Name _____

Student number _____

CS 2SC3 and SE 2S03 Fall 2008

Quiz 10 Answer Key

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You have 10 minutes to complete this quiz consisting of 2 pages and 5 questions. You may *not* use your notes and textbooks, nor may you use any calculators or other electronic devices. Circle the *best* answer for the multiple choice questions, and write the answer in the space provided for the other questions. Good luck!

(1) [2 pts.] Higher-order procedures are implemented in C using

    (a) Recursion.

    (b) Loops.

    (c) Header files.

    (d) Function pointers.

(2) [2 pts.] Which type in C acts as a universal type?

    (a) `unit`.

    (b) `void`.

    (c) `void *`.

    (d) `(void *) *`.

(3) [2 pts.] Which of the following OCaml functions is tail recursive?

    (a)
```
let rec f x =
    if x < 0 then 31 else 2 + f x ;;
```

    (b)
```
let rec f x =
    if x < 0 then 2 + f x else 31 ;;
```

    (c)
```
let rec f x =
    if x < 0 then f (2 + x) else 2 + f(x) ;;
```

    (d)
```
let rec f x =
   if x < 0 then f (2 + x) else f (x * x) ;;
```

(4) [2 pts.] In C, define a record type (structure type) named `bin_node` whose members represent nodes of a binary tree. Assume each record includes a field named `data` of type `int`.

Answer:

```
typedef struct b_node {
  int data;
  struct b_node * left;
  struct b_node * right;
} bin_node;
```

(5) [2 pts.] Assume the following type definition has been made in OCaml:

```
type int_bin_tree =
  | Leaf of int
  | Branch of int_bin_tree * int_bin_tree ;;
```

Write an OCaml function named `f` of type

    int_bin_tree -> int_bin_tree

that, given a tree T (of type `int_bin_tree`) as input, returns the tree T' (of type `int_bin_tree`) that is the mirror of T.

Answer:

```
let rec f = function
  | Leaf x -> Leaf x
  | Branch (x,y) -> Branch (f y, f x) ;;
```