CSE 304 1. Midterm Exam

I. QUESTION

Prove or disprove using axiomatic semantics: The following code swaps two integers b and c.

Precondition: {b = B **and** c = C}
   b = b + c
   c = b - c
   b = b - c
Postcondition: {b = C **and** c = B}

II. QUESTION

We want to devise a BNF grammar for the numeric constants (integers and reals) that can be used in a language. The following example numbers show the allowable formats (of course, a number can be formed of any number of digits): 150, +150, -150, .25, +.25, -.25, 150.25, +150.25, -150.25, E10, E+10, E-10, 150E10, 150E+10, 150E-10, +150E10, +150E+10, +150E-10, -150E10, -150E+10, -150E-10, .25E10, .25E+10, .25E-10, +.25E10, +.25E+10, +.25E-10, -.25E10, -.25E+10, -.25E-10, 150.25E10, 150.25E+10, 150.25E-10, +150.25E10, +150.25E+10, +150.25E-10, -150.25E10, -150.25E+10, -150.25E-10

That is, a number may be an integer (xxx), or may be a real either with an integer part (xxx.xxx) or without an integer part (.xxx). Also, each of these can be followed with an exponential part (xxxExxx, xxx.xxxExxx, .xxxExxx); exponential part is always an integer. Also an exponential part without any preceding number (Exxx) is valid. Also, all numbers and exponential parts may be preceded by + or - sign.

  a) Write a BNF grammar for the syntax of numbers in this language.
  b) Show (step by step) the rightmost derivation of the number +45E-3.
  c) Draw the parse tree corresponding to the derivation in part (b).

III. QUESTION

  a) What arguments can you make in favor of the idea of a single language for all programming domains?
  b) What arguments can you make against the idea of a single language for all programming domains?

IV. QUESTION

```
Subprogram sub1
Begin
    Var x,y,z;
    Subprogram sub2
    Begin
        Var x,a,b; Static Var c;
    Subprogram sub3
    Begin
        Var x,a; Static Var k;
        Call Sub4;
    End
    Subprogram sub4
    Begin
        Var y, t;
    End
    Call sub3;
    Call sub4;
    End
    Subprogram sub5
    Begin
        Var p, m;
        Subprogram sub6
        Begin
            Var m;
            Call sub2;
        End
        Call sub6;
    End
    Call sub5;
End
```

Above there exists a program algorithm sample. Program begins execution from sub1. Explain and show lifetime and scope of variables in the sample. For scoping you are expected to show both static scoping and dynamic scoping.

V. QUESTION

Consider the following statement

  x = f1(y) * 10

where f1 indicates a function call, and x and y are variables. List at least five bindings related to this statement. For each, indicate the element and the property that are bound, and the binding time (e.g. language design time).