CS 3304 Final Exam

Name:

ID:

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1. (20 points) Defining a function `mystery` of two arguments, in the SML environment, produces the following response:

   ```
   val mystery = fn: int list -> int list -> int list
   ```

   What can you say about `mystery`?

2. (20 points) Come up with an example of parameter passing (i.e., give code) where pass-by-value-result is distinguishable from pass-by-reference. Clearly explain how one of the mechanisms produces different results from the other.

3. (10+10=20 points) Consider the following two Prolog segments:

```
/* segment 1 */
d(X) :- a(X), !, b(X).
d(X) :- c(X).

/* segment 2 */
d(X) :- a(X), b(X).
d(X) :- not(a(X)), c(X).
```

Assume that the definitions of `a`, `b`, and `c` are the same for both segments. Answer true or false for the following two statements (with reasons):

- All solutions for `d` (i.e., values for `X`) in segment 1 are also solutions for `d` in segment 2.

- All solutions for `d` in segment 2 are also solutions for `d` in segment 1.

4. (10 points) Consider a Smalltalk class `Animal` which has three instances – `fox`, `goat`, and `chicken`. Assume also a subclass of `Animal` called `Mammal`. Let us suppose we wish to create an instance of `Mammal` called `human`. What message is required to do this and which object must be the recipient of this message? Present your answer in Smalltalk syntax.

5. (10 points) Assume that you are given the definition of the `append(X,Y,Z)` Prolog predicate which is true when `Z` is the result of appending list `Y` to list `X`. Use this predicate to define the `nextto(X,Y,L)` predicate, which is true when elements `X` and `Y` appear next to each other in list `L`. For instance, `nextto(1,2,[3,1,2])` is true but `nextto(1,2,[1,3,2])` is not.

6. (20 points) In any language of your choice, write a `square` function that returns the square of an integer. `square` *must* be written so that : (i) it is recursive, and (ii) the control context created upon its invocation must not need an ever-increasing amount of memory.