Intro/Algorithms Homework (18 points)
Due at the beginning of class on Friday, Sept 6th

1. Section 1.2 in zyBook discusses several historical figures in computer science. Here are four other important people in computer science. Read about them online, and then write a short paragraph on each (3-5 sentences) that describes what they have done for the computing revolution. The paragraph should be in your OWN words. (2 points)
   a. Marvin Minsky
   b. Fran Allen
   c. Claude Shannon
   d. Adele Goldberg

2. Figure 1.4.4 in zyBook provides pictures of several places where embedded devices reside. Provide three other examples where embedded devices exist. (1 point)

3. Use the following list in answering the following four questions: (1 point)
   \[ 2, 5, 13, 21, 27, 29, 44, 58, 66, 93, 120 \]
   a. How many list elements will be compared to find 66 using a linear search?
   b. How many list elements will be compared to find 66 using binary search?
   c. How many list elements will be compared to find 121 using linear search?
   d. How many list elements will be compared to find 121 using binary search?

4. The American Museum of Natural History in New York City contains more than 24 million specimens and artifacts in its various collections, including the world’s largest collection of dinosaur fossils. Many of these are in storage away from public view, but all must be carefully inventoried. (3 points)
   i. Suppose the inventory is unordered (!) and a sequential search is done to locate a specific artifact. Given that the search is executed on a computer that can do 12,000 comparisons per second, approximately how much time on the average would the search require?
   ii. Assuming the inventory is sorted, about how much time would a binary search require using the same computer?

5. Should one always sort a large list of items and then use binary search (versus just using linear search)? Justify your response. (1 point)

6. Consider the following algorithm to determine whether summing a list of numbers exceeds 100,000. Is the algorithm efficient? If not, how might you improve? (1 point)
   Step 1: Initialize sum = 0.
   Step 2: Start with the first number.
   Step 3: Add the current number to sum.
   Step 4: Repeat step 3 until all numbers have been added.
   Step 5: Compare sum with 100,000.
7. Describe in words what the following pseudocode will do. What is the output when the input is 5? (3 points)

Step 1: input n
Step 2: set a to 1
Step 3: set b to 1
Step 4: output a
Step 5: output b
Step 6: repeat n times
Step 7: if a > b then
Step 8: increase b by a
Step 9: output b
Step 10: else
Step 11: increase a by b
Step 12: output a

8. The following is Euclid’s 2,300-year-old algorithm for finding the greatest common divisor (gcd) of two positive integers I and J. (3 points)

<table>
<thead>
<tr>
<th>Step</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Get two positive integers as input; call the larger value i and the smaller value j</td>
</tr>
<tr>
<td>2</td>
<td>Divide i by j, and call the remainder R</td>
</tr>
<tr>
<td>3</td>
<td>If R is not 0, then reset i to the value of j, reset j to the value of R, and go back to Step 2</td>
</tr>
<tr>
<td>4</td>
<td>Print out the answer, which is the value of j</td>
</tr>
<tr>
<td>5</td>
<td>Stop</td>
</tr>
</tbody>
</table>

a. Go through this algorithm using the input values 20 and 32. After each step of the algorithm is completed, give the values of I, J, and R. Determine the final output of the algorithm.

b. Does the algorithm work correctly when the two inputs are 0 and 32? Describe exactly what happens, and modify the algorithm so that it gives an appropriate error message.

9. Suppose you wrote the following Python code to swap the values stored in variables X and Y:

```python
X = Y
Y = X
```

Does the code correctly swap the values X and Y? If not, how do you fix so it does? (1 pt)

10. On a separate sheet of paper, write pseudocode for folding an 8-1/2x11 sheet of paper into a paper airplane. Include your name AND section on this separate sheet of paper. (2 pts)