

Midterm Exam 1

CS 381

Spring 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. At what institution was the programming language Basic created?
3. Who designed the programming language Pascal?
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. What programming paradigm was invented with the creation of the programming language 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. What are the two major dialects of Lisp at the present time?

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 referential transparency?

13. What is a lambda function?

14. In what way is a language that uses static type binding different from a language that uses dynamic type binding?

15. Name three different possible binding times.

Longer questions

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

```
<A> ::= # <A>
<A> ::= <A> % b
<A> ::= a
```

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 under static scoping, and what the result would be under dynamic scoping.

```
procedure one
var x;
  procedure two( )
  begin
    x = x * 2;
  end
  procedure three( )
  var x
  begin
    x = 4;
    two();
  end;
```

```
begin
  x = 7;
  three();
  print(x);
end
```

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

```
y := 4 * x;
```

```
x := 2 * y + x - 1
```

```
{ x > 17 }
```

20. (20 points) Assume you are given an odd length list of integers, all different. Your job is to find the median; that is, the unique element having the property that the number of values larger than the median is the same as the number of elements smaller. You are to do this in a functional fashion, using map, filter, reduce, and currySecond. You can assume you have all other other list functions we have discussed, length, eq, car, cdr, cons, and so on.

Hint: Can you create the list consisting of those elements in the list that are smaller than some value? Can you then take the length of this list? Can you then write a function that takes one argument and a list, and returns true if the number of values smaller than the argument is equal to the number of elements larger than the argument? Can you then finally use that function to compute the median?