

Assignment 5

Programming Languages

1. [50 pts, ML types] Determine the ML type for each of the following declarations. Feel free to type the declarations into an ML interpreter to determine the type, but make sure to explain in a couple of sentences why the type is what it is.

(a.)

```
fun a(x,y) = x + y/2.0;
```

(b.)

```
fun b(f) = fn x => f(x)+1;
```

(c.)

```
fun c(w, x, y, z) = if w(x) then x(y) else z;
```

(d.)

```
fun addToList(nil, x) = x  
|   addToList(x, h::l) = h::addToList(x,l);
```

(e.) The `addToList` function above has a bug. Can the type inferred for this function help the programmer notice that the function is implemented incorrectly? How?

2. [50 pts, parameter passing] Consider the following program written in Algol-like pseudocode:

```
begin  
  integer i;  
  procedure foo(integer x, integer y);  
    begin  
      x := x+1;  
      y := x+1;  
      x := y;  
      i := i+1;  
    end  
  i := 1;  
  foo(i,i);  
  print i;  
end
```

What would this program print under each of the following parameter passing mechanisms?

- (a.) Pass-by-value
- (b.) Pass-by-reference
- (c.) Pass-by-value-result

