

Exercise 3

Due at 3:30 PM (on paper), March 17, 2009.

1. (27 pts) Ex. 7.2, p. 398. Use a chart to record your answers, as shown below:

	Structural Equiv	Strict Name Equiv	Loose Name Equiv
A and B			
A and C			
A and D			

2. (17 pts) Ex. 7.8, p.400. Show your work, e.g. show the address offset for each field in the first record. Hint: drawing a diagram is helpful.

3. (15 pts) Write an ML function called `isPalin` to test whether or not a string `s` is a palindrome. Hint: you may find some of the built-in functions useful (<http://www.cs.unc.edu/~stotts/723/ML/pre.html>).

Here is an example of `isPalin` in use:

```
- isPalin "abcba";
val it = true : bool
```

4. (5 pts) What is the type of the following ML expression?

```
[ ([1,2], ("ab", true)), ([], ("xy", false)) ]
```

5. (18 pts) Write an ML function called `numDiff` for numerical differentiation. Use the following formula:

$$(f(x + \partial) - f(x - \partial)) / 2\partial$$

Three arguments are needed: `f`, `x`, and `delta`. It should use currying and operate on real numbers.

Here is an example of `numDiff` in use:

```
- numDiff (fn x => x * x * x - x - 1.0) 3.0 1E-6;
val it = 26.0000000036 : real
```

What is the type of the function `numDiff`?

6. (18 pts) Write two ML functions called `iDoubleMap` and `rDoubleMap` that take a function `f` and a list `l` as curried arguments. `iDoubleMap` should operate on integers and `rDoubleMap` should operate on reals. Return a new list by applying $2*f(x)$ to every element `x` in `l`. Hint: use the built-in function `map`.

Here is an example of `iDoubleMap` in use:

```
- iDoubleMap (fn x => x * x) [1, 2, 3];  
val it = [2,8,18] : int list
```

What are the types of the functions `iDoubleMap` and `rDoubleMap`?