American University of Beirut
Department of Computer Science
CMPS 211 – Discrete Mathematics – Fall 14/15

Please solve the following exercises and submit **BEFORE 12:00 pm (noon) of Thursday 20th, November.**

Exercise 1 (10 points)

Describe an algorithm that takes as input a list of n integers and produces as output the largest sum obtained by adding an integer in the list to the one following it.

Exercise 2 (10 points)

Describe an algorithm that takes as input a list of n integers and finds the number of integers greater than 7 in the list.

Exercise 3 (10 points)

Devise an algorithm to compute a^n, where a is a real number and n is an integer. [Hint: First give a procedure for computing a^n when n is nonnegative by successive multiplication by a, starting with 1. Then extend this procedure, and use the fact that $a^{-n} = 1/a^n$ to compute a^n when n is negative.]

Exercise 4 (10 points)

Specify the steps of an algorithm that locates an element in a list of increasing integers by successively splitting the list into 3 sublists of equal (or as close to equal as possible) size, and restricting the search to the appropriate piece.

Exercise 5 (10 points)

Devise an algorithm that finds all terms of a finite sequence of integers that are greater than the product of all previous terms of the sequence.

Exercise 6 (10 points)

List all the steps used to search for 4 and for 10 in the sequence 1, 3, 4, 5, 6, 8, 9, 11 using **a)** linear search and **b)** binary search.

Exercise 7 (10 points)

Sort *q, f, t, l, a, d* showing the lists obtained at each step using **a)** bubble sort and **b)** insertion sort.

Exercise 8 (10 points)

Describe an algorithm based on the binary search for determining the correct position in which to insert a new element in an already sorted list.

Exercise 9 (10 points)

Show that if there were a coin worth 12 cents, the greedy algorithm described in class using quarters, 12-cent coins, dimes, nickels, and pennies would not always produce change using the fewest coins possible.

Exercise 10 (10 points)

Show that a greedy algorithm that schedules a set of talks in a lecture hall by selecting at each step the talk that overlaps the fewest with other talks does not always produce an optimal schedule.