

Programming Languages G22.2110 Summer 2007 hw09

Assigned Th 7/19/2007, due We 7/25/2007 at 1pm.

How to Submit Homework Assignments

Email your answers, in either plain text format or as pdf, to Abhijit Guria <guria@cs.nyu.edu>. Assignments are due on Wednesdays at 1pm. This deadline will be strictly enforced.

Reading Assignments

- For lecture on 7/19/2007: Scott 7.2.4 (on CD); Cumming (<http://www.dcs.napier.ac.uk/course-notes/sml/manual.html>)
 - For lecture on 7/26/2007: Scott 12.3.4-12.3.5, 12.4.2-12.4.3
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Homework Assignments

1. SML (6 = 3 + 3 points)

While you write the SML code for answering Question 2 below, you will probably get some error messages. Describe two error messages using the following format:

- Code: *a very short piece of code that triggers the error*
- Symptom: *the error message itself*
- Cause: *an explanation for what triggered the error message*
- Solution: *how to fix the code to prevent the error*

2. SML (20 = 5 + 5 + 5 + 5 points)

Write SML programs exercising the fundamental features.

2a. I/O (5 points)

Write a program that prompts the user for his or her name, reads the name from input, then politely greets the user by name. Here is an example interactive session:

```
What is your name?  
Bob  
Hello, Bob, nice to meet you!
```

2b. Libraries (5 points)

Write a program that uses SML basis library functions to compute $\sqrt{2}$, $\sin(3.5)$, and $e^{2.5}$, and then prints the results like this (don't worry if the numbers are displayed in a slightly different format):

```
square root of 2.0:    1.41421356237
sine of 3.5:          ~0.35078322769
e to the power of 2.5: 12.1824939607
```

2c. Types (5 points)

The following code creates a variable `c` with the character value 'Z', and then prints a description and the value of the variable:

```
let val c = #"Z"
in print ("name c, type char, value " ^ (Char.toString c) ^ "\n") end;
```

Extend this program by creating and printing more variables of different types. Your program should produce the following output:

```
name b, type bool, value true
name c, type char, value Z
name i, type int, value 42
name r, type real, value 3.141
name s, type string, value hello
```

2d. Control flow (5 points)

Write an SML function `countOccurrences` that takes a pair of parameters, a string and a character, and returns the number of occurrences of the character in the string. For example, `countOccurrences ("hello", #"l")` should return 2. Do not use a loop, use recursion. Hint: you can use `String.explode` and write a helper function that counts occurrences of a character in a list of characters.

3. Type inference (12 = 3 + 1 + 8 points)

Consider the following SML function:

```
fun a (_, []) = [] | a (n, h::t) = (n+h)::a(n, t);
```

Assume that “+” operates on integers only.

3a. (3 points) Describe in words what `a` does.

3b. (1 points) What is the type of `a`?

3c. (8 points) Show the type inference steps for `a`.

4. Type inference (12 = 3 + 1 + 8 points)

Consider the following SML function:

```
fun addOrMul (oper, x, y) = (if "add" = oper then op + else op * ) (x, y);
```

Assume that the type of “`op +`” is “`int * int -> int`”.

4a. (3 points) Describe in words what `addOrMul` does.

4b. (1 points) What is the type of `addOrMul`?

4c. (8 points) Show the type inference steps for `addOrMul`.

<http://www.cs.nyu.edu/courses/summer07/G22.2110-001/hw09.pdf>

Total points: 50.