COMMON STRUCTURAL PATTERNS

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Here are some common small patterns (but larger than conventional library cells) found in the 200 benchmarks. All variables are assumed to be polarity selectable.

-- These are ordered very roughly by commonness, probably an overemphasis on arithmetic functions. Ordering gets arbitrary toward the end.

-- Chunked to a small grain size, they can be viewed as common building blocks.

-- I've put all inside a container, but they are just as common in shared space.

-- Names are somewhat descriptive in the beginning, fuzzier toward the end.

-- Analysis is in terms of 2NAND cells. Each cell is illustrated, together with connective topology.

C = cell

X = pass-through

% = level achievable by between tier NAND
without selectable polarity (ie as is)

= level achievable with fully selectable between tier NAND

$ = level achievable with fully selectable NAND,
and selectable pass-though

-- from % and #, selectable polarity on the between tier 2NAND saves a lot. This is basically saying that most building block forms are neighbors, and that non-neighbor will not put a great demand on the next tier routing, so that middle cells may have only minimal routing.

-- from $, this is actually giving cells two levels of selectable internal logic.

-- For multilevel structures with pass-through (which is all of them!), we can use feedup to save a level. Actually no time is saved, making feedup a packing freedom. Feedup does permit nice packing of wide functions.

Common gate types

```
((x y)((x)(y)))                XOR

((x y)(z (x)))                 MUX

(w x y z)                      FLAT

(((w)(x)) ((y)(z)))            OR of ANDs
```

with level structure

```
          C   C
           \ /
            C                %=FLAT      #=rest
```

Level combinations

NOR OR x

```
           (x (y z))

          X   C
           \ /
            C                $
```

CONDITIONAL XOR, MAJORITY

```
      ((x y) (z ((x)(y))))

           C   X   C
            \   \ /
             X   C           $
              \ /
               C
```

NESTED AND

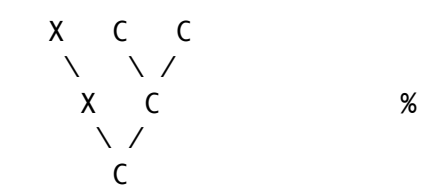
```
      (w (x ((y)(z))))

        X   X   C
         \   \ /
          X   C              $
           \ /
            C
```

MUX OR x

```
(x (y z) (w (y)))
```

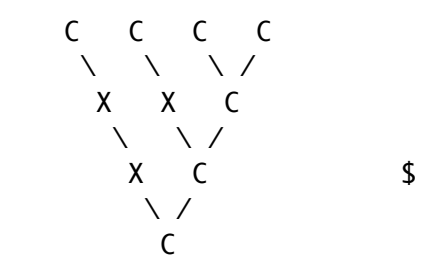
XOR OR x

```
(x (y z) ((y)(z)))
```



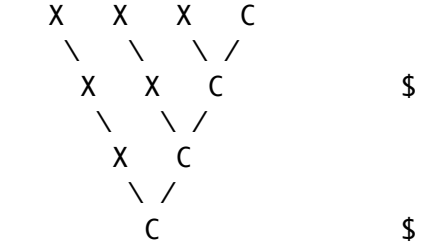
NESTED MUXes of XOR, XOR CHAIN

```
((w x)
 (((w)(x))
  ((y z)
   (((y)(z))
    ...
```



NESTED IF, SIMPLE CHAIN

```
(w (x (y (z ...)))
```



INVERTED CONDITIONAL XOR

```
((w x y) (z (x)(y))
```

DEPENDENT MUX

```
((w x (y)) (y z (w)))
```

INVERTED MUX

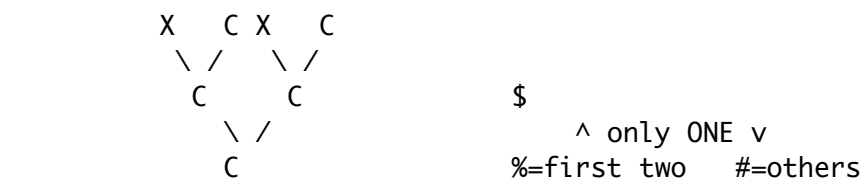
```
((w x y)(z (w (y)))
```

MAJORITY OR x

```
(x (y z) (w ((y)(z))))
```

PSEUDO-MAJORITY OR x

```
(x (y z) (w ((v)(y))))
```



MUX on NOR OR x

```
((u v) ((u) (x (y z))))
```