

Pensieve header: UEA: Very basic testing.

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<< UEA`
```

UEA` does computations in general universal enveloping algebras and PBW algebras. It is in the public domain, available at <http://drorbn.net/AcademicPensieve/Projects/UEA/>. Dror Bar-Natan is committed to support it within reason until March 18, 2022. This is version 170318.

UEA` implements / extends {\*\*, B, m, SetAlgebra, U, UB, UProducts, USimp, UU, \$Basis, \$PBWRule}.

UEA`SetAlgebra knows "sl2".

```
B[g, e] = 2 e; B[g, f] = -2 f; B[e, f] = b + e g; B[b, _] = 0;
```

```
$Basis = {b, e, g, f};
```

```
$PBWRule = {b -> 1, e -> 2, g -> 3, f -> 4};
```

```
r_{i,j}_ := USimp[U_i[f] U_j[e] +
```

$$\frac{1}{4} \left( -\epsilon^{-1} \delta U_i[b] U_j[b] + 2 U_i[b] U_j[g] + \epsilon U_i[g] U_j[g] \right) + \alpha \left( U_i[b] U_j[g] - U_i[g] U_j[b] \right)];$$

```
CYBEList = {UB[r_{1,2}, r_{1,3}], UB[r_{1,2}, r_{2,3}], UB[r_{1,3}, r_{2,3}]}
```

$$\begin{aligned} & \left\{ -2 \alpha U_1[f] U_2[e] U_3[b] + 2 \alpha U_1[f] U_2[b] U_3[e] - \frac{1}{2} \epsilon U_1[f] U_2[g] U_3[e] + \frac{1}{2} \epsilon U_1[f] U_2[e] U_3[g], \right. \\ & 2 \alpha U_1[f] U_2[e] U_3[b] + U_1[f] U_2[b] U_3[e] - U_1[b] U_2[f] U_3[e] - 2 \alpha U_1[b] U_2[f] U_3[e] - \\ & \frac{1}{2} \epsilon U_1[g] U_2[f] U_3[e] + \epsilon U_1[f] U_2[g] U_3[e] - \frac{1}{2} \epsilon U_1[f] U_2[e] U_3[g], \\ & -U_1[f] U_2[b] U_3[e] - 2 \alpha U_1[f] U_2[b] U_3[e] + U_1[b] U_2[f] U_3[e] + \\ & \left. 2 \alpha U_1[b] U_2[f] U_3[e] + \frac{1}{2} \epsilon U_1[g] U_2[f] U_3[e] - \frac{1}{2} \epsilon U_1[f] U_2[g] U_3[e] \right\} \end{aligned}$$

```
Total[CYBEList]
```

```
0
```

```
SetAlgebra["sl2"]
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```
In sl2: <e,h,f>/([h,e]=2e, [h,f]=-2f, [e,f]=h).
```

```
r_{i,j}_ := USimp[U_i[e] U_j[f] + \frac{1}{4} U_i[h] U_j[h] + \alpha (b_i U_i[] U_j[h] - b_j U_i[h] U_j[])];
```

```
CYBEList = {UB[r_{1,2}, r_{1,3}], UB[r_{1,2}, r_{2,3}], UB[r_{1,3}, r_{2,3}]}
```

$$\begin{aligned} & \left\{ 2 \alpha b_3 U_1[e] U_2[f] U_3[] - 2 \alpha b_2 U_1[e] U_2[] U_3[f] + \frac{1}{2} U_1[e] U_2[h] U_3[f] - \frac{1}{2} U_1[e] U_2[f] U_3[h], \right. \\ & -2 \alpha b_3 U_1[e] U_2[f] U_3[] + 2 \alpha b_1 U_1[] U_2[e] U_3[f] + \\ & \frac{1}{2} U_1[h] U_2[e] U_3[f] - U_1[e] U_2[h] U_3[f] + \frac{1}{2} U_1[e] U_2[f] U_3[h], \\ & \left. 2 \alpha b_2 U_1[e] U_2[] U_3[f] - 2 \alpha b_1 U_1[] U_2[e] U_3[f] - \frac{1}{2} U_1[h] U_2[e] U_3[f] + \frac{1}{2} U_1[e] U_2[h] U_3[f] \right\} \end{aligned}$$

```
Total[CYBEList]
```

```
0
```