Name: _________________________________________________

Circle Section: A (9am), B (10am), C (11am), D (12pm), E (1pm), F (2pm), G (3pm)

Intro/Algorithms Homework #4 (8 points)
Due to Gradescope by 11:45 PM on Thursday, January 23rd
(You need to submit a pdf of this file to Gradescope)

Homework Goal: Practice using and critically thinking about algorithms in general and search & sort algorithms in particular; review terminology for these chapters

Zybooks + CS Basics

1. Section 1.2 in zyBook discusses several historical figures in computer science. Here are two other important people in computer science. Read about them online, and then write a short paragraph on each (3-5 sentences each) that describes what they have done for the computing revolution. The paragraph should be in your OWN words. (1 point)
   a. Jean Bartik
   b. Edsger Dijkstra

2. Figure 1.4.4 in zyBook provides pictures of several places where embedded devices reside. Provide three other examples where embedded devices exist. (0.5 point)

3. Fill in the blanks: (1 point)
   Computer science is the study of ______________________.
   An algorithm is a set of step-by-step instructions for ____________________________.
   Pseudocode lies between ______________________ and _______________________.

Searching & Sorting

4. Given a large list of items, should one always sort the list and then use binary search (versus just using linear search on the large list)? Justify your response. (0.5 points)
5. 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 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?

6. Germany’s population is approximately 83,661,597. Suppose we have a database with everyone’s name and phone number in Germany, sorted by full name (first name, middle name, last name).

   In the worst case, how many comparisons would be needed to find the following item. Justify your answer in each case. (1 point)

   a. Sofia Marie Schneider?

   b. If the phone number 49 30 4457576 belongs to someone?

7. Match the following algorithms with their time complexity. (0.5 points)

   a. ___Binary search  
      x. O(n)

   b. ___Sequential search  
      y. O(n^2)

   c. ___Selection sort  
      z. O(log_2(n))

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. (1 point)

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

Step __: I = ___, J = ___
Step __: I = ___, J = ___, and R = ___
Step __: I = ___, J = ___, and R = ___
Step __: I = ___, J = ___, and R = ___
Step __: I = ___, J = ___, and R = ___
Step __: I = ___, J = ___, and R = ___
Step __: I = ___, J = ___, and R = ___
Step __: Print J = ___

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 if the smaller value is 0.

9. The following algorithm determines whether summing a large list of random numbers exceeds 25,000. How might you improve the algorithm? (0.5 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 25,000.
   Step 6: Print sum or message.

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. Rather than turning this problem into Gradescope with the rest of this assignment, bring it to class with you on Friday, January 24th. (1 point)