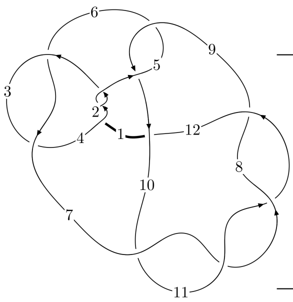
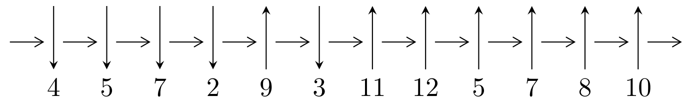
# $12n_{0673}$ ($K12n_{0673}$)




A knot diagram[1]

**Linearized knot diagam**




**Solving Sequence**

$$3,5 \xrightarrow[c_2]{} 2 \xrightarrow[c_4]{} 4 \xrightarrow[c_1]{} 1,10 \xrightarrow[c_9]{} 9 \xrightarrow[c_5]{} 6 \xrightarrow[c_6]{} 7 \xrightarrow[c_{10}]{} 11 \xrightarrow[c_{12}]{} 12 \xrightarrow[c_8]{} 8 \twoheadrightarrow c_3, c_7, c_{11}$$

**Ideals for irreducible components[2] of $X_{\text{par}}$**

$$\begin{aligned}
I_1^u = \langle & 7073u^{11} + 66159u^{10} + \cdots + 129872b + 81956, \\
& -114251u^{11} - 1031968u^{10} + \cdots + 259744a - 4523833, \\
& u^{12} + 9u^{11} + 25u^{10} - 103u^8 - 97u^7 + 152u^6 + 251u^5 + 27u^4 - 144u^3 - 101u^2 + 45u - 1\rangle \\
I_2^u = \langle & a^5 + a^4 + 3a^3 + 2a^2 + b + 3a + 1,\ a^6 + a^5 + 3a^4 + 2a^3 + 2a^2 + a - 1,\ u - 1\rangle \\
I_3^u = \langle & b + u + 2,\ a,\ u^2 + u - 1\rangle \\
I_4^u = \langle & b - 1,\ a,\ u^2 + u - 1\rangle
\end{aligned}$$

* 4 irreducible components of $\dim_{\mathbb{C}} = 0$, with total 22 representations.

[1] The image of knot diagram is generated by the software "**Draw programme**" developed by Andrew Bartholomew(`http://www.layer8.co.uk/maths/draw/index.htm#Running-draw`), where we modified some parts for our purpose(`https://github.com/CATsTAILs/LinksPainter`).

[2] All coefficients of polynomials are rational numbers. But the coefficients are sometimes approximated in decimal forms when there is not enough margin.

**I.** $\boldsymbol{I_1^u = \langle 7073u^{11} + 66159u^{10} + \cdots + 129872b + 81956,\ -1.14 \times 10^5u^{11} - 1.03 \times 10^6u^{10} + \cdots + 2.60 \times 10^5a - 4.52 \times 10^6,\ u^{12} + 9u^{11} + \cdots + 45u - 1\rangle}$

**(i) Arc colorings**

$$a_3 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$a_5 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$

$$a_2 = \begin{pmatrix} 1 \\ -u^2 \end{pmatrix}$$

$$a_4 = \begin{pmatrix} u \\ -u^3 + u \end{pmatrix}$$

$$a_1 = \begin{pmatrix} -u^2 + 1 \\ u^4 - 2u^2 \end{pmatrix}$$

$$a_{10} = \begin{pmatrix} 0.439860u^{11} + 3.97302u^{10} + \cdots - 47.5490u + 17.4165 \\ -0.0544613u^{11} - 0.509417u^{10} + \cdots + 6.62604u - 0.631052 \end{pmatrix}$$

$$a_9 = \begin{pmatrix} 0.439860u^{11} + 3.97302u^{10} + \cdots - 47.5490u + 17.4165 \\ -0.0450405u^{11} - 0.419729u^{10} + \cdots + 6.42332u - 0.616773 \end{pmatrix}$$

$$a_6 = \begin{pmatrix} 0.133728u^{11} + 1.20365u^{10} + \cdots - 13.6953u + 6.55144 \\ 0.0197733u^{11} + 0.165055u^{10} + \cdots - 1.07934u - 0.126956 \end{pmatrix}$$

$$a_7 = \begin{pmatrix} 0.113955u^{11} + 1.03859u^{10} + \cdots - 12.6159u + 6.67839 \\ 0.0197733u^{11} + 0.165055u^{10} + \cdots - 1.07934u - 0.126956 \end{pmatrix}$$

$$a_{11} = \begin{pmatrix} 0.315345u^{11} + 2.83075u^{10} + \cdots - 32.5667u + 13.8030 \\ -0.0286436u^{11} - 0.268888u^{10} + \cdots + 3.78724u - 0.484901 \end{pmatrix}$$

$$a_{12} = \begin{pmatrix} -0.113955u^{11} - 1.03859u^{10} + \cdots + 12.6159u - 6.67839 \\ -0.0649601u^{11} - 0.595448u^{10} + \cdots + 7.01396u + 0.0444168 \end{pmatrix}$$

$$a_8 = \begin{pmatrix} 0.315345u^{11} + 2.83075u^{10} + \cdots - 32.5667u + 13.8030 \\ 0.0488288u^{11} + 0.442590u^{10} + \cdots - 6.15990u - 0.207200 \end{pmatrix}$$

**(ii) Obstruction class** $= -1$

**(iii) Cusp Shapes** $= -\frac{1683}{8117}u^{11} - \frac{255349}{129872}u^{10} + \cdots + \frac{3115965}{129872}u + \frac{1650111}{129872}$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_4$ | $u^{12} - 9u^{11} + \cdots - 45u - 1$ |
| $c_3, c_6$ | $u^{12} + 15u^{11} + \cdots + 320u - 64$ |
| $c_5, c_9$ | $u^{12} + 3u^{11} + \cdots + 32u + 16$ |
| $c_7, c_8, c_{10}$ $c_{11}$ | $u^{12} - 4u^{11} + \cdots - 10u + 1$ |
| $c_{12}$ | $u^{12} - 4u^{11} + \cdots + 4188u - 167$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_4$ | $y^{12} - 31y^{11} + \cdots - 1823y + 1$ |
| $c_3, c_6$ | $y^{12} - 45y^{11} + \cdots - 200704y + 4096$ |
| $c_5, c_9$ | $y^{12} + 25y^{11} + \cdots - 5248y + 256$ |
| $c_7, c_8, c_{10}$ $c_{11}$ | $y^{12} - 12y^{11} + \cdots - 50y + 1$ |
| $c_{12}$ | $y^{12} + 124y^{11} + \cdots - 13537022y + 27889$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I_1^u$ | $\sqrt{-1}(\text{vol} + \sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = -0.568188 + 0.801699I$<br>$a = 1.49494 - 0.68223I$<br>$b = 1.272770 + 0.614644I$ | $2.73506 - 3.39089I$ | $4.46250 + 1.24643I$ |
| $u = -0.568188 - 0.801699I$<br>$a = 1.49494 + 0.68223I$<br>$b = 1.272770 - 0.614644I$ | $2.73506 + 3.39089I$ | $4.46250 - 1.24643I$ |
| $u = 0.823127$<br>$a = -0.456967$<br>$b = 1.12827$ | $-1.14502$ | $-10.9850$ |
| $u = 1.41132 + 0.46960I$<br>$a = -0.770194 + 0.438317I$<br>$b = 2.04382 + 1.53387I$ | $-1.311700 + 0.306316I$ | $0.43565 - 2.29946I$ |
| $u = 1.41132 - 0.46960I$<br>$a = -0.770194 - 0.438317I$<br>$b = 2.04382 - 1.53387I$ | $-1.311700 - 0.306316I$ | $0.43565 + 2.29946I$ |
| $u = 0.310507$<br>$a = -1.57680$<br>$b = 1.86809$ | $8.15010$ | $18.2770$ |
| $u = -1.69127$<br>$a = -0.389523$<br>$b = 0.988886$ | $-7.58478$ | $10.3110$ |
| $u = 0.0235034$<br>$a = 16.2652$<br>$b = -0.471383$ | $0.765123$ | $13.2690$ |
| $u = -2.10231 + 0.69985I$<br>$a = -0.295636 - 1.021660I$<br>$b = 4.49200 + 0.95627I$ | $-16.1694 + 9.7565I$ | $2.18491 - 3.24065I$ |
| $u = -2.10231 - 0.69985I$<br>$a = -0.295636 + 1.021660I$<br>$b = 4.49200 - 0.95627I$ | $-16.1694 - 9.7565I$ | $2.18491 + 3.24065I$ |

| Solutions to $I_1^u$ | $\sqrt{-1}(\mathrm{vol}+\sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u=-2.97376+0.73623I$<br>$a=\quad 0.149929+1.199420I$<br>$b=-6.56552-7.10055I$ | $14.6533+4.1219I$ | $0.48044-1.82182I$ |
| $u=-2.97376-0.73623I$<br>$a=\quad 0.149929-1.199420I$<br>$b=-6.56552+7.10055I$ | $14.6533-4.1219I$ | $0.48044+1.82182I$ |

**II.**

$$I_2^u = \langle a^5+a^4+3a^3+2a^2+b+3a+1,\ a^6+a^5+3a^4+2a^3+2a^2+a-1,\ u-1\rangle$$

**(i) Arc colorings**

$$a_3 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$a_5 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$a_2 = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

$$a_4 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$a_1 = \begin{pmatrix} 0 \\ -1 \end{pmatrix}$$

$$a_{10} = \begin{pmatrix} a \\ -a^5-a^4-3a^3-2a^2-3a-1 \end{pmatrix}$$

$$a_9 = \begin{pmatrix} a \\ -a^5-a^4-3a^3-2a^2-2a-1 \end{pmatrix}$$

$$a_6 = \begin{pmatrix} a^2 \\ 0 \end{pmatrix}$$

$$a_7 = \begin{pmatrix} a^2 \\ 0 \end{pmatrix}$$

$$a_{11} = \begin{pmatrix} -a^5-a^3+a \\ -a^5-a^4-3a^3-2a^2-3a-1 \end{pmatrix}$$

$$a_{12} = \begin{pmatrix} a^2 \\ -a^2-2 \end{pmatrix}$$

$$a_8 = \begin{pmatrix} -a^5-a^3+a \\ -a^4-2a^2-1 \end{pmatrix}$$

**(ii) Obstruction class** $= 1$

**(iii) Cusp Shapes** $= 7a^5+15a^4+29a^3+33a^2+28a+20$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_2$ | $(u-1)^6$ |
| $c_3, c_6$ | $u^6$ |
| $c_4$ | $(u+1)^6$ |
| $c_5$ | $u^6 - u^5 + 3u^4 - 2u^3 + 2u^2 - u - 1$ |
| $c_7, c_8$ | $u^6 + u^5 - 3u^4 - 2u^3 + 2u^2 - u - 1$ |
| $c_9, c_{12}$ | $u^6 + u^5 + 3u^4 + 2u^3 + 2u^2 + u - 1$ |
| $c_{10}, c_{11}$ | $u^6 - u^5 - 3u^4 + 2u^3 + 2u^2 + u - 1$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_4$ | $(y-1)^6$ |
| $c_3, c_6$ | $y^6$ |
| $c_5, c_9, c_{12}$ | $y^6 + 5y^5 + 9y^4 + 4y^3 - 6y^2 - 5y + 1$ |
| $c_7, c_8, c_{10}$ $c_{11}$ | $y^6 - 7y^5 + 17y^4 - 16y^3 + 6y^2 - 5y + 1$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I_2^u$ | $\sqrt{-1}(\mathrm{vol} + \sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = \quad 1.00000$<br>$a = -0.873214$<br>$b = \quad 2.01841$ | $6.01515$ | $6.57090$ |
| $u = \quad 1.00000$<br>$a = \quad 0.138835 + 1.234450I$<br>$b = -0.228804 - 0.434483I$ | $-4.60518 + 1.97241I$ | $-0.89950 - 4.53432I$ |
| $u = \quad 1.00000$<br>$a = \quad 0.138835 - 1.234450I$<br>$b = -0.228804 + 0.434483I$ | $-4.60518 - 1.97241I$ | $-0.89950 + 4.53432I$ |
| $u = \quad 1.00000$<br>$a = -0.408802 + 1.276380I$<br>$b = \quad 0.636388 - 0.565801I$ | $2.05064 - 4.59213I$ | $1.73030 + 5.96315I$ |
| $u = \quad 1.00000$<br>$a = -0.408802 - 1.276380I$<br>$b = \quad 0.636388 + 0.565801I$ | $2.05064 + 4.59213I$ | $1.73030 - 5.96315I$ |
| $u = \quad 1.00000$<br>$a = \quad 0.413150$<br>$b = -2.83358$ | $-0.906083$ | $39.7680$ |

### III. $I_3^u = \langle b + u + 2,\ a,\ u^2 + u - 1 \rangle$

**(i) Arc colorings**

$$a_3 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$
$$a_5 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$
$$a_2 = \begin{pmatrix} 1 \\ u - 1 \end{pmatrix}$$
$$a_4 = \begin{pmatrix} u \\ -u + 1 \end{pmatrix}$$
$$a_1 = \begin{pmatrix} u \\ -u \end{pmatrix}$$
$$a_{10} = \begin{pmatrix} 0 \\ -u - 2 \end{pmatrix}$$
$$a_9 = \begin{pmatrix} 0 \\ -u - 2 \end{pmatrix}$$
$$a_6 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$
$$a_7 = \begin{pmatrix} -u \\ u \end{pmatrix}$$
$$a_{11} = \begin{pmatrix} -1 \\ -u - 1 \end{pmatrix}$$
$$a_{12} = \begin{pmatrix} u \\ u + 3 \end{pmatrix}$$
$$a_8 = \begin{pmatrix} 1 \\ 2u + 2 \end{pmatrix}$$

**(ii) Obstruction class** $= 1$

**(iii) Cusp Shapes** $= -16$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_3$<br>$c_{10}, c_{11}, c_{12}$ | $u^2 + u - 1$ |
| $c_4, c_6, c_7$<br>$c_8$ | $u^2 - u - 1$ |
| $c_5, c_9$ | $u^2$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_3$<br>$c_4, c_6, c_7$<br>$c_8, c_{10}, c_{11}$<br>$c_{12}$ | $y^2 - 3y + 1$ |
| $c_5, c_9$ | $y^2$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I^u_3$ | $\sqrt{-1}(\mathrm{vol} + \sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = 0.618034$<br>$a = 0$<br>$b = -2.61803$ | 7.89568 | −16.0000 |
| $u = -1.61803$<br>$a = 0$<br>$b = -0.381966$ | −7.89568 | −16.0000 |

## IV. $I_4^u = \langle b-1,\ a,\ u^2+u-1 \rangle$

**(i) Arc colorings**

$$a_3 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$a_5 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$

$$a_2 = \begin{pmatrix} 1 \\ u-1 \end{pmatrix}$$

$$a_4 = \begin{pmatrix} u \\ -u+1 \end{pmatrix}$$

$$a_1 = \begin{pmatrix} u \\ -u \end{pmatrix}$$

$$a_{10} = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$a_9 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$a_6 = \begin{pmatrix} 0 \\ u \end{pmatrix}$$

$$a_7 = \begin{pmatrix} -u \\ u \end{pmatrix}$$

$$a_{11} = \begin{pmatrix} -u+1 \\ u \end{pmatrix}$$

$$a_{12} = \begin{pmatrix} u \\ 0 \end{pmatrix}$$

$$a_8 = \begin{pmatrix} u-1 \\ 1 \end{pmatrix}$$

**(ii) Obstruction class** $= 1$

**(iii) Cusp Shapes** $= -1$

**(iv) u-Polynomials at the component**

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_3$<br>$c_{10}, c_{11}, c_{12}$ | $u^2 + u - 1$ |
| $c_4, c_6, c_7$<br>$c_8$ | $u^2 - u - 1$ |
| $c_5, c_9$ | $u^2$ |

**(v) Riley Polynomials at the component**

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_3$ <br> $c_4, c_6, c_7$ <br> $c_8, c_{10}, c_{11}$ <br> $c_{12}$ | $y^2 - 3y + 1$ |
| $c_5, c_9$ | $y^2$ |

**(vi) Complex Volumes and Cusp Shapes**

| Solutions to $I_4^u$ | $\sqrt{-1}(\mathrm{vol} + \sqrt{-1}CS)$ | Cusp shape |
|---|---|---|
| $u = 0.618034$<br>$a = 0$<br>$b = 1.00000$ | 0 | $-1.00000$ |
| $u = -1.61803$<br>$a = 0$<br>$b = 1.00000$ | 0 | $-1.00000$ |

## V. u-Polynomials

| Crossings | u-Polynomials at each crossing |
|---|---|
| $c_1, c_2$ | $((u-1)^6)(u^2+u-1)^2(u^{12}-9u^{11}+\cdots-45u-1)$ |
| $c_3$ | $u^6(u^2+u-1)^2(u^{12}+15u^{11}+\cdots+320u-64)$ |
| $c_4$ | $((u+1)^6)(u^2-u-1)^2(u^{12}-9u^{11}+\cdots-45u-1)$ |
| $c_5$ | $u^4(u^6-u^5+\cdots-u-1)(u^{12}+3u^{11}+\cdots+32u+16)$ |
| $c_6$ | $u^6(u^2-u-1)^2(u^{12}+15u^{11}+\cdots+320u-64)$ |
| $c_7, c_8$ | $(u^2-u-1)^2(u^6+u^5-3u^4-2u^3+2u^2-u-1)$ $\cdot(u^{12}-4u^{11}+\cdots-10u+1)$ |
| $c_9$ | $u^4(u^6+u^5+\cdots+u-1)(u^{12}+3u^{11}+\cdots+32u+16)$ |
| $c_{10}, c_{11}$ | $(u^2+u-1)^2(u^6-u^5-3u^4+2u^3+2u^2+u-1)$ $\cdot(u^{12}-4u^{11}+\cdots-10u+1)$ |
| $c_{12}$ | $(u^2+u-1)^2(u^6+u^5+3u^4+2u^3+2u^2+u-1)$ $\cdot(u^{12}-4u^{11}+\cdots+4188u-167)$ |

## VI. Riley Polynomials

| Crossings | Riley Polynomials at each crossing |
|---|---|
| $c_1, c_2, c_4$ | $((y-1)^6)(y^2-3y+1)^2(y^{12}-31y^{11}+\cdots-1823y+1)$ |
| $c_3, c_6$ | $y^6(y^2-3y+1)^2(y^{12}-45y^{11}+\cdots-200704y+4096)$ |
| $c_5, c_9$ | $y^4(y^6+5y^5+9y^4+4y^3-6y^2-5y+1)$ $\cdot(y^{12}+25y^{11}+\cdots-5248y+256)$ |
| $c_7, c_8, c_{10}$ $c_{11}$ | $(y^2-3y+1)^2(y^6-7y^5+17y^4-16y^3+6y^2-5y+1)$ $\cdot(y^{12}-12y^{11}+\cdots-50y+1)$ |
| $c_{12}$ | $(y^2-3y+1)^2(y^6+5y^5+9y^4+4y^3-6y^2-5y+1)$ $\cdot(y^{12}+124y^{11}+\cdots-13537022y+27889)$ |