CSE 3302 Name _____
Test 1
Spring 2014 Last 4 Digits of Mav ID # _____

Multiple Choice. Write your answer to the LEFT of each problem. 4 points each

1. `((lambda (x y) (+ x y)) 1 2)` is an example of:
   A. Applying an anonymous function
   B. Defining a function named `x` in Scheme
   C. Defining a function name `lambda` in JavaScript
   D. Renaming the library function `+` as `x`
2. The Scheme `cond` is like what idiom in an imperative language?
   A. a chain of ifs
   B. a `for` loop
   C. `switch`
   D. a `while` loop
3. The statement "It is Lisp in C's clothing" refers to:
   A. Java's syntax and semantics
   B. Scheme's syntax and semantics
   C. JavaScript's syntax and semantics
   D. Pascal's syntax and semantics
4. It is considered good practice to assure that the second argument to `cons` is:
   A. an atom B. a function C. a list D. a number
5. Pascal indicates the value to be returned from a function by using:
   A. a global variable B. a `return` statement
   C. a `var` parameter D. the name of the function
6. The `base` function in the PL/0 interpreter is used to:
   A. Find a variable in the symbol table
   B. Initialize the stack
   C. Perform addressing on the stack
   D. Return from a procedure call
7. Which of the following is true regarding attribute grammars?
   A. Inherited attributes carry information up the parse tree
   B. Synthesized attributes carry information down the parse tree
   C. They can represent context-sensitive information
   D. They cannot capture the information that usually goes in symbol tables
8. Regular expressions are convenient for defining what element of a programming language's definition?
   A. attributes B. binary strings C. terminals D. tokens
9. A railroad diagram is an alternative notation for:
   A. attribute grammars B. extended BNF C. regular expressions D. precedence
10. The Pascal equivalent of the C `!=` operator is:
    A. `!=` B. `:=` C. <> D. `==`

Long Answer.

1. Give a Scheme function `test1` that indicates whether its three integer parameters are in strictly increasing order. 10 points
   The results for the specific cases below is indicated.
   `(test1 10 20 30)` should return `#t`
   `(test1 22 11 33)` should return `#f`
   `(test1 1 1 2)` should return `#f`

2. Give the results from the Scheme code below. 10 points
```
(car '((a b (c d)) (e f g h)))
(cdr '((a b (c d)) (e f g h)))
(cons '((a b) (c d)) '((e f) g))
```
3. A Pascal function `findm` with the header below will be passed an array with `m` zeroes followed by `n` ones, where `m` and `n` are unknown (and one of these could be zero). Complete the function so it returns the value of `m`, which may be in the range `0` through `p`, inclusive. 20 points
```
type arrtyp=array[1..p] of integer;
function findm(var arr: arrtyp): integer;
```

4. A JavaScript function `findm` with the header below will be passed an array with `m` zeroes followed by `n` ones, where `m` and `n` are unknown. Complete the function so it returns the value of `m`. 20 points

```
function findm(arr)
```

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Test 2

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Multiple Choice. Write your answer to the LEFT of each problem. 4 points each

1. The non-terminal *factor* is used in the productions for defining:
   A. *expression* B. *program* C. *statement* D. *term*
2. Which of the following is not a characteristic of recursive descent?
   A. Error recovery B. Small lookahead C. Many precedence levels D. Top-down
3. Which of the following binding times is the earliest?
   A. compilation B. execution C. linking D. program writing
4. Which of the following is not used when determining function type signatures in C++?
   A. function name B. number of parameters C. parameter types D. return type
5. Which of the following has no mechanism for achieving block scope?
   A. C B. JavaScript C. Scheme D. Pascal
6. For which of the following pairs will JavaScript evaluate the `===` operator to `false`?
   A. `1, 1.0` B. `1, "1"` C. `'1', "1"` D. `1.1, 1.1`
7. "Hoisting" of declarations to the beginning of functions is associated with which language?
   A. C B. JavaScript C. Scheme D. Pascal
8. In JavaScript, what is the value of the expression `0 ? 1 : 2 || 3`?
   A. `0` B. `1` C. `2` D. `3`
9. Type inference is associated with which language:
   A. C B. JavaScript C. ML D. Pascal
10. In C, suppose you do a `malloc()` and the provided number of bytes is larger than you requested. This is an example of:
    A. Dynamic Semantics B. External Fragmentation C. Internal Fragmentation D. Aliasing

Long Answer.

1. What appears on the console for the code below? (10 points)

```
a={b: 5, c: 6};
b=Object.create(a);
b.c=7;
c=Object.create(b);
c.d=8;
delete c.c;
delete b.c;
console.log(c.b);
console.log(c.c);
console.log(c.d);
```

2. Suppose a Pascal array is to be stored starting at location `100000` and is declared:

   ```
   c: array[15..70,25..33,5..10] of integer;
   ```

   If one `integer` takes two bytes, what is the location of `c[35,30,8]`? (10 points)

3. Give equivalent C code (e.g. using `if ... else ...`) to demonstrate the short-circuit nature of C boolean operators. Do not use `&&`, `||`, or `!` in your solution! Do not use work variables! (10 points)
   a. `result = a <= 10 && b > 13;`
   b. `result = c < 20 || d >= 17;`
   c. `result = !(e < 25 && f > 55) || g < 66;`

4. Give Scheme code for a function `levels` that replaces each atom in its single argument by its nesting level, i.e. the number of parentheses it is nested within. (30 points)

```
(levels 'a)
(levels '(a))
(levels '((((a)) b) c))
(levels '(1 (20 (3 (4 40) 3) 2) 1))
(levels '(11 (2 (3 (4 () 4) 32) 2) 15 ()))
```

would have output:

```
0
'(1)
'((((4)) 2) 1)
'(1 (2 (3 (4 4) 3) 2) 1)
```

```
'(1 (2 (3 (4 () 4) 3) 2) 1 ())
```

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Test 3

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Multiple Choice. Write your answer to the LEFT of each problem. 5 points each

1. The lambda calculus is a major influence on which language?
   A. C B. Java C. Pascal D. Scheme
2. The difference between actual parameters and formal parameters is:
   A. actuals are in the called subprogram, formals are in the caller
   B. actuals are call-by-value, formals are call-by-name
   C. actuals are in the caller, formals are in the called subprogram
   D. no difference
3. Duff's device involves which PL construct?
   A. C union B. C switch C. Java switch D. C varargs
4. Static chain links go through which type of allocation?
   A. stack B. heap C. static D. registers
5. `(car (cdr (cdr '(a b (c d e) f (g h i)))))` will result in:
   A. `'((g h i))` B. `'b` C. `'(c d e)` D. `'(g h i)`
6. `(cdr (cdr (cdr (cdr '(a b (c d e) f (g h i))))))` will result in:
   A. `'((g h i))` B. `'b` C. `'(c d e)` D. `'(g h i)`
7. A thrown JavaScript exception may be:
   A. a string B. a declared exception type C. a number D. any of these
8. Call-by-name is associated with which language?
   A. ALGOL 60 B. ALGOL 68 C. JavaScript D. Pascal
9. The Y combinator is useful for:
   A. anonymous functions B. continuations C. threads D. unary functions
10. Keyword parameters give flexibility in:
    A. achieving overloading
    B. making call-by-name work effectively
    C. overriding the reserved words of a language
    D. the order in which parameters are passed

Long Answer.

1. What is the result of executing this Scheme code? 10 points

```
(define y 4)
((lambda (x y)
   (x y (x y y)))
 (lambda (x y)
   (+ x y))
 11)
```

2. A general list (with nested sub-lists) has only integers as atoms. Give Scheme code to sum all of the values. (Line breaks, indenting, and comments are useful.) 20 points

```
> (sum '(1 2 3 4 5))
15
> (sum '((1 2 3 4 5) (1 2 3 4 5)))
30
> (sum '((1 2 3 4 (1 (1 3)) (1 2 3 4 5))))
30
> (sum '((1 2 3 4 (1 (1 3)) ((())) 15 (1 2 3 4 5))))
45
```

3. Give Scheme code to partition a simple list ("lat") of integers. The first argument will be an integer and the second will be the list of integers. The result will be a list with two sub-lists - the first will contain the values from the input list that are not larger than the first argument, the second will contain the values from the input list that are larger than the first argument. Note that the elements in the output sub-lists must retain their original relative positions. (Line breaks, indenting, and comments are useful.) 20 points

```
> (partition 5 '(1 2 3 4 5 6 7 8 9 10))
'((1 2 3 4 5) (6 7 8 9 10))
> (partition 5 '(5 3 4 7 9 10 1 2 5 8 5 6 4 3))
'((5 3 4 1 2 5 5 4 3) (7 9 10 8 6))
```