• Problems are due by 2pm, Monday, March 19th, front desk (1st floor), SDSC.
• There will be a revision section; time/location: TBD (probably Mon. or Tue. evening, finals week)

(Small) Individual Assignment 5

Problem 1 (Static vs. Dynamic Scoping) Consider the following program:

```plaintext
program main()
  var A, B, C: integer;

  procedure p1()
    var x: integer;
    begin
      X := A; A := B; B := C; C := X;
    end;

  procedure p2()
    var B: integer;
    begin
      B := A; p1();
    end;

begin (*main*)
  A := 1; B := 2; C := 3;
  p1();
  p2();
  output(A, B, C);
end.
```

a) First assume static scoping of variables: what is the environment inside the procedures p1 and p2? Hint: for all variable occurrences in p1 and p2 say whether they are binding occurrences or applied occurrences; in the latter case say to which binding occurrence (here: declaration) they belong to.

b) Under static scoping, what is the output of main()?

c) What is the output with dynamic scoping of variables?

d) With static scoping, local variables “hide” all other variables with the same name from enclosing scopes. How can they be made visible again?

Problem 2 (Parameter Passing) Consider the following program:

```plaintext
program main()
  var i: integer;
  var a: array[0..9] of integer;

  procedure swap(<pp_mode> x,y: integer)
    var tmp: integer;
    begin
      tmp := x; x := y; y := tmp
    end;

begin (*main*)
  i := 2; a[i] := 30;
  swap(i, a[i]);
end;
```

a) Trace the program execution assuming the parameters are passed by reference (i.e., <pp_mode> = “call by reference”).

b) Like (a) but assume parameters are passed by name (i.e., <pp_mode> = “call by name/call by macro”).