PL Homework 2 Answer key

1. Question 5.2

i:=1
A[1]:=2; A[2]:=3
P(A[i]); (i=1, A[1]=2, A[2]=3)
Print (i, A[1], A[2])

Ans. I=2, A[1]=2, A[2]=2

2. Question 6.1

a. fun a(x,y) = x+2*y
ans. val a: int*int-> int
since 2 is int hence 2*y is int and x has to be int.

b. fun b(x,y) = x+y/2.0
ans. val b: real*real - > real
since 2.0 is real and hence y is real and x is real

c. fun c(f) = fn y => f(y)
ans. val c: ('a -> 'b) -> 'a -> 'b
f(y): consider to be ‘a
and let output of f(y) be ‘b
f(y) is ‘a->’b

d. fun d(f,x) = f(f(x)))
ans. val d: ('a -> 'a) * 'a -> 'a
let x=’a
i.e. f(x)=f(‘a)=’a->’b
and f(x)=’b
now again f(f(x)) = f(‘b)
but function f needs ‘a and hence it is ‘a->’a

e. fun e(x,y,b) = if b(y) then x else y
ans. val e: 'a * 'a * (bool) -> 'a
let x=’a and hence y=’a and b is bool

3. Question 6.2

The return type of this sort function is list or an empty list which itself is a list.
The type of sort function is:
(‘a * ‘a -> bool) * ‘a list -> ‘a list

The above can be said because the return type of insert function is a list.
The type of insert function is:
‘a * ‘a list -> ‘a list

4. Question 6.5 The graph below represents each row in the tree depicted in the book, where y is lambda.

fun f(g,h) = g(h) +2;

y s → u → r
@ : r t = int →r

@ :t + = v →t 2

+ @:v s = u→v
int→int→int g: s h:u

Solving the constraints

int→int→int = v →t
s = u → v
t = int → r
s → u → r

v = int
t = int→ int
r = int

s → u → int
(u → v) → u → int
f has the following type:
(u → int) → u → int

In words, g is a function of type (u →int) , h is a function of type u, and f returns an int.

5. Question 6.7

Type of append is:

‘a list * ‘b -> ‘b

The first argument has to be a list or empty list since appends first argument can be nil or x::l
Nothing can be inferred about the 2nd argument though and the output of the function is the 2nd argument and hence consider 2nd argument to be ’b.

But what programmer really wants for append to work is the function with following type:
‘a list * ‘a list -> ‘a list
and hence we can simply say that the there is something incorrect in the append function given since it is simply outputting the 2nd argument without doing any manipulation on the argument.