

Using references

Warm up

Question: Give the type and the result of the following ML values:

```
val r = ref 0
```

```
val s = ref 0
```

```
val _ = r := 3
```

```
val x = !s + !r
```

```
val t = r
```

```
val _ = t := 5
```

```
val y = !s + !t
```

Question: What is the result of `f(s,t)` ?

```
fun f (a:int ref, b: int ref) = (a := !a +1; !b)
```

```
val s = ref 0
```

```
val t = s
```

```
f (s,t);
```

Program counter

Suppose we want to be able to count how many times a function is invoked in the program. We first try to wrap the function to produce another function that increments counter and then calls the function

Question: Considering the following program, give the result of the execution and explain why it does not work

```
val counter = ref 0;
fun count f = (counter := !counter +1; f)

fun add x y = x + y;
val add' = count add;

add' 5 6
!counter
add' 6 7
!counter
```

Question: Give a correct version of the program counter.

Different counters for different programs

Suppose that we want different counters for different functions.

Question: Considering the following program, give the result of the execution and explain why it does not work.

```
val counter = ref 0;

fun count f =
  let val counter = ref 0
  in fn x => (counter := !counter + 1; f x)
  end;

val add' = count add;

add' 5 6;
!counter;

add' 6 7;
!counter;
```

Question: Give a correct version of the program counter.