

1) let $f\ x\ y\ z =$
 match x with
 $| [] \rightarrow z$
 $| w :: ws \rightarrow wy;;$

$x \rightarrow y \rightarrow z \rightarrow res$

$x = ('a \rightarrow 'b) \text{ list}$ $y = 'a$ $z = 'b$ $res = 'b$

val $f: ('a \rightarrow 'b) \text{ list} \rightarrow 'a \rightarrow 'b \rightarrow 'b = \langle \text{fun} \rangle$

2) let $f\ x\ y\ z =$
 match x with
 $| ('a', 1) \rightarrow y$
 $| (x_1, x_2) \rightarrow \text{if } x_1 = y \text{ then } z$
 else failwith "Error";;

$x \rightarrow y \rightarrow z \rightarrow res$

$x = (\text{char} * \text{int})$ $y = \text{char}$ $z = \text{char}$ $res = \text{char}$

val $f: (\text{char} * \text{int}) \rightarrow \text{char} \rightarrow \text{char} \rightarrow \text{char} = \langle \text{fun} \rangle$

3) let $f\ g\ x = (g\ x) = 3;;$

$g \rightarrow x \rightarrow res$

$g = ('a \rightarrow \text{int})$ $x = 'a$ $res = \text{bool}$

val $f: ('a \rightarrow \text{int}) \rightarrow 'a \rightarrow \text{bool} = \langle \text{fun} \rangle$

4) $(\text{fun } x \rightarrow \text{fun } y \rightarrow yx + 1)(3, 4);;$

$- : (\text{int} * \text{int} \rightarrow \text{int}) \rightarrow \text{int} = \langle \text{fun} \rangle$

5) $\text{let } f \ x \ y \ z =$
 $\text{match } (x \ y) \text{ with}$
 $| [] \rightarrow (z \ y)$
 $| _ :: _ \rightarrow (z \ y) + 1;;$

$x \rightarrow y \rightarrow z \rightarrow \text{res}$

$x = ('a \rightarrow 'b \text{ list}) \quad y = 'a \quad z = ('a \rightarrow \text{int}) \quad \text{zis} = \text{int}$

$\text{val } f: ('a \rightarrow 'b \text{ list}) \rightarrow 'a \rightarrow ('a \rightarrow \text{int}) \rightarrow \text{int} = \langle \text{fun} \rangle$

Jupyter

1) $\text{if } 3 > 0 \text{ then "abc" else "cba"}$

$- : \text{string} = \text{"abc"}$

2) $(4 + 1) > (6 - 1)$

$- : \text{bool} = \text{false}$

3) $\text{fun } x \rightarrow 2. * . x$

$- : \text{float} \rightarrow \text{float} = \langle \text{fun} \rangle$

$$4) \text{ fun } x \rightarrow \text{ fun } y \rightarrow x + y$$

$$- : \text{int} \rightarrow \text{int} \rightarrow \text{int} = \langle \text{fun} \rangle$$

$$5) \text{ fun } x \rightarrow \text{ fun } y \rightarrow (\text{float_of_int } x) +. y$$

$$- : \text{int} \rightarrow \text{float} \rightarrow \text{float} = \langle \text{fun} \rangle$$

$$6) \text{ fun } x \rightarrow \text{ fun } y \rightarrow x(y+1) + 1$$

$$- : (\text{int} \rightarrow \text{int}) \rightarrow \text{int} \rightarrow \text{int} = \langle \text{fun} \rangle$$

$$7) \text{ fun } x \rightarrow \text{ fun } y \rightarrow x(y+1)$$

$$- : (\text{int} \rightarrow 'a) \rightarrow \text{int} \rightarrow 'a = \langle \text{fun} \rangle$$

$$8) \text{ fun } x \rightarrow \text{ fun } y \rightarrow (x, y)$$

$$- : 'a \rightarrow 'b \rightarrow 'a * 'b = \langle \text{fun} \rangle$$

$$9) (\text{fun } x \rightarrow x 2)(\text{fun } y \rightarrow y+1)$$

$$- : \text{int} = 3$$

$$10) \text{ fun } x \rightarrow \text{ fun } y \rightarrow x y y$$

$$- : ('a \rightarrow 'a \rightarrow 'b) \rightarrow 'a \rightarrow 'b = \langle \text{fun} \rangle$$

11) $\text{fun } x \rightarrow (x, x+1)$

$\therefore \text{int} \rightarrow \text{int} * \text{int} = \langle \text{fun} \rangle$

12) $(\text{fun } x \rightarrow 2., \text{fun } x \rightarrow x \ 2.)$

$\therefore 'a \rightarrow \text{float} * ((\text{float} \rightarrow 'b) \rightarrow 'b) = \langle \text{fun} \rangle$

13) $\text{fun } x \rightarrow \text{fun } y \rightarrow \text{if } x > 0 \text{ then } y \text{ else } x+1$

$\therefore \text{int} \rightarrow \text{int} \rightarrow \text{int} = \langle \text{fun} \rangle$

14) $\text{fun } x \rightarrow \text{fun } y \rightarrow \text{if } x = \text{true} \text{ then } y2 \text{ else } y1$

$\therefore \text{bool} \rightarrow (\text{int} \rightarrow 'a) \rightarrow 'a = \langle \text{fun} \rangle$

15) $(\text{fun } x \rightarrow \text{fun } y \rightarrow \text{if } x = \text{true} \text{ then } y2 \text{ else } y1)(\text{false})(\text{fun } x \rightarrow x+1)$

$\therefore \text{int} = 2$

16) $\text{if}(\text{fun } x \rightarrow x > 0) 5 \text{ then } (\text{fun } x \rightarrow x+1) \text{ else } (\text{fun } x \rightarrow x-1)$

$\therefore \text{int} \rightarrow \text{int} = \langle \text{fun} \rangle$

17) $\text{let } x = 3.0 +. 1.1 \text{ in } \text{fun } y \rightarrow x +. y$

$\therefore \text{float} \rightarrow \text{float} = \langle \text{fun} \rangle$

18) let $x = \text{fun } x \rightarrow x$ in x

$\therefore 'a \rightarrow 'a = \langle \text{fun} \rangle$

19) let $x = ((\text{fun } x \rightarrow (x-1, x+1)) 4)$

val $x : \text{int} * \text{int} = (3, 5)$

20) let $x \ y \ z = y (z+2)$ in $x (\text{fun } x \rightarrow x+1)$

$\therefore \text{int} \rightarrow \text{int} = \langle \text{fun} \rangle$

21) $3.2 (+) (7.1 / 9.3)$

Non è ben tipata, in un'operazione tra float serve "+."

22) $(2.1, 4)$

$\therefore \text{float} * \text{int} = (2.1, 4)$

23) if $4 > 2$ then $12 + 5$ else 21

$\therefore \text{int} = 17$

24) if $(3+1)=4$ then 2.1 else if (false) then 3.4 else 5.1

Non è ben tipata, il risultato è di tipo float e restituisce false da errore

25) $\text{fun } x \rightarrow \text{if } x \text{ then } 5 \text{ else } (x+1)$

Non è ben tipata, x è `bool` e non può essere sommato a `int`

26) $\text{if}((\text{fun } x \rightarrow x > 0)) \text{ then true else false}$

Non è un `booleano`, genera errore

27) $\text{fun } x \rightarrow (x, x)$

$\vdash : 'a \rightarrow 'a * 'a = \langle \text{fun} \rangle$

28) $\text{let } y = \text{fun } x \rightarrow x + x \text{ in } y \ 2.4$

$\vdash : \text{float} = 4.8$

29) $\text{let } x = \text{fun } x \rightarrow x + x \text{ in } x \ (\text{fun } x \rightarrow x + 1)$

Non è ben tipata, dovrebbe essere un `int`

30) $\text{let } x = 3 > 0 \text{ in if } x \text{ then } 12 \text{ else } ((\text{fun } x \rightarrow x + 1) 11)$

$\vdash : \text{int} = 12$

31) $[(3, 4); (2, 1)]$

$\vdash : (\text{int} * \text{int}) \text{ list}$

$$32) \text{ fun } x \text{ lis} \rightarrow x :: \text{lis}$$

$$\therefore 'a \rightarrow 'a \text{ list} \rightarrow 'a \text{ list} = \langle \text{fun} \rangle$$

$$33) \text{ fun } x \text{ lis} \rightarrow \text{let } b = x > 0 \text{ in if } b \text{ then lis else } [b]$$

$$\therefore \text{int} \rightarrow \text{bool list} \rightarrow \text{bool list} = \langle \text{fun} \rangle$$

$$34) \text{ fun } x \rightarrow [] :: x$$

$$\therefore ('a \text{ list}) \text{ list} \rightarrow ('a \text{ list}) \text{ list} = \langle \text{fun} \rangle$$

$$35) \text{ let } f \text{ m} = m + 1 \text{ in if true then } [f] \text{ else } [(f \text{ m} \rightarrow m), (f \text{ m} \rightarrow m - 1)]$$

$$\therefore (\text{int} \rightarrow \text{int}) \text{ list} = [\langle \text{fun} \rangle]$$

$$36) \text{ let } f \times y =$$

match x with

| [] $\rightarrow y \ 0$

| z :: z' $\rightarrow y \ z \ ;$

$$x \rightarrow y \rightarrow x \text{ is} \quad x = \text{int list} \quad y = \text{int} \rightarrow 'a \quad x \text{ is} = 'a$$

$$\text{val } f : \text{int list} \rightarrow (\text{int} \rightarrow 'a) \rightarrow 'a$$

$$37) g \rightarrow k \rightarrow x \text{ is}$$

$$g = 'a \rightarrow \text{int list} \quad k = 'a \quad x \text{ is} = \text{int}$$

$$\text{val } f : ('a \rightarrow \text{int list}) \rightarrow 'a \rightarrow \text{int}$$

