

Pensieve Header: A very simple Kauffman-bracket program, written in-class during my summer class on <http://www.math.toronto.edu/~drorbn/classes/0910/Homology>, Accra, Ghana, June 2010.

```
<< KnotTheory`
```

Loading KnotTheory` version of April 20, 2009, 14:18:34.482.

Read more at <http://katlas.org/wiki/KnotTheory>.

```
K1 = PD[Knot[8, 17]]
```

```
KnotTheory::loading: Loading precomputed data in PD4Knots`.
```

```
PD[X[6, 2, 7, 1], X[14, 8, 15, 7], X[8, 3, 9, 4], X[2, 13, 3, 14],
  X[12, 5, 13, 6], X[4, 9, 5, 10], X[16, 12, 1, 11], X[10, 16, 11, 15]]
```

```
K = PD[X[6, 4, 1, 3], X[4, 2, 5, 1], X[2, 6, 3, 5]]
```

```
PD[X[6, 4, 1, 3], X[4, 2, 5, 1], X[2, 6, 3, 5]]
```

```
SetAttributes[p, Orderless];
```

```
KB[K_] := (
```

```
  t1 = K /. X[i_, j_, k_, l_] => A p[i, j] p[k, l] + B p[j, k] p[l, i];
```

```
  t2 = Expand[Times @@ t1];
```

```
  t3 = t2 //. {
```

```
    p[i_, j_] p[j_, k_] => p[i, k],
```

```
    p[i_, j_] ^2 => p[i, i]
```

```
  };
```

```
  t4 = t3 /. p[i_, i_] => d;
```

```
  t5 = Expand[t4 /. {B -> 1/A, d -> -A^2 - 1/A^2}]
```

```
)
```

```
KB[K]
```

$$-\frac{1}{A^9} + \frac{1}{A} + A^3 + A^7$$

```
KB[PD[X[3, 6, 4, 1], X[1, 4, 2, 5], X[5, 2, 6, 3]]]
```

$$\frac{1}{A^7} + \frac{1}{A^3} + A - A^9$$

```
Simplify[
```

```
  KB[K] / KB[PD[X[3, 6, 4, 1], X[1, 4, 2, 5], X[5, 2, 6, 3]]]
```

```
]
```

$$-\frac{-1 + A^4 + A^{12}}{A^2 (-1 - A^8 + A^{12})}$$

```
KB[PD[X[2, 4, 3, 1], X[3, 4, 6, 5]]]
```

```
p[1, 5] p[2, 6]
```

```
KB[K1]
```

$$-\frac{1}{A^{18}} + \frac{2}{A^{14}} - \frac{2}{A^{10}} + \frac{1}{A^6} - \frac{1}{A^2} - A^2 + A^6 - 2 A^{10} + 2 A^{14} - A^{18}$$

Short[t3, 5]

$$B^8 p[6, 6] p[7, 7] p[9, 9] p[10, 10] p[11, 11] + AB^7 p[7, 7] p[9, 9] p[10, 10] p[12, 12] + A^7 B p[6, 6] p[8, 8] p[11, 11] p[12, 12] + \langle\langle 97 \rangle\rangle + 4 A^3 B^5 p[13, 13] p[15, 15] + 2 A^6 B^2 p[4, 4] p[13, 13] p[15, 15] + A^2 B^6 p[6, 6] p[13, 13] p[15, 15]$$

Jones[Knot[8, 17]][q]

KnotTheory::loading: Loading precomputed data in Jones4Knots`.

$$7 + \frac{1}{q^4} - \frac{3}{q^3} + \frac{5}{q^2} - \frac{6}{q} - 6q + 5q^2 - 3q^3 + q^4$$

Simplify[KB[K1] / (-A^2 - 1 / A^2)]

$$7 + \frac{1}{A^{16}} - \frac{3}{A^{12}} + \frac{5}{A^8} - \frac{6}{A^4} - 6A^4 + 5A^8 - 3A^{12} + A^{16}$$

all = Jones[#][q] & /@ AllKnots[]

KnotTheory::loading: Loading precomputed data in Jones4Knots11`.

A very large output was generated. Here is a sample of it:

$$\left\{ 1, -\frac{1}{q^4} + \frac{1}{q^3} + \frac{1}{q}, 1 + \frac{1}{q^2} - \frac{1}{q} - q + q^2, -\frac{1}{q^7} + \frac{1}{q^6} - \frac{1}{q^5} + \frac{1}{q^4} + \frac{1}{q^2}, \langle\langle 794 \rangle\rangle, 16 + \frac{3}{q^4} - \frac{7}{q^3} + \frac{11}{q^2} - \frac{15}{q} - 15q + 13q^2 - 8q^3 + 4q^4 - q^5, q^3 - q^5 + 3q^6 - 3q^7 + 4q^8 - 4q^9 + 3q^{10} - 3q^{11} + q^{12}, -2 + 7q - 10q^2 + 14q^3 - 15q^4 + 14q^5 - 12q^6 + 8q^7 - 4q^8 + q^9, 3q^2 - 7q^3 + 13q^4 - 16q^5 + 18q^6 - 18q^7 + 14q^8 - 10q^9 + 5q^{10} - q^{11} \right\}$$

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Length[Union[all]]

732

Length[AllKnots[]]

802

all137 = KB /@ PD /@ AllKnots[{3, 7}]

$$\left\{ \frac{1}{A^7} + \frac{1}{A^3} + A - A^9, -\frac{1}{A^{10}} - A^{10}, \frac{1}{A^9} + \frac{1}{A^5} + \frac{1}{A} - A^{15}, \frac{1}{A^{13}} + \frac{1}{A^5} + \frac{1}{A} - A^{11}, 1 - \frac{1}{A^{16}} - \frac{1}{A^8} - A^{12}, -\frac{1}{A^{12}} - \frac{1}{A^4} + A^{12} - A^{16}, \frac{1}{A^{14}} - \frac{1}{A^{10}} - \frac{1}{A^2} - A^2 - A^{10} + A^{14}, \frac{1}{A^{11}} + \frac{1}{A^7} + \frac{1}{A^3} - A^{21}, \frac{1}{A^{19}} + \frac{1}{A^{11}} + A - A^{13}, -\frac{1}{A^{17}} - \frac{1}{A^9} + \frac{1}{A^5} + \frac{1}{A} + A^7 + A^{15}, -\frac{1}{A^{13}} - \frac{1}{A^5} + \frac{1}{A} + A^3 + A^7 + A^{11} - A^{15} + A^{19}, \frac{1}{A^{15}} + \frac{2}{A^7} - A^9 + A^{13} - A^{17}, \frac{1}{A^{15}} - \frac{1}{A^{11}} + \frac{1}{A^7} + A + A^5 - A^9 + A^{13} - A^{17}, \frac{1}{A^{15}} - \frac{1}{A^{11}} + \frac{1}{A^7} - \frac{1}{A^3} + A^5 + 2A^{13} - A^{17} \right\}$$

all137 /. A -> -1

{-2, -2, -2, -2, -2, -2, -2, -2, -2, -2, -2, -2, -2, -2}

all37 /. A → E^{π I / 3}

$$\left\{ e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, -e^{-\frac{2i\pi}{3} - e^{\frac{2i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, -e^{-\frac{2i\pi}{3} - e^{\frac{2i\pi}{3}}}, -e^{-\frac{2i\pi}{3} - e^{\frac{2i\pi}{3}}}, \right. \\ \left. -e^{-\frac{2i\pi}{3} - e^{\frac{2i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}}, e^{-\frac{i\pi}{3} + e^{\frac{i\pi}{3}}} \right\}$$

Simplify[all37 /. A → E^{π I / 3}]

{1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1}