

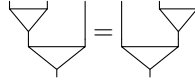
SaTeX examples

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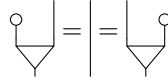
1 Usual laws

A *monoid* is associative



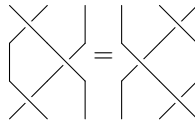
```
\deftwocell[triangle]{mu : 2 -> 1}
\[
  \twocell{(mu * 1) * mu}
  =
  \twocell{(1 * mu) * mu}
\]
```

and unital



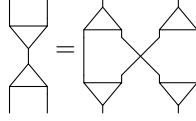
```
\deftwocell[triangle]{mu : 2 -> 1}
\deftwocell[unit]{eta : 0 -> 1}
\[
  \twocell{(eta * 1) * mu}
  =
  \twocell{1 * 1}
  =
  \twocell{(1 * eta) * mu}
\]
```

A *braiding* satisfies the Yang-Baxter law



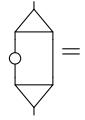
```
\deftwocell[braid]{gamma : 2 -> 2}
\[
  \twocell{(gamma * 1) * (1 * gamma) * (gamma * 1)}
  =
  \twocell{(1 * gamma) * (gamma * 1) * (1 * gamma)}
\]
```

The *bialgebra* law is



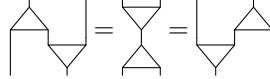
```
\deftwocell[triangle]{delta : 1 -> 2}
\deftwocell[triangle]{mu : 2 -> 1}
\deftwocell[crossing]{gamma : 2 -> 2}
\[
  \twocell{2[height=.5] * mu * delta * 2[height=.5]}
  =
  \twocell{(delta * delta) * (1 * gamma * 1) * (mu * mu)}
\]
```

The Hopf law is



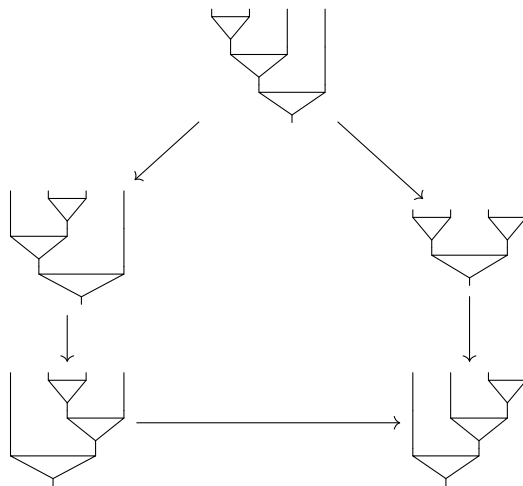
```
\deftwocell[triangle]{delta : 1 -> 2}
\deftwocell[triangle]{mu : 2 -> 1}
\deftwocell[triangle]{sigma : 1 -> 1}
\[
  \twocell{delta * (sigma * 1) * mu}
  =
  \twocell{1 * 1 * 1}
\]
```

The Frobenius law is



```
\deftwocell[triangle]{delta : 1 -> 2}
\deftwocell[triangle]{mu : 2 -> 1}
\deftwocell[circle]{sigma : 1 -> 1}
\[
  \twocell{(delta * 1) * (1 * mu)}
  =
  \twocell{mu * delta}
  =
  \twocell{(1 * delta) * (mu * 1)}
\]
```

MacLane's pentagon is

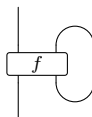


```
\deftwocell[triangle]{mu : 2 -> 1}
\[
\begin{tikzcd}
&& & & \\
&\text{\twocell{(mu * 1 * 1) * (mu * 1) * mu}{\ar[d] \ar[dr]} & \text{\twocell{(1 * mu * 1) * (mu * 1) * mu}{\ar[d]} & \text{\twocell{(mu * mu) * mu}{\ar[d]} \\
&\text{\twocell{(1 * mu * 1) * (1 * mu) * mu}{\ar[rr]} & \text{\twocell{(1 * 1 * mu) * (1 * mu) * mu}}{}
\end{tikzcd}
\]
```

The snake equations are

```
\def\wocell[cap]{cap : 0 -> 2}
\def\wocell[cup]{cup : 2 -> 0}
\begin{align*}
&\wocell{(cap * 1) * (1 * cup)}&=&\wocell{1 * 1} \\
&\& \\
&\wocell{(1 * cap) * (cup * 1)}&=&\wocell{1 * 1} \\
\end{align*}
```

The *trace* of a morphism is



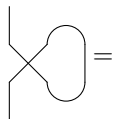
```
\deftwocell[cap]{cap : 0 -> 2}
\deftwocell[cup]{cup : 2 -> 0}
\begin{align*}
```

```

\twocell{(1 * cap) * ((2->2)[r,"f"] * 1) * (1 * cup)}
\end{align*}

```

The yanking equation is



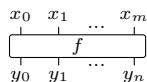
```

\deftwocell[cap]{cap : 0 -> 2}
\deftwocell[cup]{cup : 2 -> 0}
\deftwocell[gamma]{gamma : 2 -> 2}
\[
\twocell{(1 * cap) * (gamma * 1) * (1 * cup)}
=
\twocell{1 * 1 * 1}
\]

```

2 Other features

A large box with dots and labels



```

\deftwocell[dots]{dots : 2 -> 2}
\begin{align*}
\twocell{
  label[d,"x_0","x_1","x_m"] *
  (1 * dots[width=2]) *
  (3->3)[r,"f"] *
  (1 * dots[width=2]) *
  label[u,"y_0","y_1","y_n"]
}
\end{align*}

```