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CSC 305

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Assignment #5

Exercise 2:

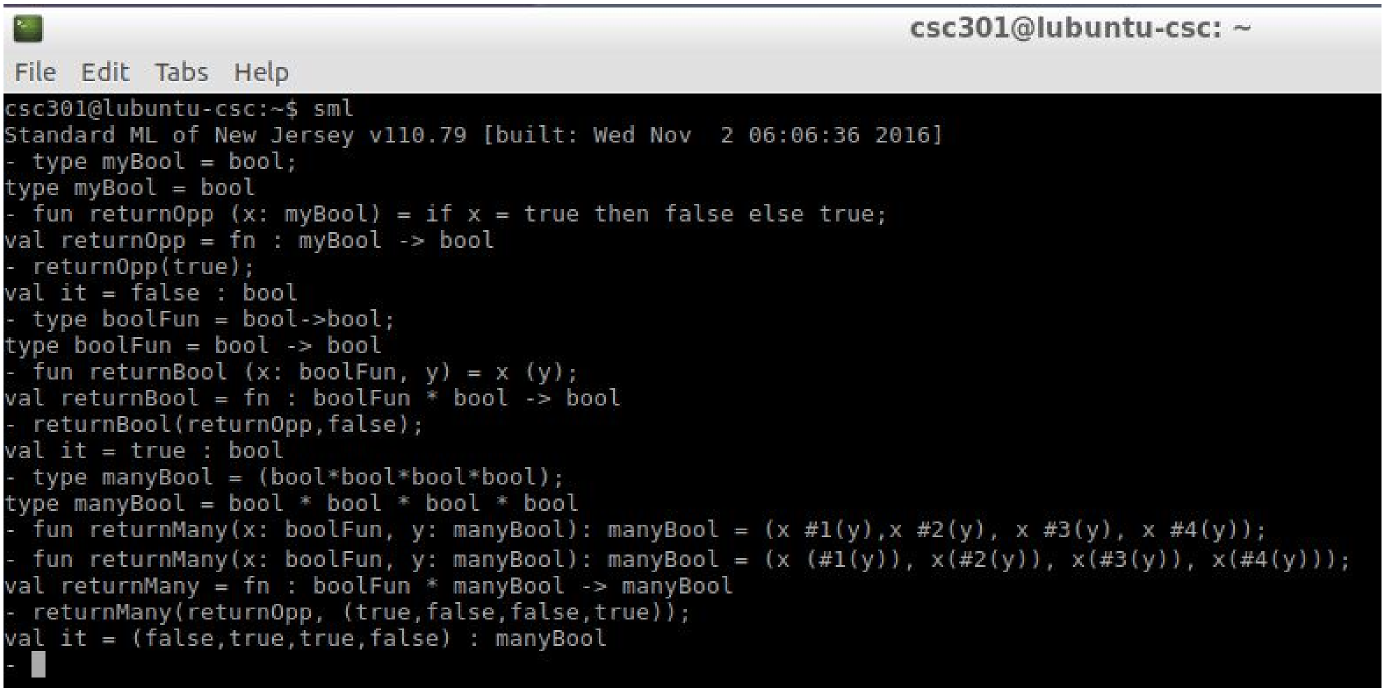
(Note: I was not sure whether to include the assignment with each ML type. Chapter 6 in the book generally displayed ML types as “type <type-name> = <type-expression>”, so I included the assignment with an arbitrary type name to be consistent. It also helped with testing in ML.)

type myBool = bool;

type boolFun = bool -> bool;

type manyBool = (bool*bool*bool*bool);

The below screenshot gives some examples of using these types.



```
csc301@lubuntu-csc:~$ sml
Standard ML of New Jersey v110.79 [built: Wed Nov  2 06:06:36 2016]
- type myBool = bool;
type myBool = bool
- fun returnOpp (x: myBool) = if x = true then false else true;
val returnOpp = fn : myBool -> bool
- returnOpp(true);
val it = false : bool
- type boolFun = bool->bool;
type boolFun = bool -> bool
- fun returnBool (x: boolFun, y) = x (y);
val returnBool = fn : boolFun * bool -> bool
- returnBool(returnOpp,false);
val it = true : bool
- type manyBool = (bool*bool*bool*bool);
type manyBool = bool * bool * bool * bool
- fun returnMany(x: boolFun, y: manyBool): manyBool = (x #1(y),x #2(y), x #3(y), x #4(y));
- fun returnMany(x: boolFun, y: manyBool): manyBool = (x (#1(y)), x(#2(y)), x(#3(y)), x(#4(y)));
val returnMany = fn : boolFun * manyBool -> manyBool
- returnMany(returnOpp, (true,false,false,true));
val it = (false,true,true,false) : manyBool
- 
```

Exercise 4:

d. This assignment is safe because X is defined by the supertype Z. Any value of X could be taken on by Z, because any integer divisible by 3 (X) is, by definition, an integer (Z).

e. This assignment is not safe because X is a subtype of Z. There are many values of Z that cannot be taken on by X, because there are many integers (Z) that are not integers divisible by 3 (X). For example, Z's set includes 2, which is not in the set defined by X (2 is not divisible by 3).

f. This assignment is safe because the set defined by X + 3 will always produce numbers divisible by 3. X will already by an integer divisible by 3, and adding 3 to an integer divisible by 3 will always produce another integer divisible by 3.

g. This assignment is not safe because the sum of any integer (Z) and an integer divisible by 3 (X) will not always be divisible by 3 (X). For example, 3 + 1 would satisfy X + Z, but its result of 4 is not in the set defined by X.