CSE 3302 Name _____

Test 1

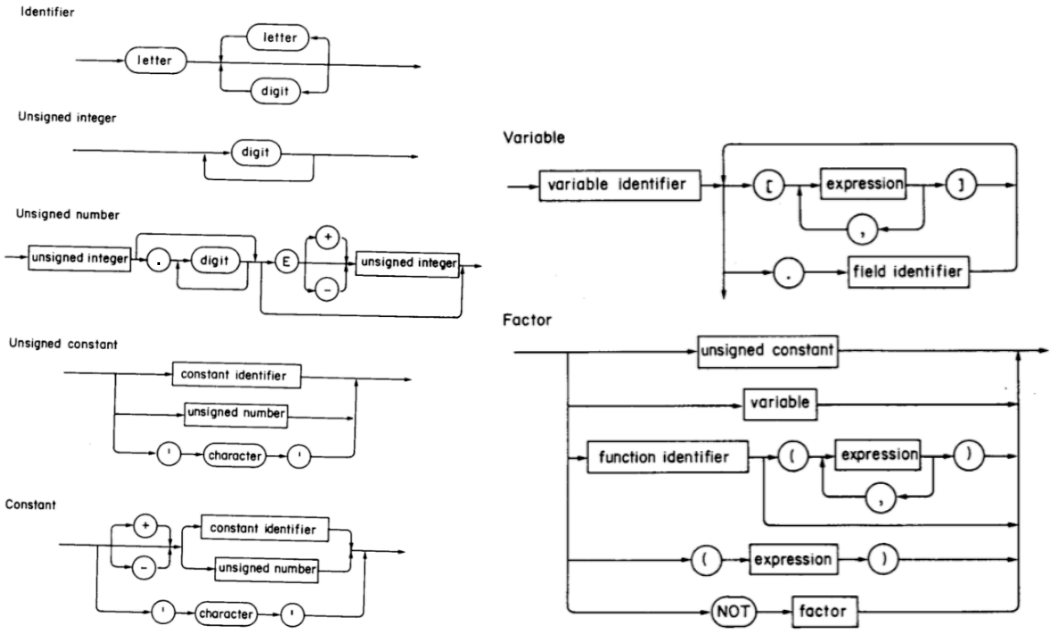
Fall 2012 Last 4 Digits of Mav ID # _____

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

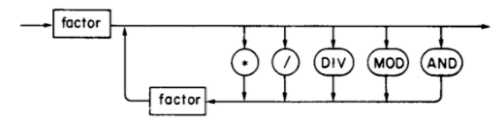
1. If a value is second class, then it can be
   A. Passed as an argument B. Returned from a function
   C. Assigned to a variable D. All of the above
2. Buddy systems are associated with which type of allocation?
   A. Static B. Heap C. Stack D. Registers
3. Suppose a closure is returned. Any referenced data must have which type of allocation?
   A. Static B. Heap C. Stack D. Registers
4. Static chain links go through which type of allocation?
   A. Static B. Heap C. Stack D. Registers
5. Who is associated with the shunting-yard technique?
   A. Dijkstra B. Hoare C. Ritchie D. Wirth
6. Which language's operators precedences bear the least similarity to the other three?
   A. C B. Java C. JavaScript D. Pascal
7. Which of the following is not true regarding attribute grammars?
   A. Synthesized attributes carry information up the parse tree
   B. Inherited attributes carry information down the parse tree
   C. They cannot represent context-sensitive information
   D. They can capture the information that usually goes in symbol tables
8. Which of the following strings is not included in the language of the regular expression $10^{*}(01)^{+}1^{*}0$?
   A. 10000010 B. 1010101010 C. 1000101110 D. 1010100
9. 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
10. Overloading operators can be done in which language?
    A. C B. C++ C. Java D. Pascal

Long Answer.

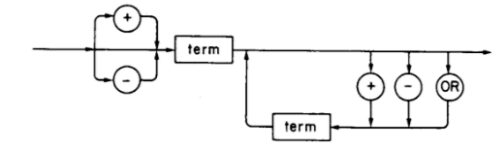
1. In the following railroad diagrams, circle the subgraphs corresponding to individual tokens that would be separated by a scanner. 20 points



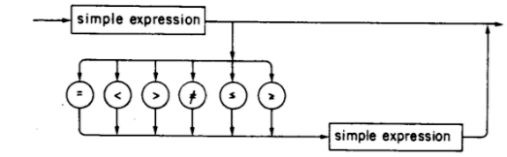
Term




Simple expression




Expression




2. The following pairs of symbols may be used for parenthesis-style bracketing in a language:

   ( )  [ ]  { }

   As is customary, a left symbol gets paired with the closest unmatched right symbol of that pair. In addition:
   1. Matching pairs may nest, but other overlap is *not* allowed (like scoping).
   2. Nesting of a pair *cannot* occur within the symbols of other pairs appearing *to the right* above.
   3. Two legal expressions *may be* concatenated.
   4. The empty string is *not* in this language.

   Thus, the following three strings are in this language (ignore the whitespace):

   ( ( ) )  ( [ { } ] )  ( ( [ { } [ { } ] ] ) )

   and the following three strings are not:

   [ ( ] )  { [ ( ) ] }  ( [ { } [ { } ] ) )

   Give either a grammar or railroad diagrams for this language. 20 points
3. Give the definitions along with three examples (each) of static and dynamic semantics. 20 points

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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. A Pascal set is like a:
   A. collection class  B. bit vector  C. hash table  D. reference count
2. Which technique is applicable to garbage collection?
   A. depth-first search  B. binary search  C. dynaming programming  D. shallow copying
3. Which type cannot be involved when ML attempts an equality comparison?
   A. list  B. tuple  C. int  D. real
4. The notion of l-value and r-value is associated with which PL construct?
   A. assignment  B. iteration  C. recursion  D. selection
5. The most tedious run-time processing is associated with call-by-
   A. value  B. sharing  C. reference  D. name
6. The evaluation of the expressions for arguments in C is usually handled in which order?
   A. programmer specified  B. short-circuit  C. left-to-right  D. right-to-left
7. Which language supports both contiguous and row-pointer methods of subscripting?
   A. C  B. Java  C. JavaScript  D. Pascal
8. Duff's device involves which PL construct?
   A. C union  B. C switch  C. Java switch  D. C varargs

Short Answer. 4 points each

1. What is the difference between row-major and column-major ordering?
2. Name three ways of approaching generic code.

Long Answer. 20 points each

You may choose any three of these. Draw a big **X** through the one you do not want graded.

The default big **X** will be through problem 4.

1. Explain cons, car, and cdr. Examples are encouraged.
2. Explain the two control constructs that use guarded commands.
3. In the context of PLs, what are the notions of shallow and deep?
4. a. Circle the `printf()`s that will have predictable values (assuming arbitrary, but appropriate initialization)?
   b. For the predictable ones, give the values that will be printed to the right.

```
// Other code
int a[10][20][30];
char b[10][20][30];

int ***c;
char ***d;

// Other code

main()
{
printf("%d\n",&a[7][7][7] - &a[5][5][5]);

printf("%d\n",&a[7][7] - &a[5][5]);

printf("%d\n",&a[7] - &a[5]);

printf("%d\n",&b[7][7][7] - &b[5][5][5]);

printf("%d\n",&b[7][7] - &b[5][5]);

printf("%d\n",&b[7] - &b[5]);

magicAllocator(&c,&d);

printf("%d\n",&c[7][7][7] - &c[5][5][5]);

printf("%d\n",&c[7][7] - &c[5][5]);

printf("%d\n",&c[7] - &c[5]);


printf("%d\n",&d[7][7][7] - &d[5][5][5]);

printf("%d\n",&d[7][7] - &d[5][5]);

printf("%d\n",&d[7] - &d[5]);
```

```
}
```

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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. Which of the following JavaScript objects does not have a `length`?
   A. arrays B. strings C. functions D. numbers
2. Which of the following will be treated like `false`?
   A. `1/2` B. `5` C. `NaN` D. `"  "`
3. JavaScript makes a simple stack available through:
   A. array methods B. prototypal inheritance
   C. cloning the stack class D. closures
4. Omitting the `new` on a call to an intended constructor will bind `this` to:
   A. an array of arguments B. the global object
   C. the last instance created by this constructor D. the prototype
5. The value resulting from `!!(null)` will be
   A. `true` B. `false` C. `null` D. `undefined`
6. The `for .. in` construct is used to:
   A. enumerate array elements that are not `undefined` B. enumerate properties
   C. test a subclass/superclass relationship D. iterate over an integer subrange
7. JavaScript was initially developed by Brendan Eich in ten:
   A. hours B. days C. months D. years
8. Which of the following is a JavaScript type?
   A. boolean B. char C. int D. real

Long Answer. 15 points each

1. How does JavaScript process each line in the code below?

```
a=[{x:2,y:5},4];
a[5]=5;
a[22/2]=22/2;
a[40/3]=40/3;
console.log(String(a.length));
```

2. Circle the first statement to throw an exception.

```
t={};
t.a="3302";
b=t.b;
c=t.b.c;
d=t.b.c.d;
```

3. What appears on the console for the code below?

```
f=function(x) {
  return x+1;
};
g=function(x) {
  var h=function(x) {
    return x+10;
  };
f=h;
return h(x);
};
console.log(String(f(1)));
console.log(String(g(3)));
```

```
console.log(String(f(1)));
```

4. What appears on the console for the code below?

```
a={x:1};
b=a;
a.x=2;
b.x=3;
console.log(String(a.x));
console.log(String(b.x));
c={x:1};
d=Object.create(a);
c.x=5;
d.x=8;
console.log(String(c.x));
console.log(String(d.x));
```

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Test 4
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Closed Book

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

1. `(cons 'a 'b)` will result in:
   A. `'(a b ())` B. `'((a) b)` C. `'(a . b)` D. `'(a b)`
2. `(cons '(a) '(b))` will result in:
   A. `'(a b ())` B. `'((a) b)` C. `'(a . b)` D. `'(a b)`
3. `(cons 'a '(b))` will result in:
   A. `'(a b ())` B. `'((a) b)` C. `'(a . b)` D. `'(a b)`
4. `(car (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)`
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. Recursion is to Scheme as _____ are to Java.
   A. arrays B. expressions C. functions D. loops
8. Tail recursion requires functions to:
   A. do significant processing after calling other functions
   B. return to their caller as the very last thing they do
   C. have one return statement at the very end of their code
   D. do no significant processing after calling another function
9. Scheme allows nameless functions by using:
   A. `cond` B. `define` C. `lambda` D. `'()`
10. (`pair? x`) returns `#t` when :
    A. the `length` of `x` is exactly `2`
    B. `(car x)` and `(cdr x)` are defined
    C. `(car x)` and `(cdr x)` are the same S-expression
    D. the first two elements of `x` are the same

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Open Book/Notes

What does this Scheme function compute? 5 points

```
(define (magic x)
  (cond
```

```
((empty? x) '())
((pair? x) (cons (magic (car x)) (magic (cdr x))))
(else x)))
```

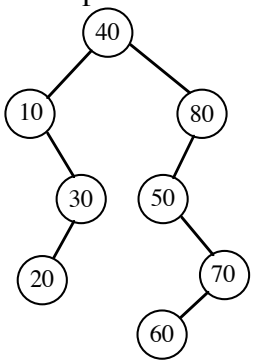
Long Answer. Choose any three of the following five problems. 15 points each.
BE SURE TO CLEARLY INDICATE WHICH THREE PROBLEMS YOU ARE SOLVING!!!

1. Give Scheme code to test if a single-level list (i.e. just atoms) is the reverse of another list. `#t` or `#f` will be returned.
2. Give Scheme code to perform inorder traversal to return a list of the keys in a binary search tree stored as an S-expression.

The S-expression:

```
(40 (10 () (30 (20 () ()) ())) (80 (50 () (70 (60 () ()) ())) ()))
```

corresponds to the tree:




and should return the list:

```
(10 20 30 40 50 60 70 80)
```

3. Give Scheme code to test if a single-level unordered list (i.e. just atoms, you may designate a single type for these) has duplicate elements. `#t` or `#f` will be returned. (Quadratic time is fine.)
4. Give Scheme code to compute the nesting depth of an S-expression, i.e. the empty list (or a single atom) has depth 0, the lists for problems 1. and 3. have depth 1, and an S-expression with nested S-expressions with maximum depth $k$ would itself have depth $k + 1$. (You may designate a single type for the atoms.)
5. Give Scheme code to count the number of atoms in an S-expression. (You may designate a single type for the atoms.)