

Midterm Exam 1

CS 381

Fall 2001

Closed book, closed notes, closed neighbors.

Short Answer Questions, 2 points each:

1. What is the name of the first programming language designed by an international committee, and not just by a single computer manufacturer?

2. In what country was the language Plankalkül created?

3. What organization sponsored the development of the language Ada?

4. The people who created the C programming language worked for what company?

5. What programming paradigm was invented with the creation of the programming language Prolog?

6. Name another functional programming language besides Lisp.

7. What do the letters BNF stand for?

8. What problem domain was the creator of Lisp interested in?

9. What problem area was COBOL designed to be used for?

10. Name two object-oriented programming languages.

Slightly longer answer questions, 4 points each

11. How can ML be a strongly typed language if programs written in ML have almost no declarations?

12. What is an array slice?

13. What is the dangling else problem? How is it solved?

14. What value is printed if A is statically typed in the first column and dynamically

typed in the second?

```

int A
A = 10
= 10
A = A / 4
= A / 4
Print A
Print A

```

A
A
A

15. Name three different possible binding times.

Longer questions

16. (10 points) Show that the following grammar is ambiguous.

```

<Logical> ::= not <Logical> | <Logical>
and <Relational> | <Relational>
<Relational> ::= <variable> <Relop>
<variable>
<Relop> ::= < | <= | = | <> | > | >=
<variable> ::= a | b | c

```

17. (10 points) Write a grammar for expressions involving addition, multiplication, and unary negation, and variables. Unary negation has highest precedence, then multiplication, then addition. Addition associates to the left, and multiplication associates to the right. (That is, $a+b+c$ should group the addition of a and b first, then the addition of c).

18. (10 points) Here is a program written in a Pseudo code. Explain what the result would be printed under static scoping, and what the result would be under dynamic scoping.

```

procedure one ( )
var x;
  procedure two ( )
  begin
    if (x < 5) then
      print (x + 1)
    else
      print (x - 1)
  end
  procedure three ( )
  var x
  begin
    x = 4;

```

```

        two();
    end;

begin
    x = 7;
    three();
end

```

19. (10 points) What is the weakest precondition for the following assignments?

```

    IF ( A <> B ) THEN
        A := A - B
    ELSE
        A := A + B
    { A = 2 B }

```

20. (20 points) Suppose we define the following function

```

(defun unknown (fun1 fun2 ident lst)
  (cond
    ((null lst) ident)
    ((funcall fun1 (car lst)) (funcall
      fun2 (car lst) (unknown fun1 fun2 ident (cdr
        lst))))
    (t (unknown fun1 fun2 ident
      (cdr lst)))))

```

Give an invocation of the function unknown that will

(a) sum the numbers in a list that contains both numbers and symbols, that is, if lst is (2 A 3 4 B) it should return 9

(b) return a list containing only the atoms in lst, that is, if lst is (A (2 3) 4 B (7 (8))) it should return (A 4 B)

(c) return a list containing only the positive values in a list of integers, that is if lst is (2 -3 4 -6 -5 7) it should return (2 4 7)