School of Computer Science, University of Windsor

60-141: Introduction to Algorithms and Programming II
Term: Summer 2014 (July-August)
Instructor: Dr. Asish Mukhopadhyay

Lab 2
Posted: 11th July, 2014
Due: Beginning of lab3

Preamble: The purpose of this lab is to increase your facility in the use of functions and arrays, covering the material of Chapters 5 and 6 of your textbook. Each one of the programs should be properly commented, following the style of your textbook. All lab work is expected to be original.

Grading Scheme: Each problem counts for 10 points, for a total of 20 points. The scoring break-up for each program is: 2 points for programming style (comments, modularity etc.) + 2 points for effort + 6 for correctness.

Credits: The first problem, with my modifications, is from your textbook; the rest is due to me.

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1. **Problem 1:** Consider the problem of reading in 20 integers lying in the range 0 to 99, both inclusive, and printing them, after removing duplicates.

   If space is not at a premium one solution is to maintain a binary array BA of size 100, initialized to 0's to begin with. If a number x is read in then BA[x] is set to 1 the first time it is read in and remains unchanged on any subsequent reading of x. Once all numbers have been read in, the numbers x for which BA[x] = 1 is output. Implement this scheme in C.

   If space is at a premium, we declare and maintain an integer array of size 20. As each number x is read in, we search for it in the existing list, maintained in increasing order, using binary search. If it already exists in this list, then we do nothing; else, we insert it into this list, by shifting the numbers that are greater than x, if any, to the right, as in insertion sort.

2. **Problem 2:** Consider the following 2-dimensional matrix:

$$M = \begin{pmatrix} -1 & 2 & 4 & -5 \\ -5 & -6 & 17 & 8 \\ 4 & -3 & 2 & 1 \\ 6 & -5 & 8 & 2 \end{pmatrix}$$

Write a C-program that outputs another matrix M' whose rows are the same as that of matrix M, but the sums of the elements in the rows of M' are in increasing order.

For the input matrix M, the row sums from the first row to the fourth are: 0, 14, 4 and 11 respectively. Thus the rows need to be rearranged so that the row sums of M' are 0, 4, 11 and 14 from the first row to the fourth respectively.