BU CAS CS 320: Concepts of Programming Languages

Quiz 1

Instructor: Hongwei Xi

September 18, 2023

Name:_____ Score:_____

No.	Points	Answer	Score
1-1.	2		
1-2.	2		
1-3.	2		
1-4.	2		
1-5.	2		
1-6.	10		
1-7.	10		
1-8.	20		
Total	50		

No computer is allowed!

(And your phone is considered a computer.)

Question 1 (*

```
Question 1-1: 2 points

let rec f(x) = f(x)

Is 'f' tail-recursive? (1 for yes and 0 for no)

Your answer:
*)
```

Question 2 (*

```
Question 1-2: 2 points

let rec f(x) = f(x+1)

Is 'f' tail-recursive? (1 for yes and 0 for no)?

Your answer:

*)
```

Question 3 (*

```
Question 1-3: 2 points

let rec f(x) = f(x)+1

Is 'f' tail-recursive? (1 for yes and 0 for no)?

Your answer:

*)
```

Question 4 (*

```
Question 1-4: 2 points

let rec f(x) =
if x > 0 then f(f(x)) else f(f(f(x)))

How many tail-recursive calls in the definition of 'f'?

Your answer:

*)
```

Question 5 (*

```
Question 1-5: 2 points

let
rec f(x) = f(g(f(x))) + 1
and g(y) = f(g(f(g(f(g(x))))))

How many (mutual) tail-recursive calls in the definition of 'g'?

Your answer:

*)
```

Question 6 (*

```
Question 1-6: 10 points

let pp x y = fun f -> f(x,y)

let ff = (* WRITE YOUR CODE *)

(*
Given an implementation of ff that
makes the following assertions pass
*)

let () = assert (pp 200 100 ff = 100)
let () = assert (pp 100 200 ff = -100)

Please present your code as follows:
*)
```

Question 7 (*

```
Question 1-7: 10 points

Given the following snippet, implement the test
function so that isPrime returns true for prime
number inputs and false otherwise.

let isPrime(n) =
let test(i:int): bool = (* YOUR CODE *)
in
  if n < 2 then false else int1_forall(n)(test)

Please present your code as follows:
*)
```

Question 8 (*

```
Question 1-8: 20 points
Please give a NON-RECURSIVE implementation of sort5
that takes 5 integers and returns a tuple that consists
exactly of the 5 given integers ordered increasingly

let sort5: int*int*int*int*int -> int*int*int*int*int =
  (* YOUR CODE *)

For instance, sort5(1, 2, 1, 2, 1) = (1, 1, 1, 2, 2)
For instance, sort5(1, 3, 4, 5, 2) = (1, 2, 3, 4, 5)
For instance, sort5(1, 3, 5, 4, 2) = (1, 2, 3, 4, 5)

You can implement your own helper functions as long as
you do not make use of recursion.

Note that we are not looking for a solution solely based
on a very large embedded if-then-else expression here.

Please present your code as follows:
*)
```