CMSC 331-05 Name: _____
Spring 2018
Final

1 (10) a) Define a non-ambiguous grammar which generates an infinite language (your choice).
b) Define an (presumably different) ambiguous grammar; demonstrate that it is ambiguous.

2 (10) Write an ML function which takes a list of int lists, and returns the list containing the average of each of the lists. int list list → int list

3 (10) Determine the types of the following chunks of ML code:

a) fun inout f (x,y) (z,w) = f (x,w) (y,z);

b) fun that [] =[] |
that ((a,b)::l) = ((a+1)=b) ::that(l);

4 (15)
Define a Ruby class which implements (string) hashes:

new() -- which creates an empty hash
insert(x,y) – updates the hash so that x is mapped to y.
value(x) – returns the most recent y mapped to x (or an error, if x hasn't been mapped)

(N.B. you may not use the built-in Ruby Hash object.)

Discuss the relative efficiency of your insert & value functions.

5 (5) Using a truth table, show that the "NOT" operator can be defined using only the "XOR" operator.

6 (10) Assuming x & y are both ints, determine the weakest precondition for:

```
if ( x > y )
  then y = 2*x + 1
  else  y = 2*x – 1
{y > 3 }
```

7 (10) Defend or defeat the following claims:

a) Static allocation is an efficient way of supporting mutual recursion.

b) Call-by-reference eliminates the storage obligation when managing parameters.

8 (10) We define Y = \t. (\x. t (x x)) (\x. t (x x))

Notice that (Y t) = (\x. t (x x))(\x. t (x x)) --just a simple beta reduction
then do another: = t (\x. t (x x)) (\x. t (x x)) --and another
and now we can get = t (Y t) – based on the identity from two lines above.

So, we have now shown that (Y t) = t (Y t) (wild, huh?)

Describe how this construct could be useful in modeling computations of interest.

9 (20)
a) What feature of HDFS are used to make Map-Reduce computation more efficient?

b) What are the benefits of using monitors to manage a producer-consumer system?

c) Describe a method which would prevent the need for variable renaming in the lambda calculus.

d) Compare and contrast: checked & unchecked exceptions.

10 (0) What will Cat Stevens (Yusuf Islam) know if successful in his quest?

"If I find my hard headed woman,
I know ….