

Programming Design, Spring 2013

Lab Exam 2

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In this exam, there are two problems. You need to write a C++ program for each problem. The grading criteria for the two programs are the same:

- 70% of your grades for this program will be based on the correctness of your output. The online grading system will input 35 sets of testing data and then check your outputs. These 35 sets count for 70 points, i.e., 2 points for each set. Before the due time of the exam, you may upload your programs multiple times. Only the last one you upload will be graded. Nevertheless, you will not see your scores during the exam.
- 30% of your grades for this program will be based on how you write your program, including the logic and format. Please try to write a robust, efficient, and easy-to-read program.

Please note that your program will be submitted to the online grading system. Therefore, your programs must be able to accept multiple lines of input and stop when the input ends. In short, your programs should be structured in the same way as in the homework.

Problem 1

(50 points) Please write a C++ program according to the following instructions.

The input contains several lines of numbers. In each line, $n + 2$ positive integers $n, B, x_1, x_2, \dots, x_n$ will be given. The first number, n , is the size of a vector $x = (x_1, \dots, x_n)$. All numbers in x are nonrepeating, i.e., $x_1 \neq \dots \neq x_n$. n is a positive integer but has no upper bound. Your program should determine whether there is a pair of numbers such that the sum is equal to the second integer, B . More precisely, suppose there are two numbers x_i and x_j such that $x_i + x_j = B$ and $i < j$, then the output should be i and j , separated by one white space. Note that the smaller one must be output first. If more than one pair sum to B , the one with the smallest index should be output. If such two numbers do not exist, the output should be 0. Below are some examples:

- Input: 10 12 3 5 7 1 6 8 4 9 2 18. Output: 1 8. Please note that the output is neither 0 7 nor 3 10. Also, even though $5 + 7 = 12$, because $3 + 9 = 12$ and 3 has the smaller index (1) than 5 does (2), the output is not 2 3.
- Input: 5 100 2 3 5 6 9. Output: 0.
- Input: 6 10 5 9 2 7 3 6. Output: 4 5.
- Input: 6 10 5 9 1 7 3 6. Output: 2 3.

Problem 2

(50 points) Please write a C++ program according to the following instructions.

The input contains several lines of numbers. In each line, $2n + 3$ positive integers $n, B, C, x_1, x_2, \dots, x_n, y_1, \dots, y_n$ will be given. The first number, n , is the size of two vectors $x = (x_1, \dots, x_n)$ and $y = (y_1, \dots, y_n)$. All numbers in x are nonrepeating, i.e., $x_1 \neq \dots \neq x_n$. Similarly, all numbers in y are nonrepeating. n is a positive integer but has no upper bound. We call $p_i = (x_i, y_i)$ as a “point” in this problem. Your program should determine whether there is a pair of points p_i and p_j , $i < j$ such that the $x_i + x_j = B$ and $y_i + y_j = C$. In this case, the output should be i and j , separated by one white space.

Note that the smaller one must be output first. If more than one pair of points satisfy this condition, the one with the smallest index should be output. If such two points do not exist, the output should be 0. Below are some examples:

- Input: 6 10 20 1 9 3 7 5 6 8 12 4 16 5 4. Output: 1 2. Please note that the output is neither 0 1 nor 4 5. Also, even though points $p_3 = (3, 4)$ and $p_4 = (4, 16)$ satisfy the condition, because p_1 and p_2 satisfy this condition and p_1 have the smaller index, the output is not 3 4.
- Input: 5 100 10 2 3 5 6 9 50 51 52 53 54. Output: 0.
- Input: 6 10 5 5 9 2 7 3 6 6 2 3 4 1 9. Output: 4 5.
- Input: 6 10 5 5 9 2 7 3 6 6 2 3 4 9 1. Output: 0.