CMSC 331: Principles of Programming Language
Sample Midterm

1. Write ML functions for the following questions.
    a. Find smallest number in a list.
    b. Find largest number in a list.

2. Write ML function to return count of numbers in a list that are divisible by 2.

3. Show parse tree and left-most derivation using below grammar for below expressions.

    assign -> id = expr
    id -> A | B | C | D
    expr -> expr + term | expr - term |term
    term -> term * factor | term / factor |factor
    factor -> (expr) | id

    a. A = (A + B) * (C - D)
    b. C = A * (B / D)

4. Write a grammar which generates all the sentences where it starts with n copies of "a", followed by exactly 2n copies of "b". (n>0)

5. Convert the below BNF grammar to EBNF.

    program -> BEGIN stmt_list END
    stmt_list -> stmt | stmt ; stml_list
    stmt -> var = expr
    var -> A | B | C
    expr -> var + var | var - var | var

6. Write an ML function that multiplies all of the ints in an int list.

7. Define Polymorphism.

8. Explain tokens and find the tokens in the following string “if (a=b) then x=7 else y=y-1;”

9. What are the types of the following:

a) fun stuff f base [] = base:(int->int) |
   stuff f base a::b = f(a,(stuff f base b));

b) fun inc x = inc (x+1);

c) fun in1 0 = 0 |
      in1 x = in1(x+1);

d) fun temp x = x + (x 0);

e) fun temp2 x = (x 0) + (x 1);

f) fun squash [] = [] |
   squash ({a,b}::c) = ((a+b):int)::(squash c);

g) fun arbsquash f [] = [] |
      arbsquash f ({a,b}::c) = ((f a b)::(arbsquash f c));