

Pensieve header: Fuller output of bch. Even fuller: <bch-to-20.m>, <bch-to-22.m>, <bch-to-23.m>.

```
SetDirectory["C:\\drorbn\\AcademicPensieve\\Projects\\WKO4"];
```

```
<< FreeLie.m;
```

```
bch = BCH[LW@x, LW@y]
```

```
FreeLie` implements / extends
```

```
{*, +, **, $SeriesShowDegree, ⟨⟩, ∫, ≡, ad, Ad, adSeries, AllCyclicWords, AllLyndonWords,
AllWords, Arbitrator, ASeries, AW, b, BCH, BooleanSequence, BracketForm, BS, CC, Crop, cw,
CW, CWS, CWSeries, D, Deg, DegreeScale, DerivationSeries, div, DK, DKS, DKSeries, EulerE,
Exp, Inverse, j, J, JA, LieDerivation, LieMorphism, LieSeries, LS, LW, LyndonFactorization,
Morphism, New, RandomCWSeries, Randomizer, RandomLieSeries, RC, SeriesSolve, Support,
t, tb, TopBracketForm, tr, UndeterminedCoefficients, αMap, Γ, ℓ, Λ, σ, ħ, −, −}.
```

```
FreeLie` is in the public domain. Dror Bar-Natan is committed to
```

```
support it within reason until July 15, 2022. This is version 150814.
```

```
LS[ $\overline{x} + \overline{y}$ ,  $\frac{\overline{xy}}{2}$ ,  $\frac{1}{12} \overline{xxy} + \frac{1}{12} \overline{xyy}$ , ...]
```

```
Do[Print[{n, TimeUsed[], Length[bch@n]}], {n, 23}]
```

{1, 0.391, 2}
{2, 0.391, 2}
{3, 0.391, 2}
{4, 0.391, 2}
{5, 0.406, 6}
{6, 0.406, 5}
{7, 0.422, 18}
{8, 0.437, 17}
{9, 0.469, 55}
{10, 0.547, 55}
{11, 0.687, 186}
{12, 1., 185}
{13, 1.625, 630}
{14, 3.172, 629}
{15, 6.297, 2181}
{16, 13.953, 2181}
{17, 29.469, 7710}
{18, 66.656, 7709}
{19, 142.734, 27594}
{20, 324.906, 27593}
{21, 712.172, 99857}
{22, 1612.7, 99857}
{23, 3495.52, 364722}