetilde{\nabla}(z)$ is the reduced Conway polynomial [2, p.340], is obtained from $\nabla(b_1, b_2, \ldots, b_m)$ by substituting $f = z^2+1$ and $g = 2$.

Proof. Apply (9) and (10) to one of the crossings in the 2-braid with $2b_{m-1}$ crossings. Then

$$\begin{aligned}\nabla(b_1,\ldots,b_{m-2},b_{m-1},b_m) &= \nabla(b_1,\ldots,b_{m-2},b_{m-1}-1,b_m)\\ &\quad + (t_1-t_1^{-1})(t_2-t_2^{-1})\nabla(b_1,\ldots,b_{m-2})\nabla(b_m).\end{aligned}$$

So by induction on b_{m-1}, we have:

$$\begin{aligned}\nabla(b_1,\ldots,b_{m-2},b_{m-1},b_m) &= \nabla(b_1,\ldots,b_{m-2}+b_m)\\ &\quad + b_{m-1}(t_1-t_1^{-1})(t_2-t_2^{-1})\nabla(b_1,\ldots,b_{m-2})\nabla(b_m).\end{aligned}$$

Apply (8) to the 2-braid with $2b_m$ crossings. Then

$$\begin{aligned}&\nabla(b_1,\ldots,b_{m-1},b_m) + \nabla(b_1,\ldots,b_{m-1},b_m-2)\\ &= g\nabla(b_1,\ldots,b_{m-1},b_m-1),\end{aligned}$$

and so we have

$$\begin{pmatrix}\nabla(b_1,\ldots,b_m)\\ \nabla(b_1,\ldots,b_m-1)\end{pmatrix} = A\begin{pmatrix}\nabla(b_1,\ldots,b_m-1)\\ \nabla(b_1,\ldots,b_m-2)\end{pmatrix}.$$

Then we have

$$\begin{aligned}&\begin{pmatrix}\nabla(b_1,\ldots,b_{m-3},b_{m-2}+b_m)\\ \nabla(b_1,\ldots,b_{m-3},b_{m-2}+b_m-1)\end{pmatrix}\\ &\qquad = A^{b_m}\begin{pmatrix}\nabla(b_1,\ldots,b_{m-3},b_{m-2})\\ \nabla(b_1,\ldots,b_{m-3},b_{m-2}-1)\end{pmatrix},\end{aligned}$$

and

$$\begin{pmatrix}\nabla(b_m)\\ \nabla(b_m-1)\end{pmatrix} = A^{b_m}\begin{pmatrix}0\\1\end{pmatrix},$$

since $\nabla(0) = 0$ by (11) and $\nabla(-1) = 1$ by (12). Therefore

$$\begin{aligned}
&\begin{pmatrix} \nabla(b_1, \ldots, b_{m-1}, b_m) \\ \nabla(b_1, \ldots, b_{m-1}, b_m - 1) \end{pmatrix} \\
&= A^{b_m} \begin{pmatrix} \nabla(b_1, \ldots, b_{m-2}) \\ \nabla(b_1, \ldots, b_{m-2} - 1) \end{pmatrix} \\
&\qquad + b_{m-1}(t_1 - t_1^{-1})(t_2 - t_2^{-1})\nabla(b_1, \ldots, b_{m-2}) A^{b_m} \begin{pmatrix} 0 \\ 1 \end{pmatrix} \\
&= A^{b_m} \begin{pmatrix} 1 & 0 \\ b_{m-1}(t_1 - t_1^{-1})(t_2 - t_2^{-1}) & 1 \end{pmatrix} \begin{pmatrix} \nabla(b_1, \ldots, b_{m-2}) \\ \nabla(b_1, \ldots, b_{m-2} - 1) \end{pmatrix} \\
&= A^{b_m} B^{b_{m-1}} \begin{pmatrix} \nabla(b_1, \ldots, b_{m-2}) \\ \nabla(b_1, \ldots, b_{m-2} - 1) \end{pmatrix} \\
&= A^{b_m} B^{b_{m-1}} \cdots B^{b_2} A^{b_1} \begin{pmatrix} 0 \\ 1 \end{pmatrix},
\end{aligned}$$

and we have the desired formula.

§3. Computational process

From [9, Sect.2, Step 1], we have the set $\mathcal{L}_n$. Let $C(a_1, a_2, \ldots, a_k) \in \mathcal{L}_n$ and p, q be the integers obtained from the continued fraction (1). Let

$$\frac{p}{q} = 2b_1 + \frac{1}{2b_2 +} \cdots + \frac{1}{2b_m}$$

and

$$\frac{p}{q-p} = 2c_1 + \frac{1}{2c_2 +} \cdots + \frac{1}{2c_\ell},$$

where m and ℓ are odd. If let $L = D(b_1, b_2, \ldots, b_m)$, then $L^\wedge = D(c_1, c_2, \ldots, c_\ell)$. We denote these 2-bridge links by $T(p, q)$ and $T(p, q - p)$ $\left(= T(p,q)^\wedge\right)$. Then $T(p, q)$ is isotopic to either $S(p, q)$ or $S(p, q-p)$.* We first compute the homfly polynomials $P_L = P(b_1, b_2, \ldots, b_m)$, $P_{L^\wedge} = P(c_1, c_2, \ldots, c_\ell)$, the Kauffman polynomials $F_L = F(b_1, b_2, \ldots, b_m)$, and the Conway polynomials $\nabla_L = \nabla(b_1, b_2, \ldots, b_m)$ using [9, Propositions 1 and 4] and Proposition 6. Then we compute: $P_{\overline{L}}$, $P_{L^\wedge}$, $F_{L^\wedge}$, $F_{\overline{L}}$, $F_{\overline{L}^\wedge}$, $\nabla_{L^\wedge}$, $\nabla_{\overline{L}}$, and $\nabla_{\overline{L}^\wedge}$, using the following:

$$P_{\overline{L}}(v, z) = P_L(v^{-1}, z),$$

*Note added in proof. T. Kanenobu and Y. Miyazawa proved that $T(p, q) = S(p, q-p)$.

$$F_{L^\wedge}(a,z) = a^{4\lambda} F_L(a,z),$$
$$F_{\overline{L}}(a,z) = F_L(a^{-1},z),$$
$$\nabla_{L^\wedge}(t_1,t_2) = -\nabla_L(t_1,t_2^{-1}),$$
$$\nabla_{\overline{L}}(t_1,t_2) = -\nabla_L(t_1,t_2),$$

where $\lambda = -b_1 - b_2 - \cdots - b_m = c_1 + c_2 + \cdots + c_\ell$ is the linking number of L.

Next we compute the Jones, Q, and reduced Conway polynomials by suitable substitutions. Finally we search all the pairs of 2-bridge links through 20 crossings having the same homfly, Kauffman, Jones, and Q polynomials as in [9, Sect.3, Step 3]. For the Conway and reduced Conway polynomials, we examine for the pairs having the same Q polynomials.

§4. Computational results

In Table 2, the three numbers "$p \quad q,r$" represent the pair of the 2-bridge links $\{T(p,q), T(p,r)\}$ sharing the same Q polynomial. If there is an entry "V" (resp. "P", "F", "A", "C"), they also share the same Jones (resp. homfly, Kauffman, 2-variable Conway, reduced Conway) polynomial. We do not list the pairs L and $L^\wedge$ having the linking number zero if they are not contained in Cases 1–5. These links have the same Kauffman polynomial.

The two numbers "$p\ q$" represent the pair of the 2-bridge links $\{T(p,q), T(p,q)^\wedge\}$ sharing the same homfly and 2-variable Conway polynomials (cf. Fact 4). Note that we do not list the pair sharing only the same 2-variable Conway or reduced Conway polynomial. The entries "a" and "b" indicate that the links are of types A and B, respectively.

Table 2

9 crossing		
24	5,11	b
11 crossing		
78	17,35	
84	19,25	
98	29,-55	P
98	-69,43	V
128	47	
12 crossing		
60	11,19	
130	57,-47	Fa
130	-73,47	Fa
13 crossing		
110	19,51	
124	39,23	
132	25,29	
132	25,59	
132	29,59	
138	31,43	
162	37,73	P
162	-125,-89	V
196	57,-111	P
196	-139,85	V
200	61	
232	101	
240	71,89	b
242	65,-155	V
242	-177,87	P
248	109	
256	95	
264	115	
280	123	
14 crossing		
188	35,59	
196	69,-155	V
196	-127,41	V
196	45,37	
220	61,39	
252	71,55	A
264	71,49	
324	127,-233	V
324	-197,91	V
370	153,-207	F
370	-217,163	F
380	137,-167	F
380	-243,213	F
15 crossing		
120	29,19	b
186	41,83	
192	43,61	
228	59,47	
234	101,43	
238	109,75	
242	111,-197	V
242	-131,45	P
252	115,47	
252	115,79	

Table 2 (continued)

252	47,79	
260	61,49	
294	127,-209	V
294	-167,85	P
304	79,63	
308	65,87	
308	83,97	
324	73,145	P
324	-251,-179	V
336	89,103	
338	79,-233	V
338	-259,105	P
350	93,-243	V
350	-257,107	V
352	161	
352	161,63	
368	169	
374	69,169	
380	103,87	
384	143	
388	85,89	
392	139,83	V
392	139,-309	PA
392	-253,83	PA
392	-253,-309	V
400	121	
400	183	
402	125,143	
406	93,121	P
406	-313,-285	V
408	121,127	
416	191	
418	111,89	
434	177,115	
448	137,201	
450	97,133	P
450	-353,-317	V
468	101,-211	P
468	-367,257	V
476	109,277	P
476	-367,-199	V
484	131,-309	V
484	-353,175	P
488	213	
494	105,131	
504	221	
504	221,-115	P
504	221,389	V
504	-283,-115	P
504	-283,389	V
504	181,197	Ab
512	223	
520	227	
522	119,155	P
522	-403,-367	V
536	235	
574	131,159	P
574	-443,-415	V
578	169,237	V
578	-409,-341	P
648	253,181	PA
648	253,-467	V
648	-395,181	V
648	-395,-467	PA
722	305,-455	P
722	-417,267	V
	16 crossing	
256	81,49	V
256	-175,-207	V
296	47,137	
316	59,99	
322	71,57	
324	77,61	
352	163,291	V
352	-189,-61	V
354	73,163	
374	167,303	V
374	-207,-71	V
378	137,67	
396	73,91	
402	83,113	
406	73,143	
456	107,125	
462	127,83	
462	127,97	
462	83,97	
484	109,197	V
484	-375,-287	V
506	137,93	
508	135,119	A
510	107,233	
516	121,223	
516	121,113	A
516	223,113	
564	245,131	
572	125,333	V
572	-447,-239	V
572	155,131	
576	107,125	
588	209,-463	V
588	-379,125	V
594	163,-413	V
594	-431,181	V
620	253,-347	F
620	-367,273	F
624	145,175	
630	193,-227	V
630	-437,403	V
630	193,277	V
630	-437,-353	V
630	227,-277	F
630	-403,353	F
638	139,371	V
638	-499,-267	V
644	289,473	V
644	-355,-171	V
666	241,-203	V
666	-425,463	V
676	287,183	V
676	-389,-493	V
702	197,-487	V
702	-505,215	V
704	149,299	
728	215,327	V
728	-513,-401	V
742	303,515	V
742	-439,-227	V
748	159,317	
972	271,-593	V
972	-701,379	V
1016	397,-651	A
1032	379,-661	A
1130	437,-467	Fa
1130	-693,467	Fa
	17 crossing	
240	107,53	
246	55,79	
338	53,157	P
338	-285,-181	V
342	53,109	
370	89,59	
380	119,71	
380	119,61	
380	71,61	
388	73,93	
390	101,61	
392	113,-223	P
392	-279,169	V
406	187,-277	V
406	-219,129	V
462	79,101	
464	101,-379	V
464	-363,85	V
472	221	
476	151,-257	V
476	-325,219	V
484	221,-395	V
484	-263,89	P
486	217,109	P
486	-269,-377	V
488	229	
496	157,405	V
496	-339,-91	V
512	191	
512	161,97	V
512	161,-415	PA
512	-351,97	PA
512	-351,-415	V
528	163,427	V
528	-365,-101	V
536	251	
536	93,85	
552	259	
560	107,-437	V
560	-453,123	V
564	179,197	
570	181,169	
578	203,-477	P
578	-375,101	V
594	271,107	
598	113,425	V
598	-485,-173	V
600	181	
602	163,191	V
602	-439,-411	V
616	279,113	
636	167,151	
638	135,-525	V
638	-503,113	V
644	141,153	
672	209,239	b
672	211,197	
676	209,-519	P
676	-467,157	V
686	181,209	V
686	-505,-477	V
714	155,127	
720	317,133	
722	151,-533	P
722	-571,189	V
726	263,-529	P
726	-463,197	V
728	333	
728	333,229	
736	337	
738	137,331	
742	233,339	
744	325	
748	141,163	
752	345	
754	199,225	
756	235,163	P
756	-521,-593	V
760	333	
760	349	
764	203,179	
770	137,277	
772	181,177	
774	349,-167	P
774	-425,607	V
776	355	
776	339	
784	359	
784	279,167	V
784	279,-617	PA
784	-505,167	PA
784	-505,-617	V
786	163,361	
792	347	
798	251,223	
798	143,283	
800	367	
808	371	
814	173,-663	V
814	-641,151	V
834	233,173	
840	379,181	b
846	193,-371	P
846	-653,475	V
854	153,181	
864	269,197	P
864	-595,-667	V
868	353,-639	V
868	-515,229	V
874	245,-675	V
874	-629,199	V

Table 2 (continued)

894	247,187	
896	205,261	P
896	-691,-635	V
924	415,283	
930	421,601	C
936	205,277	P
936	205,-659	V
936	-731,277	V
936	-731,-659	V
938	409,275	
942	431,197	
942	203,215	
950	199,249	
954	427,-209	P
954	-527,745	V
966	409,745	V
966	-557,-221	P
968	395,219	PA
968	395,-749	V
968	-573,219	V
968	-573,-749	PA
990	223,-437	P
990	-767,553	V
992	447,639	C
994	303,-549	V
994	-691,445	V
994	431,767	V
994	-563,-227	P
996	227,449	
996	275,233	
1008	227,299	P
1008	-781,-709	V
1022	285,313	
1022	285,-751	V
1022	-737,271	V
1022	285,299	
1022	313,271	
1022	313,-723	V
1022	-709,299	V
1022	271,299	
1024	447	
1026	215,269	
1034	285,219	
1036	317,303	
1036	317,275	
1036	317,-747	V
1036	-719,289	V
1036	303,-761	V
1036	-733,275	V
1036	303,289	
1036	275,289	
1056	241,463	b
1056	247,457	
1058	459,-737	P
1058	-599,321	V
1058	231,415	V
1058	-827,-643	P
1064	299,243	P
1064	299,-821	V
1064	-765,243	V
1064	-765,-821	V
1102	251,-793	V
1102	-851,309	V
1104	257,479	
1120	297,457	
1122	245,-811	V
1122	-877,311	V
1134	509,347	
1140	241,301	
1144	309,243	
1156	339,475	V
1156	-817,-681	P
1164	271,325	
1190	321,349	
1216	257,321	
1242	379,343	PA
1242	-863,-899	PA
1250	451,551	F
1250	-799,-699	PF
1278	391,-461	PA
1278	-887,817	PA
1292	295,-929	V
1292	-997,363	V
1296	505,361	PA
1296	505,-935	V
1296	-791,361	V
1296	-791,-935	PA
1298	349,-1015	V
1298	-949,283	V
1314	401,-475	PA
1314	-913,839	PA
1316	543,355	
1330	389,579	
1350	377,413	PA
1350	-973,-937	PA
1352	365,573	V
1352	365,-779	PA
1352	-987,573	PA
1352	-987,-779	V
1372	405,-995	V
1372	-967,377	V
1444	533,-835	V
1444	-911,609	P
1456	393,407	
1458	541,433	P
1458	-917,-1025	V
1528	549,-931	A
1544	555,571	A
1682	637,-1219	V
1682	-1045,463	P
1784	653	
1800	659	
1922	805,-1179	V
1922	-1117,743	P
2024	741	
2040	781,749	Ab
2056	755	
2296	843	
2312	885	
18 crossing		
210	29,41	
400	139,-341	V
400	-261,59	V
444	83,139	
452	109,85	
532	109,137	
544	93,189	
558	131,-301	V
558	-427,257	V
576	119,263	V
576	119,-313	V
576	-457,263	V
576	-457,-313	V
684	145,107	
686	141,-531	V
686	-545,155	V
688	123,307	
702	163,-557	V
702	-539,145	V
704	161,129	V
704	-543,-575	V
704	127,193	
720	169,151	
732	337,151	
736	135,503	V
736	-601,-233	V
738	173,-583	V
738	-565,155	V
748	203,137	
760	159,121	
764	183,199	A
768	241,145	V
768	-527,-623	V
770	159,-541	V
770	-611,229	V
772	185,169	A
780	161,239	
782	135,169	
784	141,-475	V
784	-643,309	V
800	153,553	V
800	-647,-247	V
812	151,-633	V
812	-661,179	V
832	191,159	V
832	-641,-673	V
836	217,-543	V
836	-619,293	V
858	301,-635	V
858	-557,223	V
858	181,233	
868	179,-381	V
868	-689,487	V
870	353,-487	F
870	-517,383	F
880	317,-387	F
880	-563,493	F
882	199,163	
882	205,-479	V
882	-677,403	V
896	375,-185	V
896	375,711	V
896	-521,-185	V
896	-521,711	V
900	209,-511	V
900	-691,389	V
900	247,-617	V
900	-653,283	V
936	295,-329	V
936	-641,607	V
942	287,221	
948	289,199	
952	345,-775	V
952	-607,177	V
952	205,171	
956	227,251	
964	229,221	
976	181,213	V
976	-795,-763	V
980	209,-631	V
980	-771,349	V
994	275,-789	V
994	-719,205	V
996	209,455	
1002	235,433	
1008	187,-653	V
1008	-821,355	V
1008	187,691	V
1008	-821,-317	V
1008	355,-317	V
1008	-653,691	V
1010	313,293	PFAa
1010	-697,-293	PFAa
1020	239,271	A
1024	225,289	V
1024	225,-735	V
1024	-799,289	V
1024	-799,-735	V
1032	185,271	
1040	197,717	V
1040	-843,-323	V
1044	329,-751	V
1044	-715,293	V
1062	233,197	
1064	277,221	
1072	235,203	V
1072	-837,-869	V
1078	493,885	V
1078	-585,-193	V
1078	475,-225	V
1078	-603,853	V
1100	203,603	V
1100	-897,-497	V
1102	235,293	
1106	197,239	
1118	245,-787	V
1118	-873,331	V
1148	241,-935	V
1148	-907,213	V
1156	307,-645	V
1156	-849,511	V
1158	269,503	
1162	263,-409	V
1162	-899,753	V
1162	417,207	
1164	515,527	
1164	433,343	

Table 2 (continued)

1166	303,-841	V
1166	-863,325	V
1188	211,545	
1190	431,-269	V
1190	-759,921	V
1190	423,213	
1218	559,253	
1218	373,283	
1232	229,555	
1246	223,265	
1260	263,-913	V
1260	-997,347	V
1266	347,377	
1266	263,353	
1272	571,277	
1274	537,269	
1274	279,-561	V
1274	-995,713	V
1278	343,361	
1288	269,381	V
1288	269,-907	V
1288	-1019,381	V
1288	-1019,-907	V
1296	397,-827	V
1296	-899,469	V
1316	571,403	V
1316	-745,-913	V
1320	371,349	
1320	371,389	
1320	349,389	
1326	277,367	
1330	353,733	V
1330	-977,-597	V
1342	377,-987	V
1342	-965,355	V
1342	379,291	V
1342	-963,-1051	V
1374	311,377	
1374	629,287	
1378	513,293	
1380	379,301	
1414	635,411	V
1414	-779,-1003	V
1428	401,311	
1428	583,991	V
1428	-845,-437	V
1430	607,303	
1434	529,427	
1452	329,593	V
1452	-1123,-859	V
1456	431,319	V
1456	431,-1137	V
1456	-1025,319	V
1456	-1025,-1137	V
1462	575,-309	V
1462	-887,1153	V
1462	607,1015	V
1462	-855,-447	V
1470	617,-307	V
1470	-853,1163	V
1474	313,625	
1482	335,653	
1484	409,-1159	V
1484	-1075,325	V
1488	439,409	
1536	689,335	
1536	359,425	
1542	349,679	
1582	345,-1111	V
1582	-1237,471	V
1590	473,587	
1596	691,373	
1620	631,-1169	V
1620	-989,451	V
1634	347,433	
1634	617,579	
1644	611,485	
1644	713,383	
1650	463,373	
1666	377,-1303	V
1666	-1289,363	V
1666	699,-365	V
1666	-967,1301	V
1690	759,359	
1704	397,475	
1716	727,703	
1758	523,493	
1782	389,1037	V
1782	-1393,-745	V
1786	661,-783	V
1786	-1125,1003	V
1804	477,-1163	V
1804	-1327,641	V
1804	391,479	V
1804	-1413,-1325	V
1826	679,-1313	V
1826	-1147,513	V
1846	391,495	
1848	773,-403	V
1848	773,1445	V
1848	-1075,-403	V
1848	-1075,1445	V
1860	1081,841	C
1870	763,-1097	F
1870	-1107,773	F
1876	823,-409	V
1876	-1053,1467	V
1880	737,-767	F
1880	-1143,1113	F
1890	523,-1313	V
1890	-1367,577	V
1904	557,837	V
1904	-1347,-1067	V
1918	835,1383	V
1918	-1083,-535	V
1926	517,743	
1926	695,-589	V
1926	-1231,1337	V
1936	747,-1365	V
1936	-1189,571	V
1962	599,-709	V
1962	-1363,1253	V
1962	527,769	
1984	895,1151	C
1998	557,-1387	V
1998	-1441,611	V
2014	845,-1131	V
2014	-1169,883	V
2028	859,547	V
2028	-1169,-1481	V
2040	797,-1307	A
2056	739,-1293	A
2116	873,-1335	V
2116	-1243,781	V
2142	593,-1675	V
2142	-1549,467	V
2198	957,649	V
2198	-1241,-1549	V
2210	863,-837	Fa
2210	-1347,837	Fa
2212	933,1565	V
2212	-1279,-647	V
2318	1017,-1339	V
2318	-1301,979	V
2500	1051,-1549	F
2500	-1449,951	F
2546	935,-1117	V
2546	-1611,1429	V
2610	719,701	
3064	1133,-1899	A
3080	1131,-1941	A

19 crossing

294	131,65	
300	97,67	
426	83,59	
438	67,61	
450	61,-239	P
450	-389,211	V
472	215,73	
490	211,-349	V
490	-279,141	P
508	159,95	
516	125,97	
592	281	
608	277,-107	V
608	-331,501	V
608	289	
620	149,99	
630	101,121	
640	239	
648	289,145	P
648	-359,-503	V
666	101,137	
672	319	
676	99,177	
676	105,313	P
676	-571,-363	V
688	327	
722	115,-493	V
722	-607,229	P
726	133,-395	P
726	-593,331	V
726	251,233	
728	113,153	
732	235,217	
754	353,111	
800	119,279	V
800	119,-521	PA
800	-681,279	PA
800	-681,-521	V
800	241	
808	167,127	
816	139,173	
836	151,381	
840	193,263	
850	133,303	
858	389,157	
882	211,-713	V
882	-671,169	P
884	139,309	
892	215,231	
900	197,217	
928	163,-733	V
928	-765,195	V
936	149,427	
942	329,299	
944	221,-771	V
944	-723,173	V
948	295,301	
968	351,-705	P
968	-617,263	V
976	457	
976	179,667	V
976	-797,-309	V
984	461	
988	173,211	
992	173,-787	V
992	-819,205	V
1000	469	
1000	437	
1008	473	
1014	235,-701	V
1014	-779,313	P
1014	161,265	
1016	445	
1024	193,321	V
1024	193,-703	PA
1024	-831,321	PA
1024	-831,-703	V
1032	451	
1040	487	
1048	459	
1048	491	
1050	487,163	
1058	183,275	P
1058	-875,-783	V
1062	229,337	P
1062	-833,-725	V
1064	337,167	
1064	337,489	
1064	167,489	
1064	499	
1072	503	
1072	205,741	V
1072	-867,-331	V
1078	501,893	V
1078	-577,-185	V

Table 2 (continued)

1080	233,-487	P	1364	245,-1075	V	1554	355,439	P	1708	481,523	
1080	-847,593	V	1364	-1119,289	V	1554	-1199,-1115	V	1708	481,495	
1092	491,251		1386	317,401	P	1554	277,557		1708	481,-1255	V
1100	189,589	V	1386	-1069,-985	V	1562	337,359		1708	-1227,453	V
1100	-911,-511	V	1394	487,241		1562	295,863	V	1708	523,-1213	V
1102	175,347		1414	381,325		1562	-1267,-699	V	1708	-1185,495	V
1104	211,-845	V	1422	295,331	V	1564	703,473		1708	523,453	
1104	-893,259	V	1422	-1127,-1091	V	1566	487,343	P	1708	495,453	
1120	209,239	b	1422	421,313	P	1566	-1079,-1223	V	1708	521,451	
1120	257,513		1422	-1001,-1109	V	1568	281,617	PA	1710	401,781	
1120	513		1426	255,301		1568	281,-951	V	1722	457,527	
1136	521		1440	643,-317	P	1568	-1287,617	V	1722	457,-1223	V
1148	275,299		1440	-797,1123	V	1568	-1287,-951	PA	1722	-1265,499	V
1152	239		1444	379,-1141	V	1568	487,-297	V	1722	457,485	
1152	239,527	V	1444	-1065,303	P	1568	487,1271	V	1722	527,499	
1152	239,-625	V	1456	317,-1123	V	1568	-1081,-297	V	1722	527,-1237	V
1152	-913,527	V	1456	-1139,333	V	1568	-1081,1271	V	1722	-1195,485	V
1152	-913,-625	V	1456	317,-619	V	1576	723		1722	499,485	
1152	527		1456	-1139,837	V	1582	563,283		1734	319,455	
1156	203,-749	V	1456	333,837	P	1582	419,363		1734	713,509	V
1156	-953,407	P	1456	-1123,-619	V	1584	709,1285	V	1734	-1021,-1225	P
1156	265,277		1458	593,269	V	1584	-875,-299	V	1748	367,459	
1156	531,251		1458	-865,-1189	P	1584	709,-347	P	1758	487,367	
1162	475,267		1458	305,341	V	1584	-875,1237	V	1758	385,787	
1162	341,369	V	1458	-1153,-1117	V	1584	299,-1237	V	1760	373,483	
1162	-821,-793	V	1472	337,273	V	1584	-1285,347	V	1768	315,485	
1162	337,365		1472	337,-1199	V	1586	329,277		1778	545,405	
1168	535		1472	-1135,273	V	1596	331,733		1786	407,467	
1176	251,419	V	1472	-1135,-1199	V	1600	303,367	V	1792	389,333	V
1176	251,-757	PA	1476	653,-331	P	1600	303,-1233	V	1792	-1403,-1459	V
1176	-925,419	PA	1476	-823,1145	V	1600	-1297,367	V	1800	419,779	V
1176	-925,-757	V	1484	641,1145	V	1600	-1297,-1233	V	1800	419,-1021	PA
1178	245,207		1484	-843,-339	P	1602	733,373	V	1800	-1381,779	PA
1184	543		1484	471,415	V	1602	-869,-1229	V	1800	-1381,-1021	V
1188	271,-521	P	1484	-1013,-1069	V	1610	507,367		1804	767,381	
1188	-917,667	V	1488	277,-1163	V	1610	493,723		1806	377,827	
1190	377,547		1488	-1211,325	V	1616	371,-1261	V	1806	479,737	
1206	383,275	P	1494	335,443	P	1616	-1245,355	V	1812	397,391	
1206	-823,-931	V	1494	-1159,-1051	V	1624	471,703		1812	553,379	
1206	551,283		1496	533,269		1628	309,727		1820	817,557	
1206	223,533		1496	685		1638	349,293		1820	543,-1433	V
1218	557,383		1498	267,323		1644	341,503		1820	-1277,387	V
1224	553,281		1504	279,-473	V	1650	343,757		1826	773,389	
1224	547,227		1504	279,1031	V	1652	379,505		1848	491,421	
1232	563,387		1504	-1225,-473	V	1656	373,-731	P	1860	401,419	
1276	335,303		1504	-1225,1031	V	1656	373,925	V	1860	389,851	
1278	587,299	V	1512	479,409		1656	-1283,-731	V	1862	519,491	V
1278	-691,-979	V	1518	703,263		1656	-1283,925	V	1862	-1343,-1371	V
1284	301,305		1520	411,1171	V	1672	299,365		1862	519,393	
1288	363,405		1520	-1109,-349	V	1672	439,351		1862	519,421	
1288	409,-695	V	1520	477,1237	V	1674	521,377	P	1862	491,393	
1288	-879,593	V	1520	-1043,-283	V	1674	-1153,-1297	V	1862	491,421	
1298	345,-931	V	1528	701		1680	733,-1187	V	1862	393,421	PA
1298	-953,367	V	1536	671		1680	-947,493	V	1862	-1469,-1441	PA
1300	383,583	V	1540	283,-1213	V	1682	753,521	V	1870	507,397	
1300	-917,-717	V	1540	-1257,327	V	1682	-929,-1161	P	1872	589,517	PA
1312	229,-603	V	1544	707		1682	737,365		1872	-1283,-1355	PA
1312	-1083,709	V	1550	461,411		1692	355,731		1908	671,-601	PA
1330	607,303		1552	293,1069	V	1698	353,473		1908	-1237,1307	PA
1358	625,-927	V	1552	-1259,-483	V	1700	467,297		1914	431,787	
1358	-733,431	V	1552	421,1197	V	1702	363,-1385	V	1914	431,863	
1360	613,237		1552	-1131,-355	V	1702	-1339,317	V	1914	787,863	

Table 2 (continued)

1922	557,433	V
1922	-1365,-1489	P
1922	683,-1053	V
1922	-1239,869	P
1924	515,-1357	V
1924	-1409,567	V
1932	359,695	V
1932	-1573,-1237	V
1936	439,791	PA
1936	439,-1145	V
1936	-1497,791	V
1936	-1497,-1145	PA
1938	409,511	
1944	757,541	PA
1944	757,-1403	V
1944	-1187,541	V
1944	-1187,-1403	PA
1946	579,411	P
1946	-1367,-1535	V
1946	593,-1075	V
1946	-1353,871	V
1958	449,797	
1958	427,361	
1960	573,517	V
1960	573,-1443	V
1960	-1387,517	V
1960	-1387,-1443	V
1968	449,431	
1976	451,413	
1976	535,-1545	V
1976	-1441,431	V
1978	613,-1107	V
1978	-1365,871	V
1980	623,-697	PA
1980	-1357,1283	PA
1984	415,353	
1988	705,369	V
1988	-1283,-1619	V
1990	617,-1383	PFA
1990	-1373,607	PFA
1992	587,421	
2010	583,1387	PFA
2010	-1427,-623	PFA
2014	435,-1473	V
2014	-1579,541	V
2016	563,635	PA
2016	-1453,-1381	PA
2022	905,461	
2022	617,473	
2028	599,-1585	V
2028	-1429,443	V
2048	577,449	PA
2048	577,-1599	V
2048	-1471,449	V
2048	-1471,-1599	PA
2072	601,559	
2074	439,371	
2076	485,575	
2080	453,-1523	V
2080	-1627,557	V
2082	901,487	
2082	919,469	
2108	951,375	
2114	873,485	
2116	919,-1473	P
2116	-1197,643	V
2116	829,461	V
2116	-1287,-1655	P
2128	395,451	V
2128	-1733,-1677	V
2132	577,-1503	V
2132	-1555,629	V
2136	481,487	
2136	925,499	
2142	871,-1577	V
2142	-1271,565	V
2156	601,657	V
2156	-1555,-1499	V
2166	913,-1367	P
2166	-1253,799	V
2170	647,-1213	P
2170	-1523,957	V
2170	883,573	
2178	925,-1715	P
2178	-1253,463	V
2184	509,947	
2198	907,593	
2210	467,597	
2212	957,641	
2238	971,521	
2240	473,-983	V
2240	473,1257	P
2240	-1767,-983	V
2240	-1767,1257	V
2244	625,523	
2254	687,659	V
2254	-1567,-1595	V
2254	993,1777	V
2254	-1261,-477	P
2268	925,517	
2268	949,1789	V
2268	-1319,-479	P
2296	947,523	
2298	703,535	
2310	521,499	
2312	613,1021	PA
2312	613,-1291	V
2312	-1699,1021	V
2312	-1699,-1291	PA
2314	645,-1695	V
2314	-1669,619	V
2320	913,607	
2332	641,-1823	V
2332	-1691,509	V
2336	989,1053	
2338	533,1049	
2338	697,-1307	P
2338	-1641,1031	V
2338	659,631	
2338	829,1809	PA
2338	-1509,-529	PA
2352	533,701	P
2352	-1819,-1651	V
2356	537,499	
2358	697,733	P
2358	-1661,-1625	V
2366	851,1831	PA
2366	-1515,-535	PA
2398	519,1007	
2412	751,-857	P
2412	-1661,1555	V
2436	743,1091	
2448	761,-871	P
2448	761,1577	V
2448	-1687,-871	V
2448	-1687,1577	V
2450	531,1371	P
2450	-1919,-1079	V
2450	687,-1777	V
2450	-1763,673	V
2450	911,-1889	V
2450	-1539,561	P
2464	667,723	V
2464	-1797,-1741	V
2464	1103,751	V
2464	1103,-1713	V
2464	-1361,751	V
2464	-1361,-1713	V
2482	725,-1723	V
2482	-1757,759	V
2494	659,975	
2496	673,737	
2500	1101,901	F
2500	-1399,-1599	PF
2502	779,743	P
2502	-1723,-1759	V
2508	679,-1961	V
2508	-1829,547	V
2530	899,711	
2538	775,703	PA
2538	-1763,-1835	PA
2546	673,581	
2546	689,-1991	V
2546	-1857,555	V
2552	917,-1555	A
2552	917,675	
2552	-1555,675	
2562	709,541	P
2562	-1853,-2021	V
2568	757,923	
2568	757,955	
2568	923,955	A
2574	787,-929	PA
2574	-1787,1645	PA
2592	793,937	PA
2592	793,-1655	V
2592	-1799,937	V
2592	-1799,-1655	PA
2600	567,-1097	V
2600	-2033,1503	V
2610	943,-797	PA
2610	-1667,1813	PA
2622	1183,565	
2626	555,1109	
2632	725,557	P
2632	725,-2075	V
2632	-1907,557	V
2632	-1907,-2075	V
2646	769,-1919	V
2646	-1877,727	V
2646	737,809	PA
2646	-1909,-1837	PA
2660	737,793	P
2660	-1923,-1867	V
2660	787,563	P
2660	-1873,-2097	V
2676	1201,583	
2678	1107,-1961	V
2678	-1571,717	V
2680	821	
2684	581,1127	
2686	727,795	V
2686	-1959,-1891	P
2704	729,1145	V
2704	729,-1559	PA
2704	-1975,1145	PA
2704	-1975,-1559	V
2724	809,587	
2724	761,803	
2728	1587,-1525	C
2730	739,-1601	V
2730	-1991,1129	V
2738	591,1035	P
2738	-2147,-1703	V
2738	815,-1997	V
2738	-1923,741	P
2744	811,755	P
2744	811,-1989	V
2744	-1933,755	V
2744	-1933,-1989	V
2756	1237,813	V
2756	-1519,-1943	V
2758	597,821	P
2758	-2161,-1937	V
2758	625,1605	P
2758	-2133,-1153	V
2772	1031,733	
2778	767,827	
2782	1179,589	
2784	769,607	
2784	601,823	
2786	1215,817	
2794	993,751	
2800	821,1221	
2828	613,837	P
2828	-2215,-1991	V
2832	791,617	
2842	797,-2003	V
2842	-2045,839	V
2842	643,615	PA
2842	-2199,-2227	PA
2852	1841,1289	C
2856	835,1243	V
2856	835,-1613	V
2856	-2021,1243	V
2856	-2021,-1613	P
2856	619,787	P
2856	619,-2069	V

Table 2 (continued)

2856	-2237,787	V
2856	-2237,-2069	V
2886	1301,623	
2886	653,797	
2892	853,799	
2914	1315,1879	C
2916	865,1081	P
2916	-2051,-1835	V
2924	1273,865	V
2924	-1651,-2059	P
2924	1285,619	
2926	1283,2263	V
2926	-1643,-663	P
2940	869,671	
2940	641,1319	
2946	877,1087	
2994	677,1319	
2996	809,683	
3014	895,807	V
3014	-2119,-2207	P
3038	1275,2395	V
3038	-1763,-643	P
3038	883,-2141	V
3038	-2155,897	V
3038	1761,-1699	C
3040	853,-2347	V
3040	-2187,693	V
3042	1327,-1793	V
3042	-1715,1249	P
3048	899,1133	
3052	853,895	
3054	691,1345	
3054	697,1339	
3058	663,1775	V
3058	-2395,-1283	V
3074	1105,909	
3078	833,-2407	V
3078	-2245,671	V
3080	901,859	
3094	863,-2257	V
3094	-2231,837	V
3094	863,-2189	V
3094	-2231,905	V
3094	837,905	V
3094	-2257,-2189	P
3102	707,1361	
3102	1145,923	
3122	845,873	V
3122	-2277,-2249	V
3122	859,-1817	P
3122	-2263,1305	V
3162	715,883	
3172	841,-2487	V
3172	-2331,685	V
3198	677,859	
3200	879	
3216	733,955	
3220	1347,2523	V
3220	-1873,-697	P
3222	865,901	
3230	737,-2323	V
3230	-2493,907	V

3232	1407	
3234	1357,2533	V
3234	-1877,-701	P
3248	1425,-703	V
3248	1425,2545	V
3248	-1823,-703	P
3248	-1823,2545	V
3268	917,-2523	V
3268	-2351,745	V
3270	973,913	
3298	1009,-2323	V
3298	-2289,975	V
3332	755,923	P
3332	-2577,-2409	V
3346	1467,-2357	V
3346	-1879,989	P
3352	1243	
3360	991	
3362	901,1229	V
3362	-2461,-2133	P
3362	1311,1475	P
3362	-2051,-1887	V
3362	985,-1967	P
3362	-2377,1395	V
3364	927,-2089	P
3364	-2437,1275	V
3374	1423,941	
3388	1475,991	
3440	1049	
3444	1411,1459	
3456	1519	
3458	971,-2669	V
3458	-2487,789	V
3468	1421,1433	
3576	1309	
3586	1065,2297	V
3586	-2521,-1289	P
3592	1333	
3600	1319	
3650	1609,1509	F
3650	-2041,-2141	PF
3674	1351,2583	P
3674	-2323,-1091	V
3696	1609	
3698	1547,1031	P
3698	-2151,-2667	V
3700	1329,-1631	F
3700	-2371,2069	PF
3710	1027,803	P
3710	-2683,-2907	V
3712	1617	
3728	1623	
3800	1669,-1371	F
3800	1669,2429	F
3800	-2131,-1371	F
3800	-2131,2429	PF
3816	1397	
3824	1401	
3832	1421	
3844	1487,-2233	P
3844	-2357,1611	V
3848	1427	

3850	1591,1691	F
3850	-2259,-2159	PF
3870	1039,1499	
3872	1495,1143	V
3872	1495,-2729	PA
3872	-2377,1143	PA
3872	-2377,-2729	V
3906	1049,1525	
3936	1729	
3952	1737	
3984	1751	
4064	1489	
4088	1517	
4088	1517,1549	A
4088	1549	
4096	1503	
4104	1507	
4104	1507,1523	A
4104	1523	
4120	1219	
4192	1825	
4208	1833	
4232	1563,1747	V
4232	1563,-2485	PA
4232	-2669,1747	PA
4232	-2669,-2485	V
4240	1847	
4246	1261,1173	V
4246	-2985,-3073	P
4328	1605	
4336	1591	
4344	1595	
4360	1651	
4418	1693,-3195	P
4418	-2725,1223	V
4464	1961	
4480	1969	
4496	1975	
4554	1223,1259	
4600	1749,1701	Ab
4600	1707	
4616	1749	
4624	1769	
4736	2063	
4802	1863,-3037	V
4802	-2939,1765	P
4888	1851	
5000	2101,1901	PFA
5000	2101,-3099	F
5000	-2899,1901	F
5000	-2899,-3099	PFA
5024	2207	

20 crossing

484	67,155	V
484	-417,-329	V
572	179,107	
580	141,109	
610	159,89	
642	125,89	
654	103,91	
744	115,131	
836	153,265	
858	155,131	A
884	415,129	
890	131,409	
918	157,-659	V
918	-761,259	V
946	259,171	
956	183,175	
990	181,269	
1020	247,263	A
1024	159,415	V
1024	-865,-609	V
1028	249,225	A
1064	339,899	V
1064	-725,-165	V
1078	481,205	
1084	343,207	
1092	337,209	
1100	509,191	
1102	345,925	V
1102	-757,-177	V
1110	169,229	
1110	169,511	
1110	229,511	
1118	165,295	
1120	453,-627	F
1120	-667,493	F
1130	407,-497	F
1130	-723,633	F
1158	365,239	
1184	217,281	V
1184	-967,-903	V
1200	419,-1021	V
1200	-781,179	V
1206	331,-821	V
1206	-875,385	V
1216	249,313	
1216	385,993	V
1216	-831,-223	V
1240	567,193	
1242	431,-397	V
1242	-811,845	V
1248	199,329	
1256	509,195	
1258	327,191	Va
1258	-931,-191	Va
1276	219,241	
1280	401,241	V
1280	-879,-1039	V
1292	593,-223	V
1292	-699,1069	V
1304	205,531	
1308	607,269	
1340	323,347	
1344	415,1087	V
1344	-929,-257	V
1348	309,325	
1350	431,-469	V
1350	-919,881	V
1368	253,307	
1372	293,-883	V
1372	-1079,489	V

Table 2 (continued)

1376	263,327	V
1376	-1113,-1049	V
1386	443,-997	V
1386	-943,389	V
1390	211,361	
1406	221,297	
1422	293,-1003	V
1422	-1129,419	V
1428	335,449	
1434	451,301	
1444	341,645	V
1444	-1103,-799	V
1444	265,417	V
1444	-1179,-1027	V
1482	677,235	
1482	677,311	
1482	235,311	
1488	349,643	
1496	313,233	
1508	267,-661	V
1508	-1241,847	V
1532	367,399	A
1540	369,361	A
1548	713,-319	V
1548	-835,1229	V
1548	341,287	
1554	289,275	
1562	271,723	
1564	245,279	
1566	341,-1243	V
1566	-1225,323	V
1568	275,851	V
1568	-1293,-717	V
1576	247,327	
1584	301,707	
1586	713,-899	V
1586	-873,687	V
1596	419,379	
1598	733,-287	V
1598	-865,1311	V
1600	281,681	V
1600	-1319,-919	V
1652	341,-1171	V
1652	-1311,481	V
1692	383,-913	V
1692	-1309,779	V
1710	353,-787	V
1710	-1357,923	V
1712	299,771	
1728	791,359	V
1728	791,-1369	V
1728	-937,359	V
1728	-937,-1369	V
1734	373,-1259	V
1734	-1361,475	V
1748	515,1435	V
1748	-1233,-313	V
1750	361,-759	V
1750	-1389,991	V
1752	407,761	
1764	799,463	V
1764	-965,-1301	V
1778	753,-367	V
1778	-1025,1411	V
1802	335,505	
1804	823,1479	V
1804	-981,-325	V
1812	571,421	
1816	317,285	
1826	827,1491	V
1826	-999,-335	V
1832	841,287	
1836	793,-431	V
1836	-1043,1405	V
1836	379,-1421	V
1836	-1457,415	V
1854	565,-1271	V
1854	-1289,583	V
1854	853,-383	V
1854	-1001,1471	V
1862	333,1313	V
1862	-1529,-549	V
1876	527,-1489	V
1876	-1349,387	V
1886	335,499	V
1886	-1551,-1387	V
1888	331,395	V
1888	-1557,-1493	V
1890	337,407	
1890	863,-397	V
1890	-1027,1493	V
1904	333,299	
1924	865,-695	V
1924	-1059,1229	V
1926	677,-607	V
1926	-1249,1319	V
1936	331,419	V
1936	-1605,-1517	V
1946	429,359	
1946	361,767	
1946	347,697	
1950	581,529	
1952	341,405	V
1952	-1611,-1547	V
1952	425,457	V
1952	425,-1495	V
1952	-1527,457	V
1952	-1527,-1495	V
1962	691,-617	V
1962	-1271,1345	V
1968	365,461	V
1968	-1603,-1507	V
1972	557,-1619	V
1972	-1415,353	V
1974	367,773	
1974	613,703	
1974	613,353	
1974	703,353	
1978	537,365	
1980	409,-1391	V
1980	-1571,589	V
1998	467,-1081	V
1998	-1531,917	V
1998	595,-1529	V
1998	-1403,469	V
2000	373,437	V
2000	-1627,-1563	V
2000	371,1371	V
2000	-1629,-629	V
2002	523,607	P
2002	-1479,-1395	V
2002	613,865	V
2002	-1389,-1137	V
2016	535,-473	V
2016	535,1543	V
2016	-1481,-473	V
2016	-1481,1543	V
2016	535,-905	V
2016	535,1111	V
2016	-1481,-905	V
2016	-1481,1111	V
2016	473,905	V
2016	473,-1111	V
2016	-1543,905	V
2016	-1543,-1111	V
2030	433,363	
2032	637,1653	V
2032	-1395,-379	V
2034	929,-427	V
2034	-1105,1607	V
2034	623,-1393	V
2034	-1411,641	V
2050	443,607	V
2050	-1607,-1443	V
2052	431,-1441	V
2052	-1621,611	V
2054	929,449	
2058	631,547	V
2058	-1427,-1511	V
2064	643,1675	V
2064	-1421,-389	V
2068	555,731	V
2068	-1513,-1337	V
2076	569,647	
2080	553,-487	V
2080	553,1593	V
2080	-1527,-487	V
2080	-1527,1593	V
2082	955,433	
2090	359,579	V
2090	-1731,-1511	V
2096	459,395	V
2096	-1637,-1701	V
2096	651,1699	V
2096	-1445,-397	V
2100	607,943	V
2100	-1493,-1157	V
2112	595,485	
2114	647,1251	V
2114	-1467,-863	V
2128	635,373	
2128	499,403	V
2128	-1629,-1725	V
2130	443,593	
2142	445,-1643	V
2142	-1697,499	V
2142	461,-1555	V
2142	-1681,587	V
2144	503,471	V
2144	503,-1673	V
2144	-1641,471	V
2144	-1641,-1673	V
2156	457,915	
2166	493,-1559	V
2166	-1673,607	V
2178	455,-1669	V
2178	-1723,509	V
2178	511,457	
2178	511,-1685	V
2178	-1667,493	V
2178	511,475	
2178	457,493	
2178	457,-1703	V
2178	-1721,475	V
2178	493,475	
2190	481,979	
2190	457,607	
2196	497,479	
2196	497,-1735	V
2196	-1699,461	V
2196	497,515	
2196	479,461	
2196	479,-1681	V
2196	-1717,515	V
2196	461,515	
2200	779,581	
2200	933,467	
2204	657,387	
2204	933,1009	
2222	599,-1645	V
2222	-1623,577	V
2238	1025,467	
2238	629,695	
2240	513,417	V
2240	-1727,-1823	V
2254	1021,685	V
2254	-1233,-1569	V
2266	609,389	V
2266	-1657,-1877	V
2268	883,-1637	V
2268	-1385,631	V
2272	397,1229	V
2272	-1875,-1043	V
2272	423,1559	V
2272	-1849,-713	V
2278	399,801	
2282	827,421	
2288	525,931	
2288	809,-647	V
2288	809,1641	V
2288	-1479,-647	V
2288	-1479,1641	V
2292	515,629	
2298	505,631	
2304	529,625	V
2304	-1775,-1679	V
2304	535,679	V
2304	535,-1625	V

Table 2 (continued)

2304	-1769,679	V	2530	-1643,657	V	2744	-2171,-1163	V	2992	565,829	V
2304	-1769,-1625	V	2530	669,449	V	2744	-2171,1581	V	2992	-2427,-2163	V
2322	685,-1835	V	2530	-1861,-2081	V	2744	601,-1191	V	2992	653,685	V
2322	-1637,487	V	2534	711,-2005	V	2744	-2143,1553	V	2992	-2339,-2307	V
2322	541,-1259	V	2534	-1823,529	V	2744	839,727	V	2992	653,1741	V
2322	-1781,1063	V	2538	1097,-595	V	2744	-1905,-2017	V	2992	-2339,-1251	V
2336	441,1609	V	2538	-1441,1943	V	2754	1243,-593	V	2992	685,1741	V
2336	-1895,-727	V	2546	677,543		2754	-1511,2161	V	2992	-2307,-1251	V
2340	529,-1271	V	2550	703,533		2758	579,509		2994	653,1343	
2340	-1811,1069	V	2552	895,-1889	V	2760	859,509		3000	679,1321	
2352	491,-1021	V	2552	-1657,663	V	2772	599,-2257	V	3010	873,2077	PFA
2352	-1861,1331	V	2552	453,717	V	2772	-2173,515	V	3010	-2137,-933	PFA
2352	733,835		2552	453,-1835	V	2772	599,-1993	V	3014	1117,2213	V
2352	421,-1427	V	2552	-2099,717	V	2772	-2173,779	V	3014	-1897,-801	V
2352	-1931,925	V	2552	-2099,-1835	V	2772	491,601		3014	1239,679	
2356	1039,-1393	V	2552	575,1049		2772	515,779	V	3038	687,-2393	V
2356	-1317,963	V	2562	785,755		2772	-2257,-1993	V	3038	-2351,645	V
2358	553,-1019	V	2562	745,-2027	V	2778	863,989		3042	655,-2189	V
2358	-1805,1339	V	2562	-1817,535	V	2778	605,851		3042	-2387,853	V
2366	439,425		2562	563,1145		2782	1257,829		3042	707,-2137	V
2368	447,543	V	2568	577,1135		2784	853,1003		3042	-2335,905	V
2368	-1921,-1825	V	2616	725,611		2784	775,649		3048	689,1343	
2376	701,557	V	2616	815,929		2794	519,739	V	3054	931,901	
2376	701,-1819	V	2616	779,797		2794	-2275,-2055	V	3056	701,2229	V
2376	-1675,557	V	2620	1083,-1557	F	2794	641,1137		3056	-2355,-827	V
2376	-1675,-1819	V	2620	-1537,1063	F	2826	613,649		3058	667,1779	V
2380	673,503		2622	1177,571		2832	641,863		3058	-2391,-1279	V
2398	677,853		2626	783,1187		2834	837,-2215	V	3060	661,-2219	V
2398	1095,431		2628	1159,1087		2834	-1997,619	V	3060	-2399,841	V
2400	1061,539		2630	1037,-1067	F	2838	865,619		3064	1197,-1963	A
2406	871,733		2630	-1593,1563	F	2844	895,-2057	V	3072	673,865	V
2412	1057,-551	V	2640	553,1097		2844	-1949,787	V	3072	673,-2207	V
2412	-1355,1861	V	2652	575,745		2844	661,-1235	V	3072	-2399,865	V
2420	549,989	V	2664	1195,619	V	2844	-2183,1609	V	3072	-2399,-2207	V
2420	-1871,-1431	V	2664	1195,-2045	V	2852	1009,1561	V	3078	1351,-701	V
2422	447,853		2664	-1469,619	V	2852	-1843,-1291	P	3078	-1727,2377	V
2430	523,-1097	V	2664	-1469,-2045	V	2860	787,-2117	V	3080	1147,-1973	A
2430	-1907,1333	V	2676	601,751		2860	-2073,743	V	3088	707,2251	V
2442	1105,449		2676	1159,625		2862	665,-2215	V	3088	-2381,-837	V
2448	1103,-529	V	2676	817,559		2862	-2197,647	V	3096	851,707	V
2448	1103,1919	V	2678	799,1203		2880	1013,-907	V	3096	851,-2389	V
2448	-1345,-529	V	2682	623,-1165	V	2880	-1867,1973	V	3096	-2245,707	V
2448	-1345,1919	V	2682	-2059,1517	V	2882	1073,765		3096	-2245,-2389	V
2448	965,-1339	V	2686	579,477		2892	901,811		3102	725,947	
2448	-1483,1109	V	2698	565,707		2912	1045,-2371	V	3104	1297,1393	
2450	1107,743	V	2700	629,-1531	V	2912	-1867,541	V	3104	919,951	
2450	-1343,-1707	V	2700	-2071,1169	V	2914	1037,1601	V	3108	577,-2447	V
2454	689,539		2702	821,709	P	2914	-1877,-1313	P	3108	-2531,661	V
2460	511,1129		2702	-1881,-1993	V	2924	1035,519		3122	663,-2193	V
2484	541,-1907	V	2704	571,987	V	2926	851,-2285	V	3122	-2459,929	V
2484	-1943,577	V	2704	-2133,-1717	V	2926	-2075,641	V	3130	1277,-1227	F
2484	1135,-521	V	2718	745,-2099	V	2944	899,853		3130	-1853,1227	Fa
2484	-1349,1963	V	2718	-1973,619	V	2952	929,-1039	V	3136	953,1289	V
2486	571,659		2724	1181,635		2952	-2023,1913	V	3136	-2183,-1847	V
2502	1087,-581	V	2724	1247,569		2954	647,-2125	V	3136	1329,-687	V
2502	-1415,1921	V	2728	615,769		2954	-2307,829	V	3136	1329,2449	V
2508	767,521		2736	625,769	V	2968	551,-1913	V	3136	-1807,-687	V
2508	767,653		2736	625,-1967	V	2968	-2417,1055	V	3136	-1807,2449	V
2508	521,653		2736	-2111,769	V	2988	941,-2155	V	3146	593,681	V
2514	691,781		2736	-2111,-1967	V	2988	-2047,833	V	3146	-2553,-2465	V
2516	441,543		2744	573,-1163	V	2990	907,927	PFA	3152	691,723	V
2530	887,-1873	V	2744	573,1581	V	2990	-2083,-2063	PFA	3152	-2461,-2429	V

Table 2 (continued)

3162	1369,739	
3168	1127,841	
3178	1397,921	V
3178	-1781,-2257	V
3182	845,-2251	V
3182	-2337,931	V
3186	973,-2303	V
3186	-2213,883	V
3192	1381,-899	V
3192	1381,2293	V
3192	-1811,-899	V
3192	-1811,2293	V
3210	1157,983	
3212	597,685	
3216	985,727	
3222	985,-1163	V
3222	-2237,2059	V
3230	847,677	
3256	689,711	
3258	1177,-995	V
3258	-2081,2263	V
3264	995,1181	
3268	691,863	
3278	871,1179	V
3278	-2407,-2099	V
3294	1007,-2377	V
3294	-2287,917	V
3300	623,887	V
3300	-2677,-2413	V
3306	1295,-2533	V
3306	-2011,773	V
3318	1439,773	
3322	881,749	
3328	981,1493	V
3328	-2347,-1835	V
3330	1193,1373	
3358	623,715	
3378	1033,787	
3380	911,1431	V
3380	-2469,-1949	V
3384	731,-1525	V
3384	731,1859	V
3384	-2653,-1525	V
3384	-2653,1859	V
3402	775,-1493	V
3402	-2627,1909	V
3404	987,1033	
3406	735,1423	
3420	781,-1499	V
3420	-2639,1921	V
3430	1511,-729	V
3430	-1919,2701	V
3432	1051,1021	
3444	1003,-2693	V
3444	-2441,751	V
3458	927,1031	
3468	749,-2515	V
3468	-2719,953	V
3468	1531,-2549	V
3468	-1937,919	V
3484	1029,-2723	V
3484	-2455,761	V
3484	759,2007	V
3484	-2725,-1477	V
3498	1261,-2555	V
3498	-2237,943	V
3498	799,755	A
3514	795,-1249	V
3514	-2719,2265	V
3520	763,653	
3520	931,-2269	V
3520	-2589,1251	V
3542	801,-1271	V
3542	-2741,2271	V
3562	961,753	
3600	781,1381	V
3600	-2819,-2219	V
3612	767,-1585	V
3612	-2845,2027	V
3626	1597,-783	V
3626	-2029,2843	V
3640	773,-1523	V
3640	773,2117	V
3640	-2867,-1523	V
3640	-2867,2117	V
3668	1587,1083	V
3668	-2081,-2585	V
3682	1563,2615	V
3682	-2119,-1067	V
3710	809,-1571	V
3710	-2901,2139	V
3738	1621,-815	V
3738	-2117,2923	V
3762	1055,-2905	V
3762	-2707,857	V
3782	2197,1709	C
3800	1003,803	
3838	815,1017	
3844	1673,1425	PA
3844	-2171,-2419	PA
3850	871,1579	A
3888	1189,-2483	V
3888	-2699,1405	V
3894	889,1589	A
3906	2267,1763	C
3918	1453,1159	
3934	849,-2763	V
3934	-3085,1171	V
3952	1061,1165	V
3952	-2891,-2787	V
3952	1733,-1459	V
3952	-2219,2493	V
3962	1719,1159	V
3962	-2243,-2803	V
3972	1477,1171	
3976	1115,-1725	V
3976	1115,2251	V
3976	-2861,-1725	V
3976	-2861,2251	V
3978	1681,841	
3982	1119,1053	
3982	1119,1075	
3982	1119,-2885	V
3982	-2863,1097	V
3982	1053,-2907	V
3982	-2929,1075	V
3982	1053,1097	
3982	1075,1097	
4002	1651,1697	
4004	1103,-2945	V
4004	-2901,1059	V
4004	1103,1125	
4004	1103,873	
4004	1103,1081	
4004	1103,-3153	V
4004	-2901,851	V
4004	1059,1125	
4004	1059,873	
4004	1059,1081	
4004	1059,851	V
4004	-2945,-3153	V
4004	1125,-3131	V
4004	-2879,873	V
4004	1125,-2923	V
4004	-2879,1081	V
4004	1125,851	
4004	873,1081	V
4004	-3131,-2923	V
4004	873,851	
4004	1081,851	
4010	1183,1223	PFAa
4010	1223,2827	PFAa
4018	867,-3109	V
4018	-3151,909	V
4020	1193,1103	
4032	1193,857	V
4032	1193,-3175	V
4032	-2839,857	V
4032	-2839,-3175	V
4080	889,1831	
4096	1215,1727	V
4096	-2881,-2369	V
4096	1601,1473	PA
4096	1601,-2623	V
4096	-2495,1473	V
4096	-2495,-2623	PA
4108	1103,895	V
4108	-3005,-3213	V
4128	1217,1151	
4130	877,-2987	V
4130	-3253,1143	V
4134	1751,875	
4142	1751,-2429	V
4142	-2391,1713	V
4160	1227,1123	V
4160	-2933,-3037	V
4180	1757,-2347	V
4180	-2423,1833	V
4186	1731,1501	
4188	1159,913	
4200	1243,907	V
4200	1243,-3293	V
4200	-2957,907	V
4200	-2957,-3293	V
4228	913,-3063	V
4228	-3315,1165	V
4236	923,1181	
4242	1165,1255	
4246	917,961	A
4256	1853,1237	V
4256	-2403,-3019	V
4270	1241,2461	V
4270	-3029,-1809	V
4278	1765,1535	
4290	1277,1187	
4296	1267,1189	
4318	1773,2997	V
4318	-2545,-1321	V
4332	989,-3115	V
4332	-3343,1217	V
4344	1949,947	
4344	1289,1607	
4352	1331,2555	V
4352	-3021,-1797	V
4356	1651,1915	PA
4356	-2705,-2441	PA
4394	1981,1305	
4398	1217,995	
4398	1301,1235	
4452	1655,1313	
4458	1645,1327	
4462	1891,1845	
4466	1587,-3285	V
4466	-2879,1181	V
4484	1891,-2517	V
4484	-2593,1967	V
4488	1261,1669	V
4488	1261,-2819	V
4488	-3227,1669	V
4488	-3227,-2819	V
4488	1237,973	V
4488	1237,-3515	V
4488	-3251,973	V
4488	-3251,-3515	V
4506	1985,1019	
4512	1339,1669	
4550	963,1223	
4566	2011,1033	
4592	991,-1921	V
4592	991,2671	V
4592	-3601,-1921	V
4592	-3601,2671	V
4606	979,-1933	V
4606	-3627,2673	V
4614	1703,1373	
4620	997,-2027	V
4620	-3623,2593	V
4624	1701,1293	V
4624	-2923,-3331	V
4628	1955,3619	V
4628	-2673,-1009	V
4674	1303,1057	
4674	1687,-2741	V
4674	-2987,1933	V
4708	1305,1019	
4712	1733,-2067	V
4712	1733,2645	V
4712	-2979,-2067	P

Table 2 (continued)

4712	-2979,2645	V	4978	-3641,1075	V	5434	-3187,-3967	V	5828	2131,3259	C
4722	1751,1397		5018	1399,1347	V	5434	2247,-3473	V	5850	1571,2281	
4756	1315,1257		5018	-3619,-3671	V	5434	-3187,1961	V	5966	2467,-3461	V
4782	1333,1423		5050	1969,-2071	F	5434	1467,-3473	V	5966	-3499,2505	V
4784	1411,2147	V	5050	-3081,2979	F	5434	-3967,1961	V	6094	1677,-4395	V
4784	-3373,-2637	V	5074	1981,1803		5456	1521,2017	V	6094	-4417,1699	V
4796	1337,-3503	V	5112	1933,-3211	A	5456	1521,-3439	V	6136	2325,-3859	A
4796	-3459,1293	V	5128	1907,-3245	A	5456	-3935,2017	V	6152	2275,-3869	A
4802	2015,-1037	V	5150	2161,-3039	F	5456	-3935,-3439	V	6348	2345,-3727	V
4802	-2787,3765	V	5150	-2989,2111	F	5456	1181,1467		6348	-4003,2621	V
4836	1435,1357		5166	1441,1387		5546	2339,-3113	V	6498	1799,1745	
4850	2039,-2861	F	5172	2119,2191		5546	-3207,2433	V	6578	2569,-4035	F
4850	-2811,1989	F	5196	2129,2153		5704	3189,2085	C	6578	-4009,2543	F
4898	2149,3097	P	5278	1139,-3817	V	5776	1595,2203	V	6604	2501,-2579	F
4898	-2749,-1801	V	5278	-4139,1461	V	5776	-4181,-3573	V	6604	-4103,4025	F
4950	2029,-1931	F	5302	1425,1469		5798	1565,1617	V	6900	2899,2851	A
4950	-2921,3019	F	5336	1469,1411		5798	-4233,-4181	V	7500	3151,-4649	F
4950	1073,1337	V	5382	1445,2225	V	5808	2243,-4093	V	7500	-4349,2851	F
4950	-3877,-3613	V	5382	-3937,-3157	V	5808	-3565,1715	V			
4978	1337,-3903	V	5434	2247,1467	V	5814	1561,2255				

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