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CIS 425 : Final Exam – Fall 2010

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1   ML - 14 points

What do the following ML expressions evaluate to:

```
let fun f x = x+x
in f 7
end
```

```
let fun f x = x+x
    val x = 3
in f 7
end
```

```
let val x = 3
    fun f x = x+x
in f 7
end
```

```
let val x = 3
    fun f y = x+y
in f 7
end
```

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```
let val x = 3
    fun f y = x+y
in let val x = 5
   in f 7
   end
end
```

```
let val g = let val x = 3
                fun f y = x+y
            in f
            end
in let val x = 5
   in g 7
   end
end
```

```
let val x = 3
    fun f y = x+y
in let val x = 4
       fun g h = h (h 7)
   in g f
   end
end
```

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2 Parameter Passing (9 points)

In the presence of side-effects, the choice of parameter-passing technique can have non-trivial consequences. To see this, consider the following ML expression:

```
val y = ref 1;
fun f x =  (!y) + (x + x);
(f (y := (!y)+1; !y)) + (!y);
```

For each of the following parameter passing conventions, indicate the final value computed by this program. (You may assume that + is left-associative.)

1. [3] call-by-value

    ```
    val it =
    ```

2. [3] call-by-name

    ```
    val it =
    ```

3. [3] call-by-need

    ```
    val it =
    ```

3   CPS - tail recursion - 10 points

Convert the function preorder to CPS. Do not convert the functions :: (cons)

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4 Streams in ML - 12 Points

Given the following datatype for streams:

datatype stream = E of int * (unit -> stream)

- Write a function genZeros in ML that generates a stream in which every element is a 1, i.e., generate the stream that represents an infinite sequence of ones.

- Write a function addStreams in ML that takes two streams s1 and s2 and produces a stream s such that the ith element in s is the sum of the ith elements in s1 and s2.

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TERM	PROFESSOR	TAGS
Fall '08	Staff	Control flow, Evaluation strategy, val y, val G

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