A Functional Programming Language for Interaction Nets

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Department of Informatics

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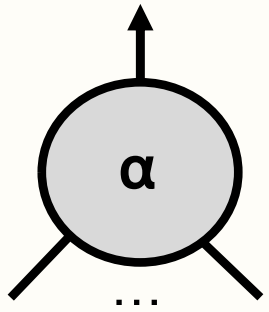
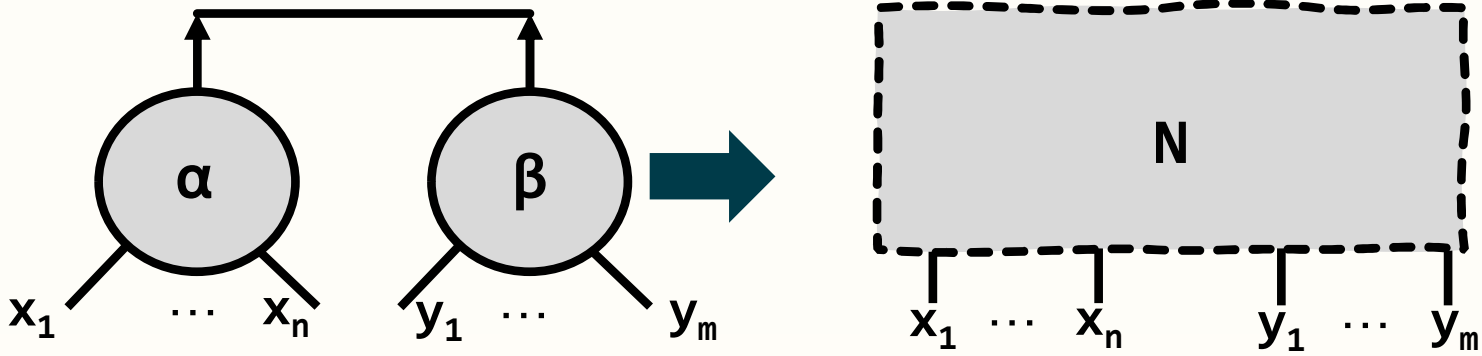
Interaction nets

Graph rewriting system (Lafont, 1990)

Finite set nodes (“agents”):



Finite set of rewrite rules:



At most one rule per agent pair.

Interface preserved.

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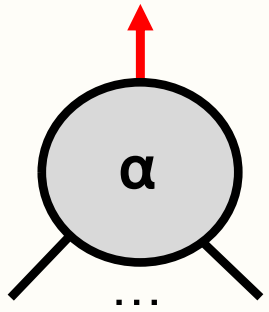

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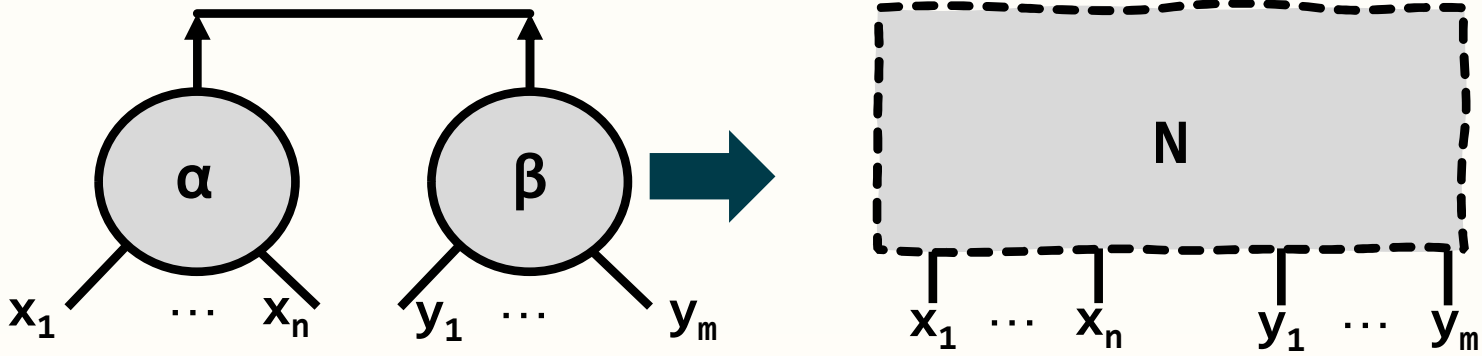

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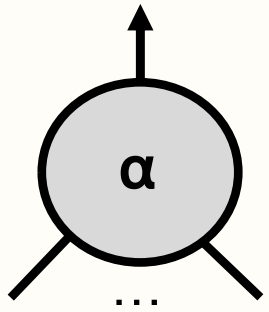

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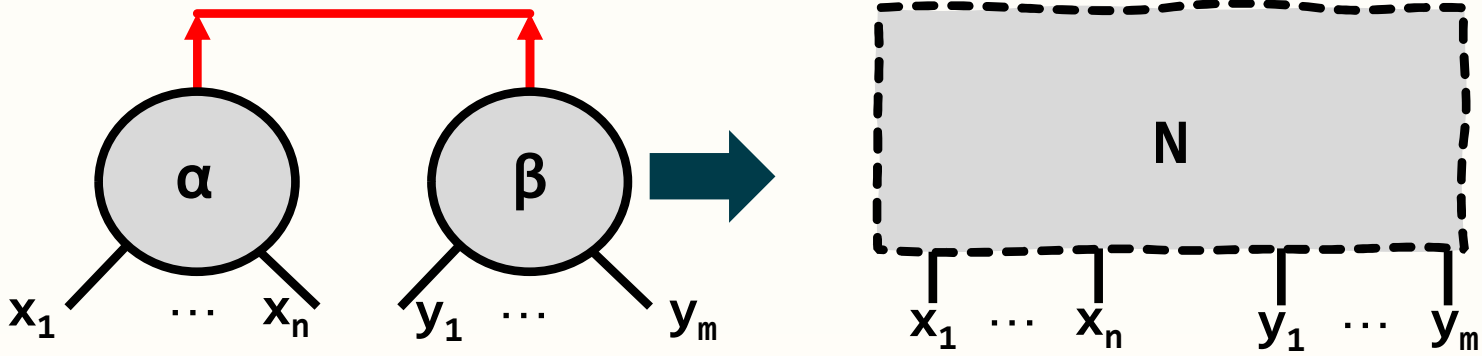

At most one rule per agent pair.

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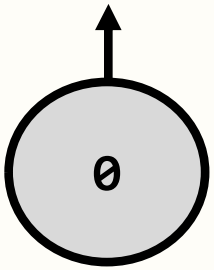
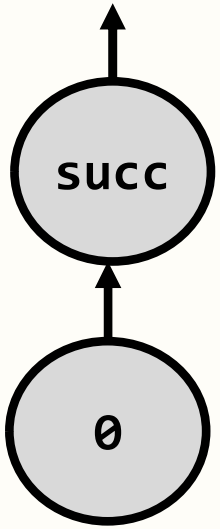
Unary numbers

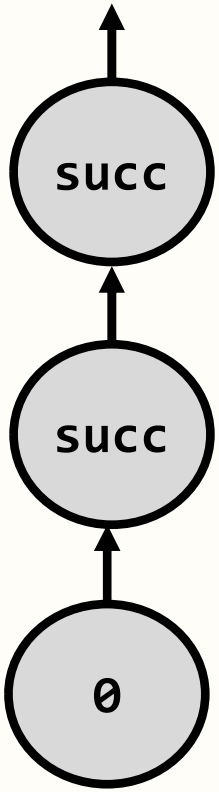
Zero



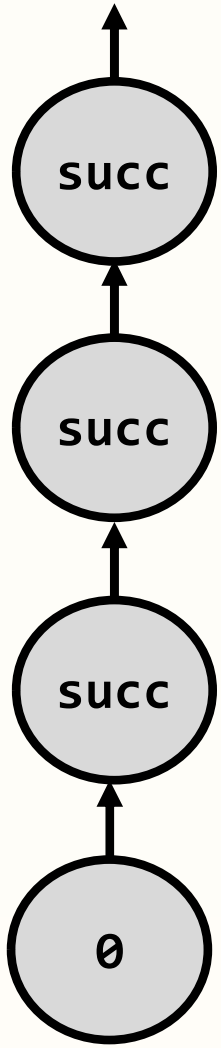
One



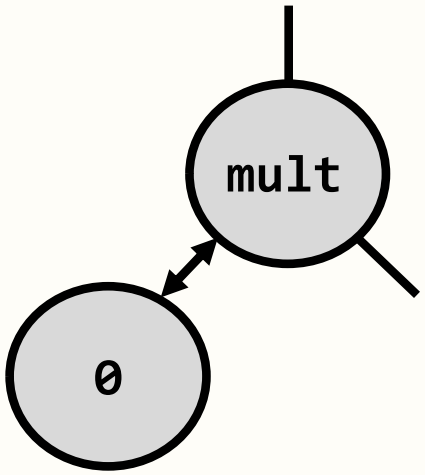
Two



Three



Unary multiplication



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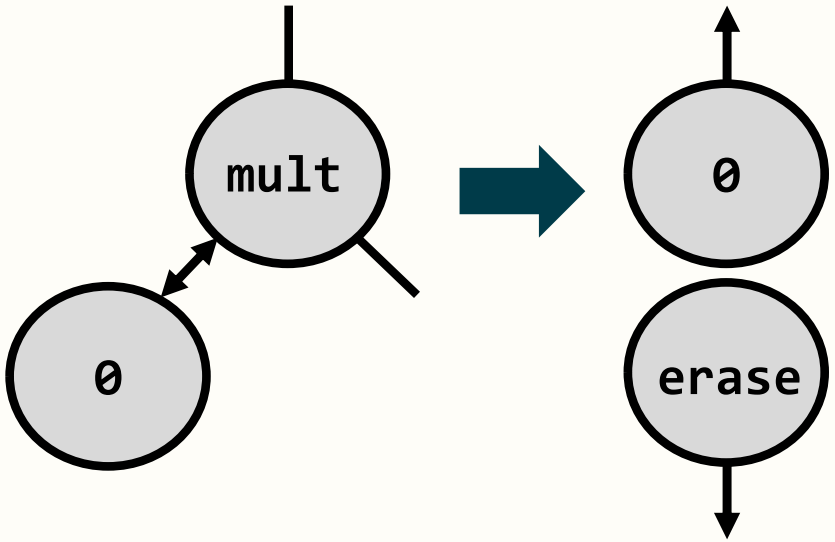

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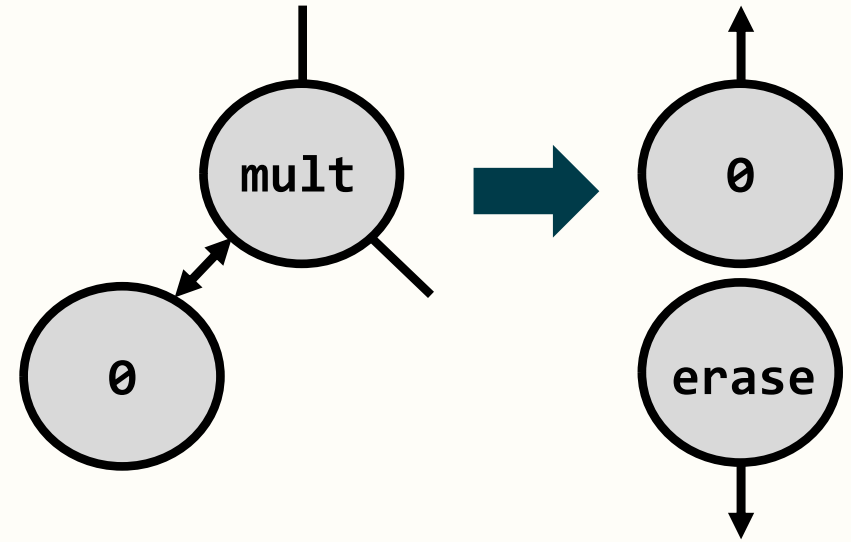

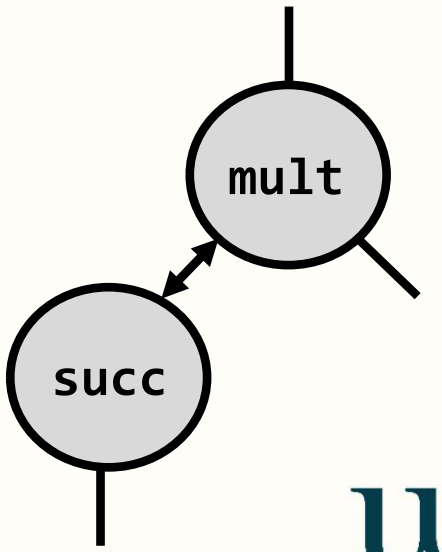

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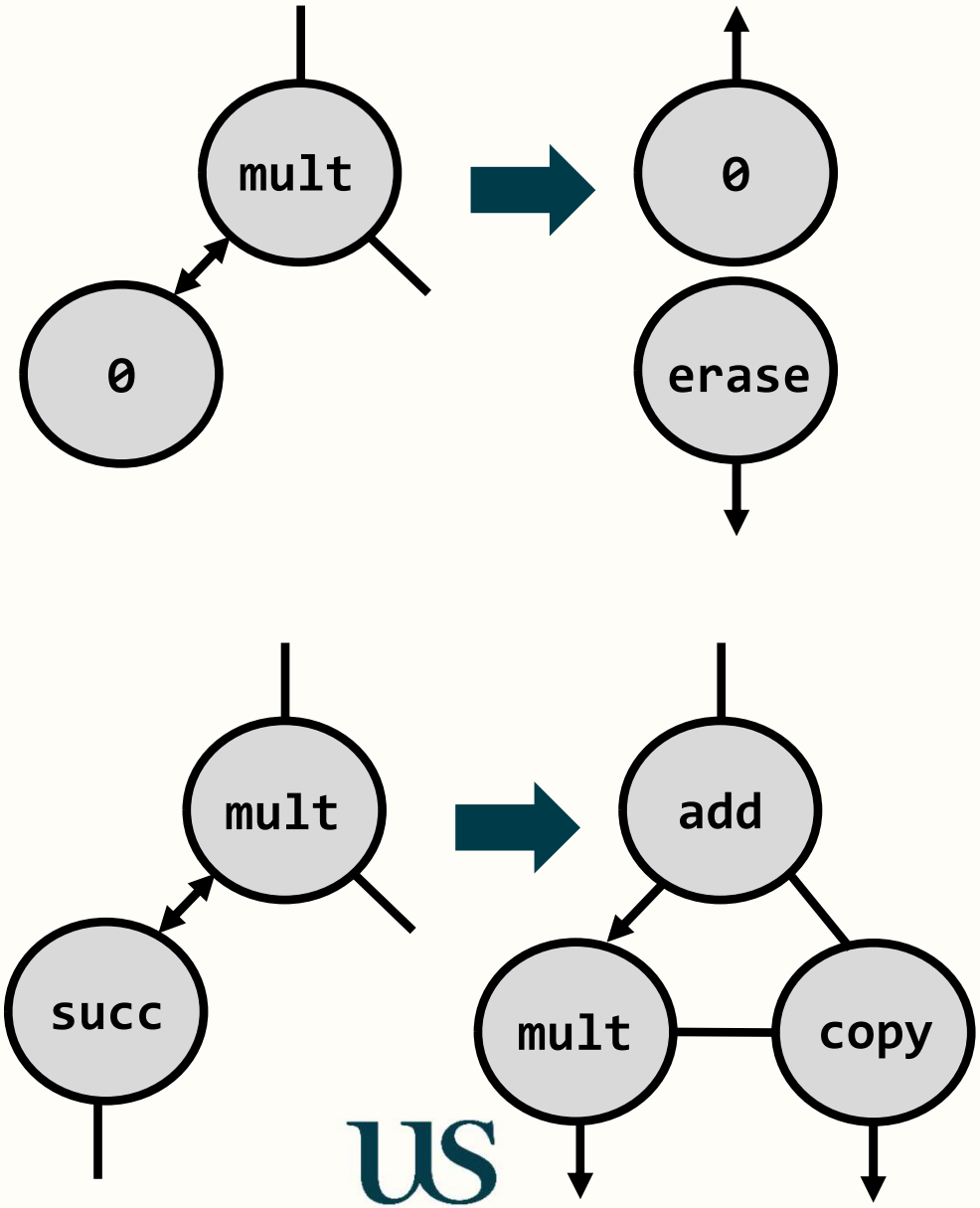

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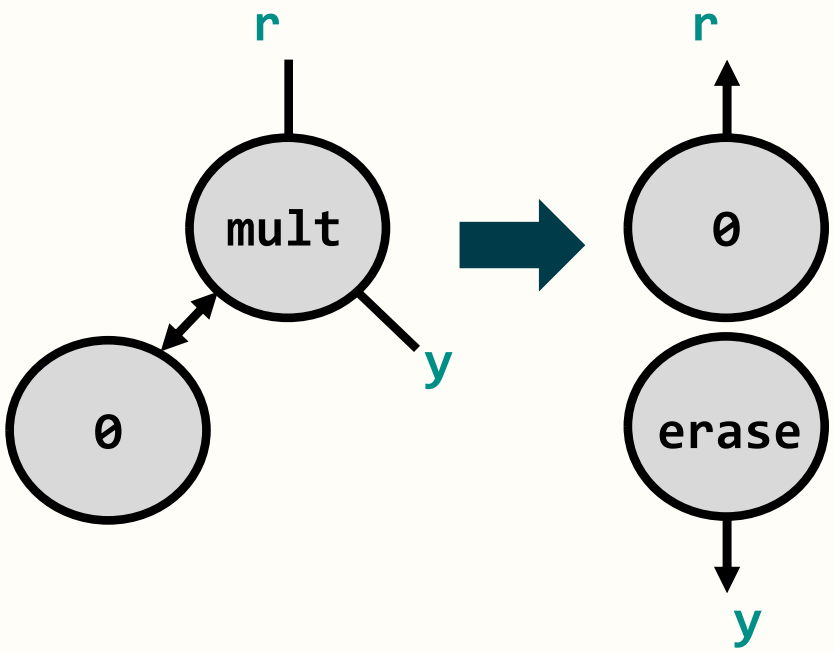
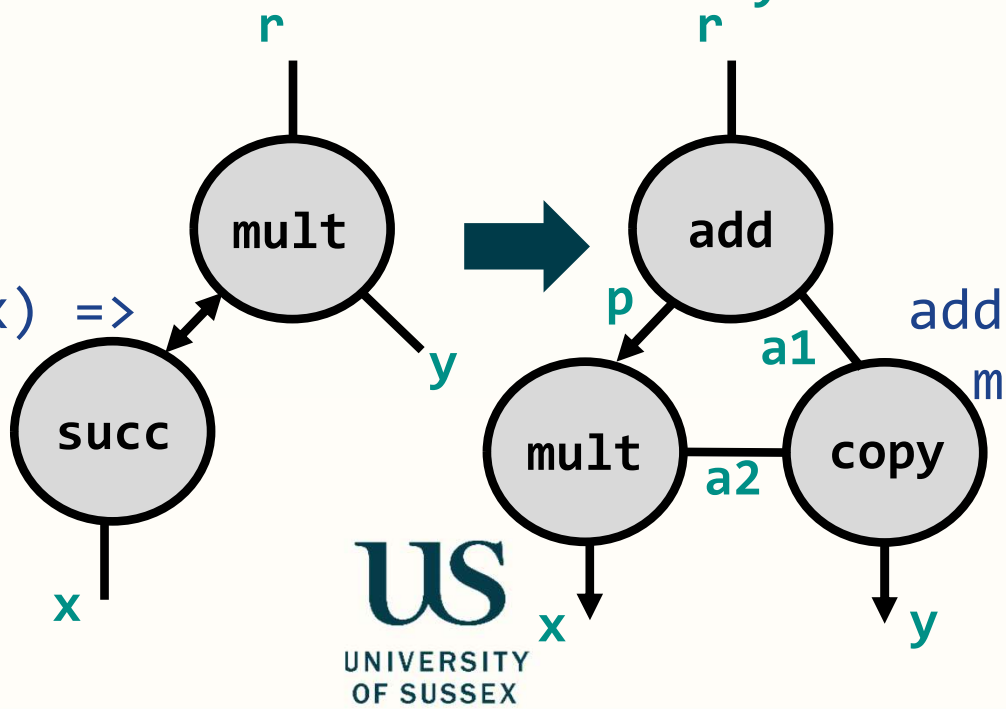
Explicit textual description

mult(r,y)><0 =>



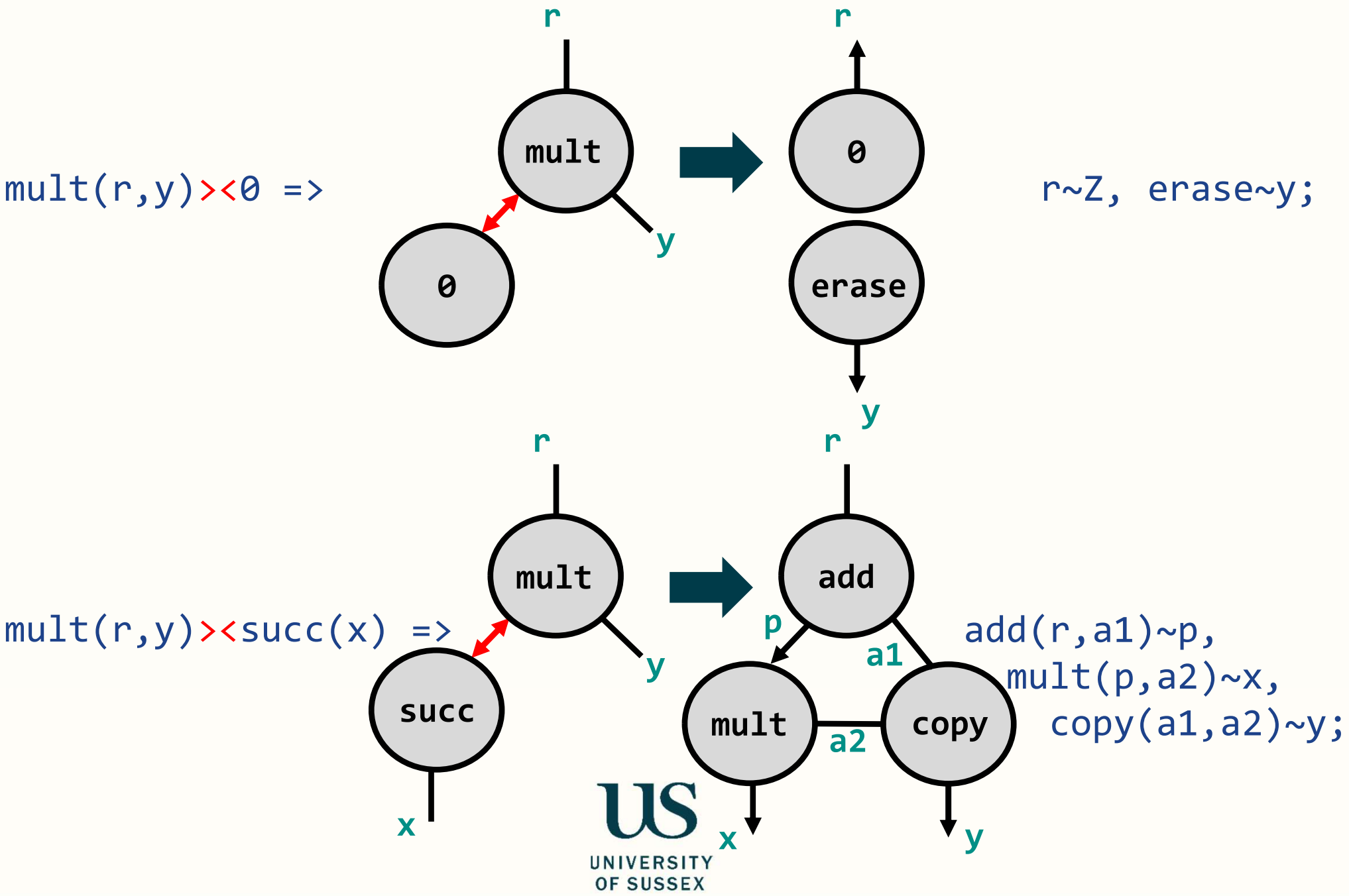
r~Z, erase~y;

mult(r,y)><succ(x) =>



add(r,a1)~p,
mult(p,a2)~x,
copy(a1,a2)~y;

Explicit textual description



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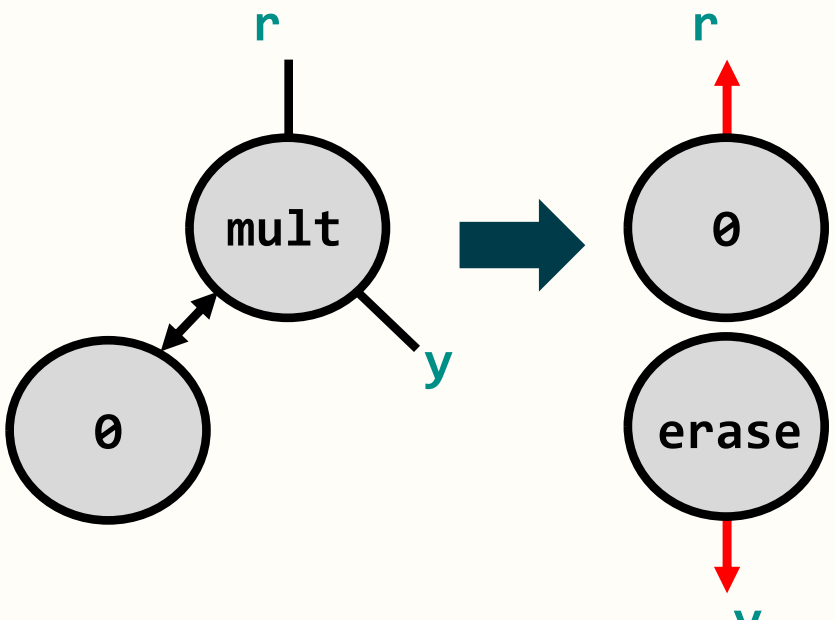

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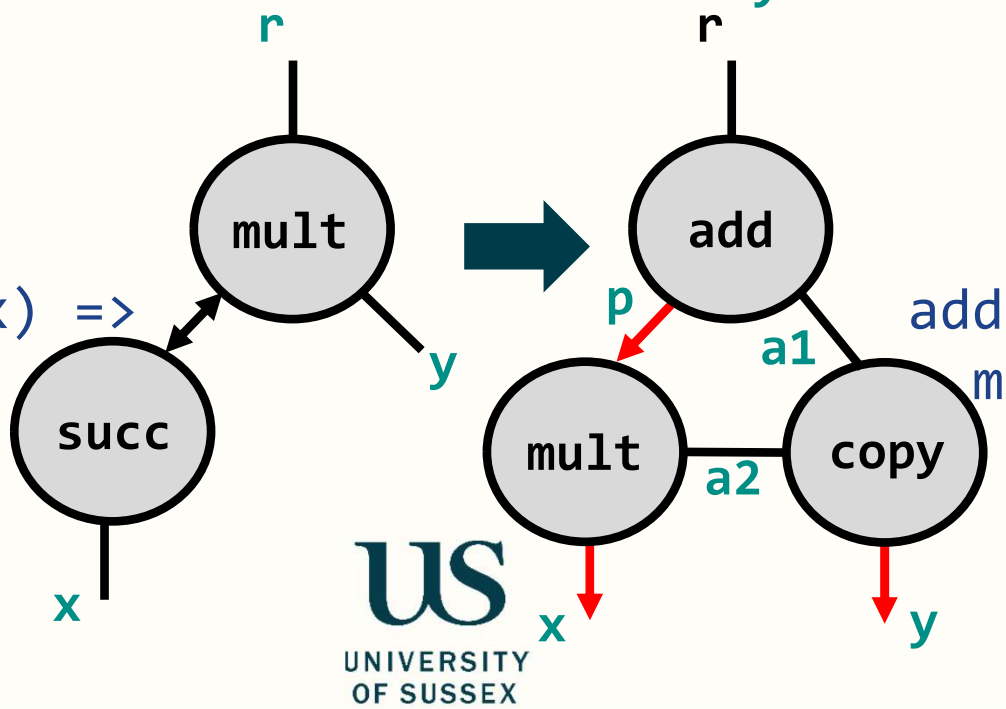

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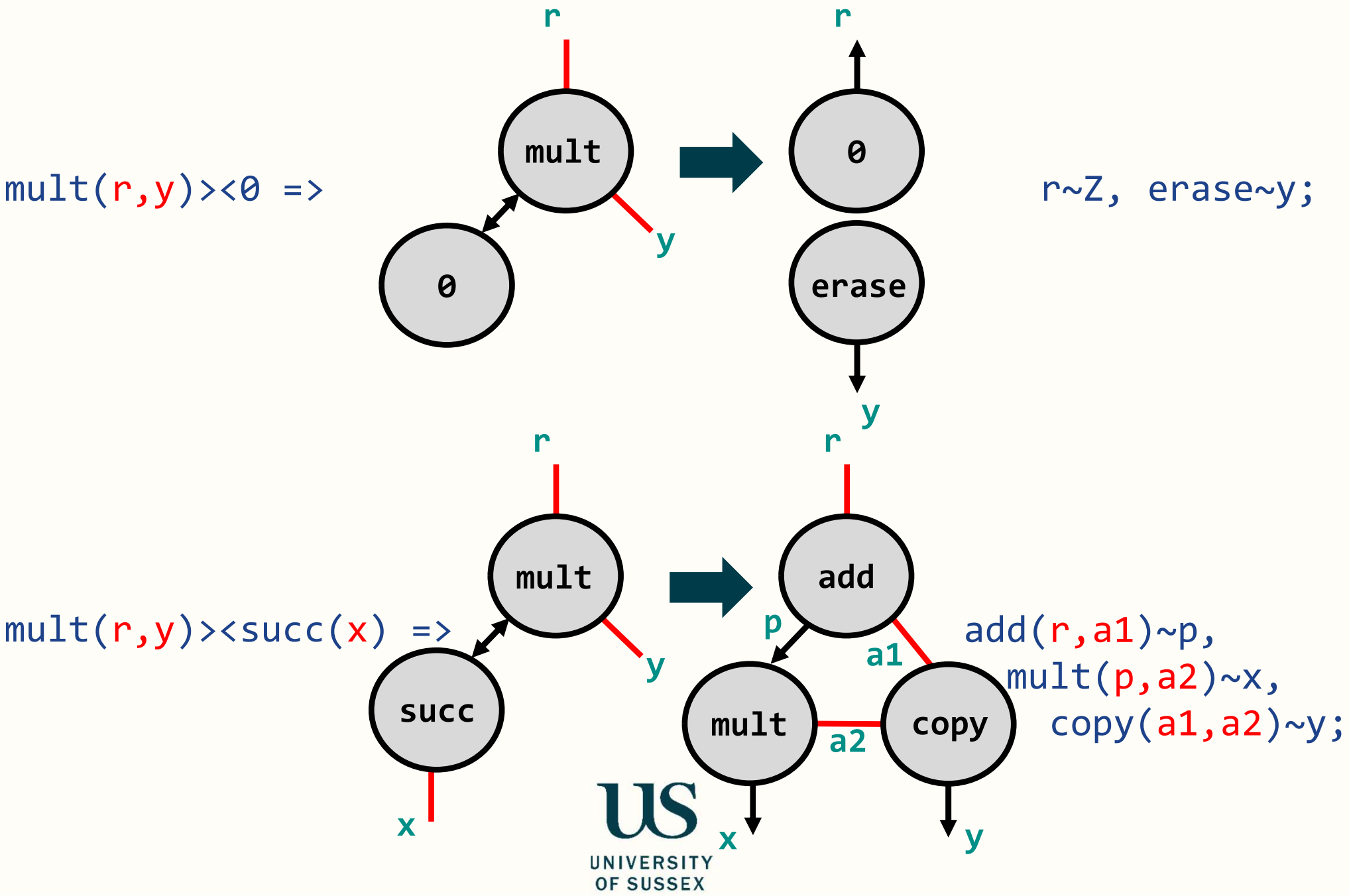
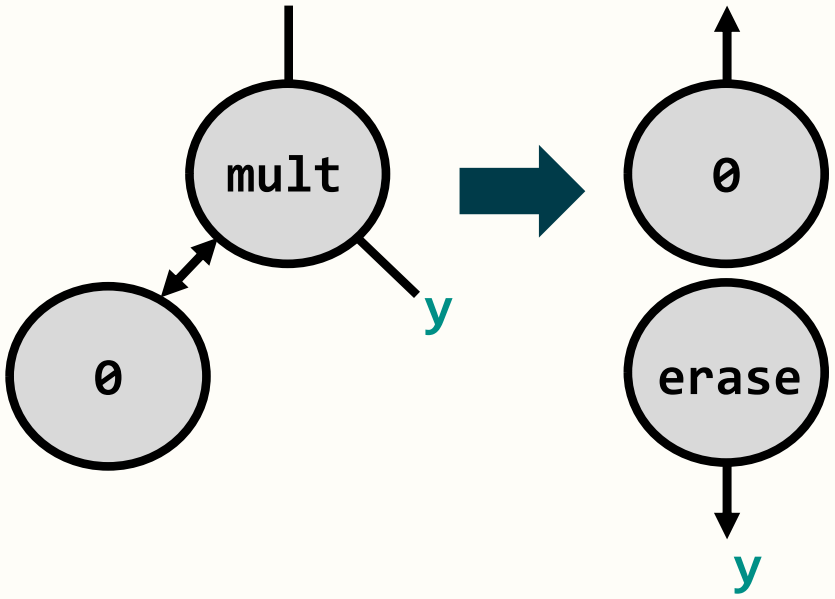


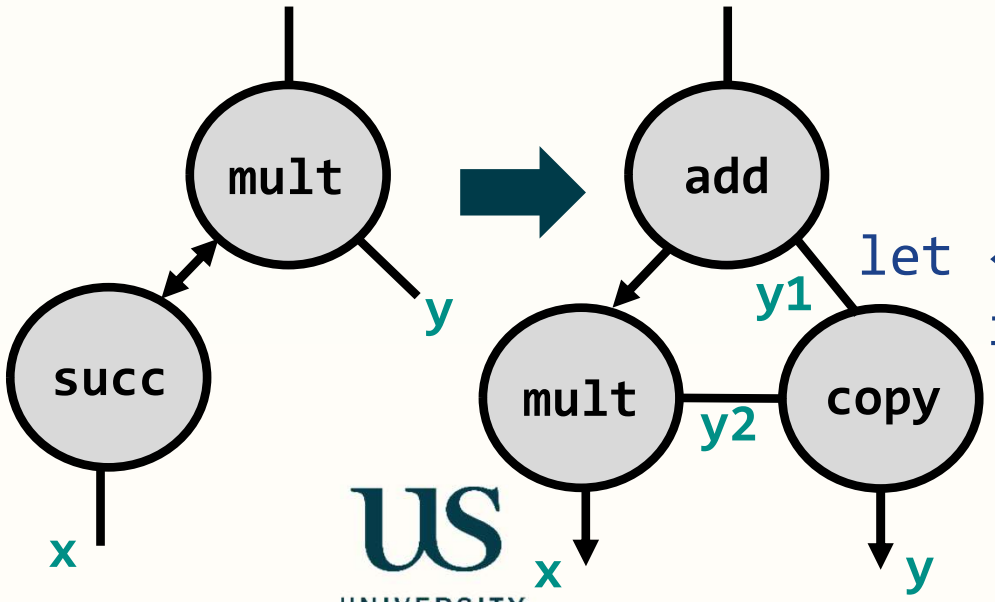
Functional style description

mult(0,y)=



0 {erase~y}

mult(Succ(x),y)=




```
let <y1,y2>=copy(y)
in add(
     mult(x,y2),
          y1))
```

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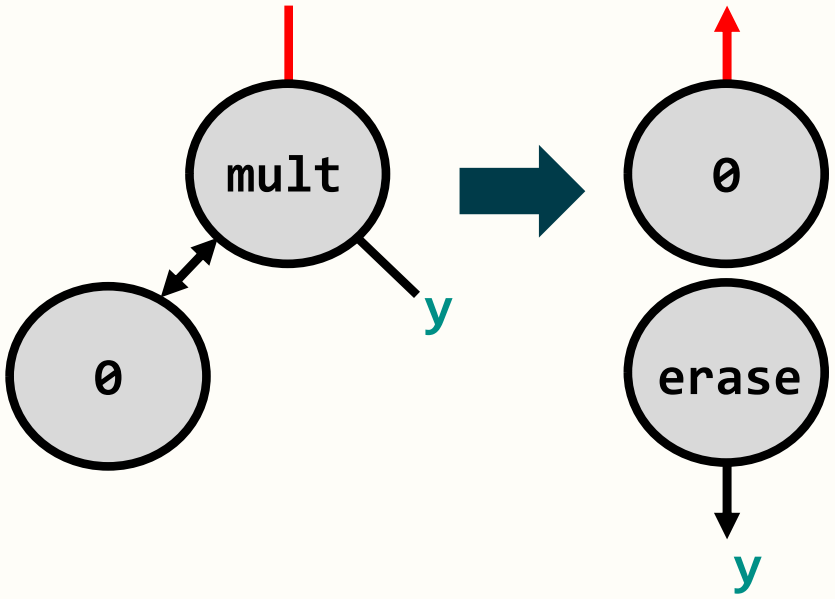
Functional style description

mult(0,y)=



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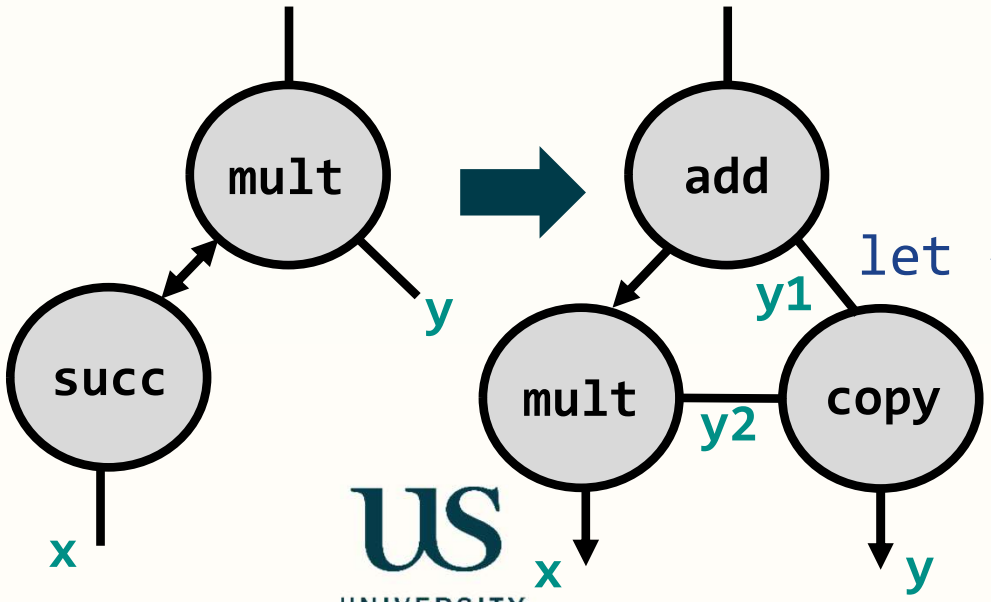
mult(Succ(x),y)=

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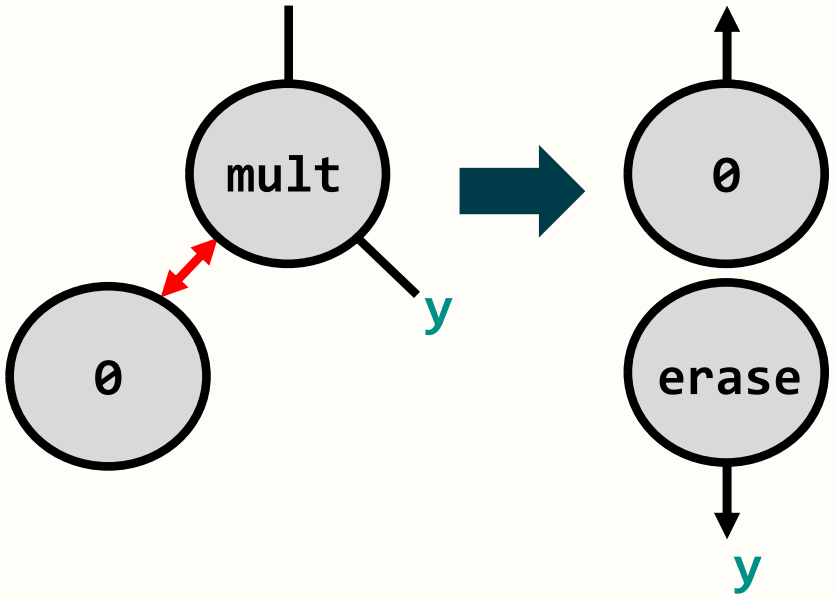


```
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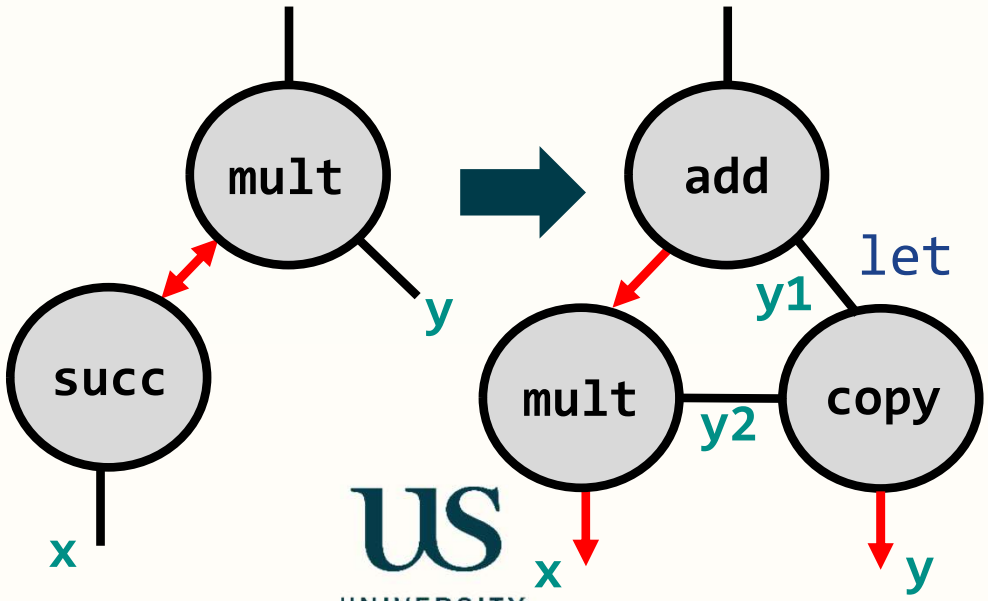


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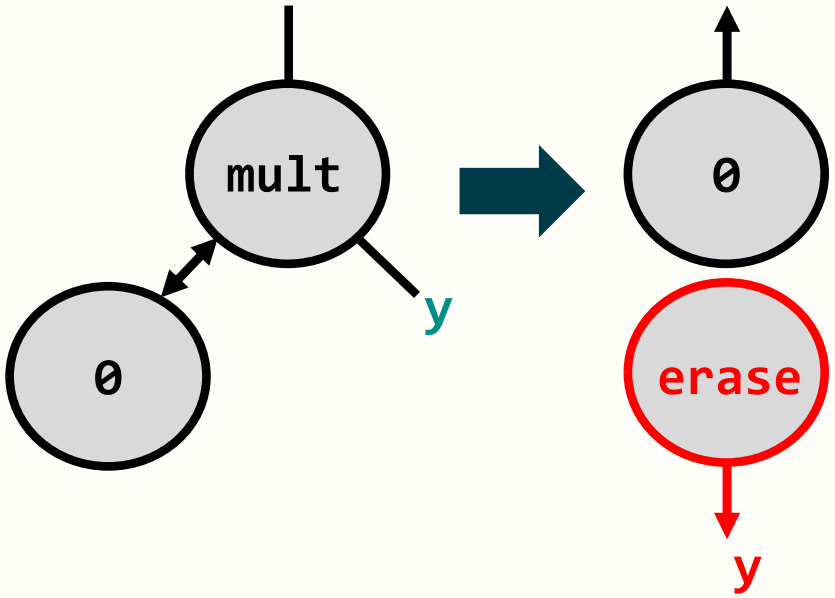
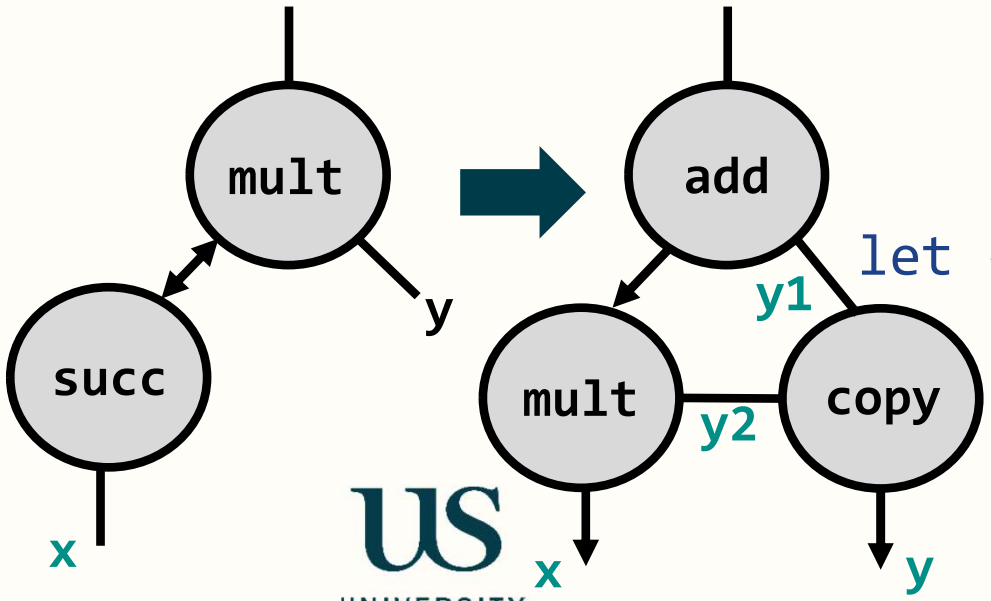


0 {erase~y}

mult(Succ(x),y)=

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in add(
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          y1))
```

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Further examples

```
add(0,y)          = y
add(Succ(x),y)    = add(x,add(x,y))

len(Nil)          = 0
len(Cons(x,xs))= Succ(len(xs)) {erase~x}

bubble(Nil)               = Nil
bubble(Elem|x|,list)      = bx|x|(list)
bx|x|(Nil)                = Elem|x|(Nil)
bx|x|(list)               = bxy|x,y|(list)
bxy|x,y|(Nil)
     | x<= y              = Elem|x|(Elem|y|(Elem(Nil))
     | _                  = Elem|y|(Elem|x|(Elem(Nil))
bxy|x,y|(list)
     | x<= y              = Elem|x|(bx|y|(list))
     | _                  = Elem|y|(bx|x|(list))
```

On-going work

- Lists — *[ ] [Nil, Z]*
- Integer arithmetic — *incr(Num|x|) = Num|x+1|*
- Conditional expressions — *bubble(x:xs) | Num(n) = …*
- Templates / polymorphism — *copy(_y) = <_y, _y>*
- Modules — *import sort as …*
- Types — *mult :: nat x nat → nat*

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