

CSCI 431: *Programming Languages*
Midterm #2

The entire exam is to be turned in at 4:20 PM. This is an open book exam.

Problem 1. (10 points)

Give a grammar for the language consisting of all strings of *a*'s and *b*'s in which every *a* is immediately following by at least one *b*.

Problem 2. (10 points)

Give an example of one string that is a legal variable name in Pascal but not in C and an example of one string that is a legal variable name in C but not in Pascal.

Problem 3. (10 points)

Suppose *P* is an integer pointer variable in Pascal, and *I* is an integer variable. Can *P*[^] ever be an alias for *I*? If not, why not? If so, how?

Suppose *P* is an integer pointer variable in C, and *I* is an integer variable. Can **P* ever be an alias for *I*? If not, why not? If so, how?

Problem 4. (10 points)

In C, if *x* is declared as a float, what is the result of executing the statement:
`x := sqrt(2.0)`
if the `sqrt` function has not been declared.

Problem 5. (10 points)

Write a Pascal type declaration for a variant record that can be used to store information about college applicants. Your record should contain the name of an applicant and, for high school applicants, his or her SAT score stored in an integer, and, for transfer applicants, his or her GPA stored in a real.

Problem 6. (15 points)

On pages 386 and 387 of the text book there are specification packages and body packages for an Ada implementation of a stack. Suppose you wanted to add a new function `size` that returns the number of elements in the stack. Show how you'd modify the specification and body packages to do this.

Problem 7. (15 points)

On pages 391 and 392 of the text book is a C++ implementation of a stack. Suppose you wanted to add a new function `size` that returns the number of elements in the stack. Show how you'd modify the C++ module to do this.

Problem 8. (10 points)

Consider the following program written in Pascal:

```

program foo ;
  var n: integer ;
      function g(): integer;
      begin
        g := n+1
      end ;
      function f(): integer;
      var n: integer ;
      begin
        n := 1 ;
        writeln( g(), n ) ;
      end ;
begin
  n := 5 ;
  writeln( f(), n ) ;
end ;

```

Outline the scope of the variable(s) `n`.

What does the program print when it is executed?

Problem 9. (10 points)

Pascal prohibits programmers from directly using the value returned by a pointer-valued function as a pointer reference. For example, you cannot use `f(5)^` as a Pascal expression, even if `f` is function that maps integers into pointers.

What do you think are the reasons for this restriction?