Name (print): __________________________________________

• **INTEGRITY:** By taking this exam, you pledge that this is your work and you have neither given nor received inappropriate help during the taking of this exam in compliance with the Honor Code of Emory University. Do NOT sign nor take this exam if you do not agree with the honor code.

• **INSTRUCTIONS:**
  - Keep your eyes on your own paper.
  - Do your best to prevent anyone else from seeing your work.
  - Do NOT communicate with anyone other than the professor/proctor for ANY reason in ANY language in ANY manner.
  - Do not use notes, books, calculators, etc during the exam.
  - Turn all mobile devices off and put them away now. You cannot have them on your desk.
  - Stop writing and put down your pencils when told to do so.
  - Academic misconduct will not be tolerated. The penalty for violating any of the above policies or other misconduct will be a zero on this exam. Other disciplinary action as deemed appropriate by the Emory Honor Council may also be applied.

• **TIME:** This exam has 9 questions on 11 pages including the title page. Please check to make sure all pages are included. You will have 50 minutes to complete this exam.

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*I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Emory community. I have also read and understand the requirements outlined above.*

Signature: __________________________________________

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<th>9</th>
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<tbody>
<tr>
<td>Points</td>
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</table>
1. **Multiple Choice.** Circle the correct answer for each question.

(a) (1 point) Javascript is an:
   A. interpreted language
   B. compiled language
   C. machine language
   D. assembly language
   E. algorithmic language

(b) (1 point) In Javascript, the `+` operator can be used on what data types?
   A. a combination of strings and numbers
   B. strings only
   C. numbers only
   D. whole numbers only (such as 1, 2, 3, etc)
   E. partial numbers only (such as 1.23 or 4.56)

(c) (1 point) Which of the following is **NOT** a high-level language?
   A. C++
   B. Java
   C. Javascript
   D. Fortran
   E. binary

(d) (1 point) What values does the function `Math.random()` return?
   A. between 0 (inclusive) and 1 (exclusive)
   B. between 0 (inclusive) and 1 (inclusive)
   C. between 0 (inclusive) and 100 (exclusive)
   D. between 1 (inclusive) and 2 (inclusive)
   E. between 1 (inclusive) and 100 (exclusive)

(e) (1 point) What statement displays an alert box in Javascript?
   A. `write.alert`;
   B. `alert("text")`;
   C. `display.alert`;
   D. `alert = "text"`;
   E. `innerHTML = "alert text"`;

(f) (1 point) In Javascript a line beginning with the symbols `//` is a(n):
   A. variable
   B. function
   C. comment
   D. HTML element
   E. statement
(g) (1 point) In programming, *debugging* is the process of systematically locating and
A. understanding data types.
B. using the assignment operator.
C. using precedence rules to evaluate expressions.
D. **fixing errors.**
E. removing variables.

(h) (1 point) In Computer Science, Big-Oh notation is used to
A. measure the exact number of seconds required by a given algorithm on a particular computer.
B. **represent an algorithm’s performance in relation to the size of the problem.**
C. measure the amount of computer memory required by a given algorithm.
D. count the number of “operate” instructions needed to solve a problem of a given size.
E. specify how precise an algorithm needs to be.

(i) (1 point) In Javascript, the `=` operator performs what function?
A. It is used to store numbers in memory.
B. It is used to assign data types to variables.
C. It is used to test whether two mathematical expressions are logically equivalent.
D. **It assigns the value on its right hand side to the left hand side.**
E. It is used to test whether two expressions are equal to each other

(j) (1 point) In a programming context, *libraries* are
A. the output of a function.
B. the inputs to a function.
C. user defined functions which allow code reuse.
D. user manuals which document a programming language.
E. **similar functions grouped together for easy reference.**
2. **Multiple Answer.** Circle ALL of the correct answers for each question. There will be at least one correct answer for each question, but there may be more.

(a) (2 points) Binary search is an example of an:

A. **logarithmic algorithm.**
B. \(O(N^2)\) algorithm.
C. \(O(\log(N))\) algorithm.
D. **divide-and-conquer algorithm.**
E. \(O(N)\) algorithm.
F. \(O(X^N)\) algorithm.
G. constant time algorithm.

(b) (2 points) Which of the following would NOT be considered an algorithm.

A. A web browser.
B. A method of searching data for a specific number.
C. A recipe for baking a cake.
D. A high-level programming language.
E. Instructions on how to put together a bookcase.

(c) (2 points) Which of the following are examples of legal variable names in Javascript?

A. 1x
B. x1
C. x_1
D. X1
E. x+1
F. x 1
G. x11

(d) (2 points) Consider the following Javascript statements:

\[
\begin{align*}
    w & = 3; \\
    x & = 4; \\
    y & = 12;
\end{align*}
\]

If added as the 4th statement, which of the following statements would make the variable \(z\) equal to the value of 3?

A. \(z = y - (x \times w) + w;\)
B. \(z = y / x;\)
C. \(z = x / y;\)
D. \(z = 3;\)
E. \(z = w;\)
F. \(z = w \times y;\)
G. \(z = w / 0;\)
3. **Fill in the Blank.** Answer the following questions about the following HTML/Javascript webpage.

```html
<html>
<head>
    <title>My Calculating Webpage</title>
    <script type="text/javascript">
    function GetRand()
    {
        num = Math.random();
        bignum = num * 100;
        num = Math.round(bignum);
        document.getElementById('output').innerHTML = num;
    }
    </script>
</head>

<body>
    <input type="button" value="Click me!" onclick="GetRand();">
    <div id="output"></div>
</body>
</html>
```

(a) (2 points) What is the name of the function defined in this file?

(a) **GetRand**

(b) (2 points) How many Javascript statements are in the function?

(b) **4**

(c) (2 points) How many variables are defined in the function?

(c) **2**

(d) (2 points) List the variables defined in the function.

(d) **num, bignum**

(e) (2 points) What library (or libraries) does this function use?

(e) **Math**

(f) (2 points) What function(s) from the library (or libraries) you listed in Part e above are used in the code?

(f) **random, round**

(g) (3 points) In your own words, briefly describe how this webpage works.
Solution: Every time the user clicks the button a new random number between 0 and 100 (inclusive) will be generated. The number will have no decimal places since it is rounded.
4. (4 points) Briefly describe the difference between an interpreter and a compiler

**Solution:** Interpreter: translates 1 line of code to machine language at a time  
Compiler: translates entire program to machine lang. at once

5. (6 points) When designing algorithms, we must sometimes make trade-offs between a variety of factors that are desirable. List 3 different things you might consider when designing an algorithm.

**Solution:** simplicity, running time, amount of memory, precision, etc. Note that “correctness” is different then “precision”. We always want our algorithm to be correct but the level of precision that defines correctness may be open for debate.

6. (8 points) Briefly describe the difference between a syntax error and a logic error and give a Javascript statement that is an example of each.

**Solution:** syntax: typographical errors. Forgetting a quotation mark, semicolon, misspelling a word, etc.  
user_name = 'valerie; is missing a quotation mark.  
logic: code is correct/legal, but gives an unexpected result because user applied logic incorrectly.  
avg = 100 + 96 / 2; when user really meant avg = (100 + 96) / 2;
7. Write the value of the variable after each Javascript statement executes. Write “–” if
the variable does not have a value assigned to it. Be sure to indicate whether a value is
a string or a number through the use of quotation marks.

(a) (14 points)

<table>
<thead>
<tr>
<th></th>
<th>x</th>
<th>y</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>x = 42;</code></td>
<td>42</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><code>y = x * 2;</code></td>
<td>42</td>
<td>84</td>
<td>–</td>
</tr>
<tr>
<td><code>x = y + 2 - 4 / 2;</code></td>
<td>84</td>
<td>84</td>
<td>–</td>
</tr>
<tr>
<td><code>z = 'Hello' + '!';</code></td>
<td>84</td>
<td>84</td>
<td>'Hello!'</td>
</tr>
<tr>
<td><code>x = z + x;</code></td>
<td>'Hello!84'</td>
<td>84</td>
<td>'Hello!'</td>
</tr>
<tr>
<td><code>z = parseFloat('13');</code></td>
<td>'Hello!84'</td>
<td>84</td>
<td>13</td>
</tr>
<tr>
<td><code>y = (y + z) * 2;</code></td>
<td>'Hello!84'</td>
<td>194</td>
<td>13</td>
</tr>
</tbody>
</table>

(b) (8 points)

<table>
<thead>
<tr>
<th></th>
<th>x</th>
<th>y</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>x = 6 + 5 * 2 - 4;</code></td>
<td>12</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><code>y = (2 + 1) * 2 - 2</code></td>
<td>12</td>
<td>4</td>
<td>–</td>
</tr>
<tr>
<td><code>z = y / 2 * 2 + 2;</code></td>
<td>12</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td><code>x = x / y - z</code></td>
<td>-3</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>
8. (12 points) **ALGORITHMS.**
Suppose you have a list of numbers. You want to count all numbers that are greater than a given number. You know three additional pieces of information:

- the list is sorted in ascending order
- the length of the list
- there are no numbers repeated in the list.

For example, if the list was:

```
12 15 19 22 45 62 75 81 93 101
```

and you were trying to find all numbers greater than 25.

One way to do this is to use a sequential search. That is, examine the first element, decide if it is greater than your target number, examine the second element, decide if it is greater than your target number, etc. until you have examined all the elements in the list and counted the number that are greater than your target number.

Develop a different algorithm which is more efficient than the one described above. Write it as an ordered list of steps. **Hint, test your algorithm using the above list and a target number of 101. Is your algorithm more efficient than the one described above?**

**Solution:** Preform a binary search find the location of the target number or the location where target number should be (if it isn’t in the list). Once you’ve found that location, subtract the location from the length of the list.

Most common mistake: many students described a binary search without stating how they would use that to find the count asked for in the question.

Complete the webpage below by writing a function described below. The HTML has been given for you and should not be modified.

Write a function named `Average` which gets two numbers from the user (via the input text boxes) and averages them. The average should be displayed as shown in Figure 1 (next page) when the user clicks the button.

```html
<html>
<head>
    <title>My Averaging Webpage</title>
    <script type="text/javascript">

    </script>
</head>

<body>
    <input type="text" size=4 id="num1">
    <input type="text" size=4 id="num2">
    <input type="button" value="Average these!" onclick="Average();">
    <hr>
    <div id="output"></div>
</body>
</html>
```

Solution:

Should be something like:

```javascript
function Average()
{
    n1 = parseFloat(document.getElementById('num1').value);
    n2 = parseFloat(document.getElementById('num2').value);
    avg = (n1+n2)/2;
    document.getElementById('output').innerHTML = 'The average of ' + n1 + ' and ' + n2 + ' is ' + avg;
}
```

+2 function declaration/name
+2 values retrieved from user input correctly (x2)
+2 strings/values converted to numbers correctly (x2)
+3 variables used appropriately
+2 average computed correctly
+2 correct output string generated and assigned to innerHTML
+2 correct syntax

Figure 1: Example of webpage in Question 9

The average of 40 and 60 is 50

Figure 1: Example of webpage in Question 9