

Owen McEvoy
Homework 5
CIS 425
Spring 2020

1

1a - INT

1b - ARROW (INT, BOOL)

1c - ARROW(ARROW(VAR "a",VAR "b"), ARROW(VAR "a", VAR "b"))

2a - AST_APP(AST_SUCC(AST_APP(AST_PRED(AST_NUM 5)))

2b - AST_IF(AST_NUM 7, AST_BOOL true, AST_NUM 5)

2c - AST_FUN(AST_ID "a", INT, AST_APP(AST_APP (AST_ID "f", AST_ID "a"), AST_ID "a"))

2

1 - **Fun f(g,h) = g (h 0)**

F: 'a1 * 'a2 → 'a3

G: 'a1 : 'a4 → 'a3

h : 'a2 : int → 'a4

F: ('a4 → 'a3) * (int → 'a4) → 'a3

F: ('a → 'b) * (int → 'a) → 'b

2 - **fun Apply(f,x) = f x**

Apply: a1 * a2 -> a1 -> a2

(a' -> b') -> a' -> b'

3 - **fun reverse nil = nil | reverse (x::xs) = reverse xs** (from lecture)

reverse: a' list -> b' list

delta list -> sigma

a 'list = delta list => a' = delta

b' list = sigma => b' = sigma

reverse: a' list -> b' list

4 - **fun f(g,h) = g h + 2**

Fn : ('a1 * 'a2) -> INT

A1 : 'a2 -> INT

Fn : 'a2 -> INT * 'a2 -> INT

$\text{Fn} : (a \rightarrow \text{INT}) * a \rightarrow \text{INT}$

5 - fun f g = g(g) + 2

fn: ('a1 * 'a1) \rightarrow int

g: 'a1 : (('a2 \rightarrow int) \rightarrow int) \rightarrow in

6 - Fun ff f x y = if (f x y) then (f 3 y) else (f x "zero")

ff: 'a1 \rightarrow 'a2 \rightarrow 'a3 \rightarrow 'a4

f: 'a1 \rightarrow 'a2 \rightarrow 'a3 \rightarrow bool

f: 'a1 : int \rightarrow 'a3 \rightarrow bool

f: 'a1 : 'a2 \rightarrow string \rightarrow bool

'A4 : bool

'A2 : int

'A3 : string

'A1 : int \rightarrow string \rightarrow bool

ff: (int \rightarrow string \rightarrow bool) \rightarrow int \rightarrow string \rightarrow bool

7 - fun gg f x y = if (f x y) then (f 3 y) else (f y "zero")

gg: a1 \rightarrow a2 \rightarrow a3 \rightarrow a4

f: a1: a2 \rightarrow a3 \rightarrow bool

f: a1: int \rightarrow a3 \rightarrow bool

f: a1: string \rightarrow string \rightarrow bool

TYPE ERROR: f is expecting a type int but is given type string

a4: bool

a3: string

8 - fun hh f x y = if (f x y) then (f x y) else (f x "zero")

hh: a1 \rightarrow a2 \rightarrow a3 \rightarrow a4

f: a1: a2 \rightarrow a3 \rightarrow bool

f: a1: a2 \rightarrow a3 \rightarrow bool

f: a1: a2 \rightarrow string \rightarrow bool

a3: string

a4: bool

a1: a2 \rightarrow string \rightarrow bool

hh: (a' \rightarrow string \rightarrow bool) \rightarrow a' \rightarrow string \rightarrow bool