1. (5 points) Consider the problem of finding the distance between the two closest numbers in an array of n numbers. (The distance between two numbers x and y is computed as $|x - y|$.)
    a. Design a presorting-based algorithm for solving this problem and determine its efficiency class.
    b. Compare the efficiency of this algorithm with that of the brute-force algorithm

2. (5 points) Let A = {a1, . . . , an} and B = {b1, . . . , bm} be two sets of numbers. Consider the problem of finding their intersection, i.e., the set C of all the numbers that are in both A and B.
    a. Design a brute-force algorithm for solving this problem and determine its efficiency class.
    b. Design a presorting-based algorithm for solving this problem and determine its efficiency class.

3. (5 points) Solve the following system by Gaussian elimination:

$$x_1 + x_2 + x_3 = 2$$
$$2x_1 + x_2 + x_3 = 3$$
$$x_1 - x_2 + 3x_3 = 8$$

4. (5 points) For each of the following lists, construct an AVL tree by inserting their elements successively, starting with the empty tree.
    a. 1, 2, 3, 4, 5, 6
    b. 6, 5, 4, 3, 2, 1

5. (5 points) Construct a heap for the list 1, 8, 6, 5, 3, 7, 4.
    a. Put all numbers in an array and then swap elements to make it a heap.
    b. Start with an empty tree and insert numbers one by one.
    c. Is it always true that both approaches yield the same heap for the same input?