

MREN 178 Week 3 Tutorial

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The topic for this week is recursion. This is a topic which we covered in weeks 11 and 12 of APSC 143, but it will be a very important concept in this course. The problems in this tutorial document are intended to guide discussion on recursion and demonstrate examples of how it is used to solve concrete problems.

Problem 1. Recall that we solve a problem recursively by dividing the possible inputs into *base cases*, in which we can immediately compute the result, and *recursive cases*, in which we must solve the problem for one or more smaller inputs first, and use their results to compute the overall result. For each of the following problems, define the base cases and recursive cases and provide a recurrence relation which specifies a recursive solution to the problem.

- (a) Searching for an integer in a sorted array.
- (b) Sorting an array of integers.
- (c) Computing the sum of an array of integers.

Problem 2. Implement your recursive solutions to Problem 1 in C, as follows.

- (a) *// Returns index or -1.*
`int search_integers(const int *array, int length, int target);`
- (b) *// Sorts an array in-place.*
`void sort_integers(int *array, int length);`
- (c) *// Returns the sum of the integers in the array.*
`int sum_integers(const int *array, int length);`

Problem 3. In many cases, the recursive algorithm implies a recursive view of the structure of the input it is working with; i.e., the input type is either (base case) or (recursive case, in terms of the input type). In all the cases of Problem 1, this input was an array of integers, but the recursive structure applied to this array was not necessarily the same for each algorithm. Describe this recursive structure for your algorithms for (a) and (c).