## NCSq Examples

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To draw a diagram, pass \NCSq.diagram a function building a rectangular array of objects, horizontal arrows and vertical arrows. (Diagonal arrows are not supported.)

```
\NCSq.diagram

(fun tb ->

(let emp = tb#emp in

let obj = tb#obj in

let harr = tb#harr in

let varr = tb#varr in

[[obj {${A}} ; harr {${f}} {}; obj {${B}} ];

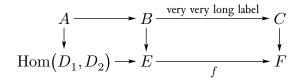
[varr {} {${g}}; emp ; varr {${h}} {}];

[obj {${C}} ; harr {} {${k}}; obj {$${D}} ]]));
```



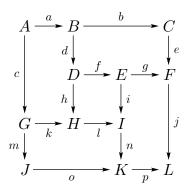
Arrows stretch automatically.

```
\NCSq.diagram
(fun tb ->
  (let emp = tb#emp in
  let obj = tb#obj in
  let harr = tb#harr in
  let varr = tb#varr in
  [[obj {${A}}; harr {} {}; obj {${B}};
    harr {very very long label} {}; obj {${C}}];
  [varr {} {}; emp; varr {} {}; emp; varr {} {}];
  [obj {${\mathrm{Hom}\paren{D_{1}, D_{2}}}}; harr {} {};
  obj {${E}}; harr {} {${f}}; obj {${F}}]]));
```



The source and the target of an arrow are automatically detected: the source of a horizontal arrow is the nearest object on the left; the target of a horizontal arrow is the nearest object on the right; the source of a vertical arrow is the nearest object above; the target of a vertical arrow is the nearest object below. (If the source or the target of an arrow is not found, then the arrow will not be drawn.)

```
\NCSq.diagram(fun tb -> (
 let emp = tb#emp in
 let obj = tb#obj in
 let harr = tb#harr in
 let varr = tb#varr in
 [[obj {${A}}; harr {${a}} {}; obj {${B}}; harr {${b}} {};
   emp; emp; obj {${C}}];
   [varr {} {${c}}; emp; varr {} {${d}}; emp;
   emp; emp; varr {${e}} {}];
   [emp; emp; obj {${D}}; harr {${f}} {};
   obj {${E}}; harr {${g}} {}; obj {${F}}];
   [emp; emp; varr {} {${h}}; emp;
   varr {${i}} {}; emp; varr {${j}} {}];
   [obj {${G}}; harr {} {${k}}; obj {${H}}; harr {} {${1}};
   obj {${I}}];
   [varr {} {${m}}; emp; emp; emp;
   varr {${n}} {}];
   [obj {${J}}; harr {} {${o}}; emp; emp;
   obj {${K}}; harr {} {${p}}; obj {${L}}]]));
```



heq and veq draw horizontal and vertical, respectively, equality signs, so we can now draw a commutative "triangle".

```
\NCSq.diagram(fun tb -> (
  let emp = tb#emp in
  let obj = tb#obj in
  let harr = tb#harr in
  let varr = tb#varr in
  let heq = tb#heq in
  [[obj {${A}}; heq; obj {${A}}];
  [varr {} {${f}}; emp; varr {${h}} {}];
  [obj {${B}}; harr {} {${g}}; obj {${C}}]]));
```

$$\begin{array}{ccc}
A & \longrightarrow & A \\
f \downarrow & & \downarrow h \\
B & \longrightarrow & C
\end{array}$$

One can also draw 2-arrows. (Internally, a 2-arrow is an object to which "\" is appended.)

```
\NCSq.diagram(fun tb -> (
  let obj = tb#obj in
  let harr = tb#harr in
  let varr = tb#varr in
  let arr2 = tb#arr2 in
  [[obj {${A}}; harr {${f}} {}; obj {${B}}];
  [varr {} {${g}}; arr2 {${\alpha}}; varr {${h}} {}];
```

```
[obj {${C}}; harr {} {${k}}; obj {${D}}]]));
```

$$\begin{array}{ccc}
A & \xrightarrow{f} & B \\
g \downarrow & \downarrow \alpha & \downarrow h \\
C & \xrightarrow{k} & D
\end{array}$$

\NCSq.diagram-m is suitable for drawing diagrams in math formulas.

```
\neq \$
 \paren{
   \NCSq.diagram-m
    !(fun tb -> (
     let obj = tb#obj in
     let harr = tb#harr in
     let varr = tb#varr in
     let heq = tb#heq in
     let veq = tb#veq in
     let arr2 = tb#arr2 in
      [[obj {${A}}; harr {${f}} {}; obj {${B}}; heq; obj {${B}}];
      [veq; arr2 {${\epsilon}};
       varr {${g}} {}; arr2 {${\eta}}; veq];
       [obj {${A}}; heq; obj {${A}}; harr {} {${f}}; obj {${B}}]]
   ))
 } =
 \paren{
   \NCSq.diagram-m
    !(fun tb -> (
     let emp = tb#emp in
     let obj = tb#obj in
     let harr = tb#harr in
      let veq = tb#veq in
      [[obj {${A}}; harr {${f}} {}; obj {${B}}];
       [veq; emp; veq];
```

```
[obj {${A}}; harr {} {${f}}; obj {${B}}]]))
}
});
```

$$\begin{pmatrix}
A \xrightarrow{f} B = B \\
\parallel \downarrow_{\varepsilon} \downarrow^{g} \downarrow_{\eta} \parallel \\
A = A \xrightarrow{f} B
\end{pmatrix} = \begin{pmatrix}
A \xrightarrow{f} B \\
\parallel & \parallel \\
A \xrightarrow{f} B
\end{pmatrix}$$

Arrows can be backwards.

```
\NCSq.diagram
(fun tb -> (
  let obj = tb#obj in
  let rarr = tb#rarr in
  let uarr = tb#uarr in
  let darr = tb#darr in
  let arr2 = tb#arr2 in
  [[obj {${C}}; rarr {$$$}$;
  obj {${\app{\mathbf{Fun}}{C^{\mathrm{op}}}, \mathbf{Set}}}];
  [darr {} {${F}}; arr2 {$}; uarr {} {${F^{**}}}];
  [obj {${\app{\mathbf{Fun}}{C^{\mathrm{op}}}, \mathbf{Set}}}]));
```

$$C \xrightarrow{\sharp} \mathbf{Fun}(C^{\mathrm{op}}, \mathbf{Set})$$

$$F \downarrow \qquad \qquad \downarrow F^{*}$$

$$D \xrightarrow{\sharp} \mathbf{Fun}(D^{\mathrm{op}}, \mathbf{Set})$$

## Here,

• larr = left arrow

• rarr = right arrow

• uarr = up arrow

• darr = down arrow

In fact, harr and varr are aliases to rarr and darr, respectively.

Arrow functions such as rarr and darr accept an optional argument to change the style.

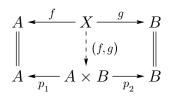
```
\NCSq.diagram

(fun tb -> (
    let emp = tb#emp in
    let obj = tb#obj in
    let larr = tb#larr in
    let rarr = tb#rarr in
    let darr = tb#darr in
    let veq = tb#veq in

[[obj {${A}}; larr {} {${f}}; obj {${X}};
    rarr {${g}} {}; obj {${B}}];

[veq; emp; darr ?:(Dashed) {${\paren{f, g}}} {}; emp; veq];

[obj {${A}}; larr {${p_{1}}} {}; obj {${A}}; rarr {} {${p_{2}}}; obj {${A}}; obj {{A}}; obj
```



Currently, two styles Solid (default) and Dashed are supported.