Exercise 1. Answer Sheet

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Problem 1. *(30 points)* For each function ***f(n)*** and time ***T*** in the following table, determine the largest size *n* of a problem that can be solved in time ***T***, assuming that the algorithm to solve the problem takes ***f(n)*** milliseconds.

f(n)	***T*** = 1 second 1000mil	***T*** = 1 minute 60000mil	***T*** = 1 hour 36000mil	***T*** = 1 day 864000mil	***T*** = 1 month (30 days) 25920000
$\sqrt{n}$	10^6	36*10^8	1296*10^6	6746496*10^6	6718464*10^8
n	10^3	60000	36000	864000	25920000
n^2	10√10	100√6	60√10	10√8640	100√2592
n^3	10	10*(60)^(1/3)	10*(36)^(1/3)	10√864	10√25920
2^n	log2(1000)	Log2(60000)	Log2(36000)	Log2(864000)	Log2(25920000)

Problem 2. *(30 points)* Consider sorting ***n*** numbers stored in array ***A*** by first finding the smallest element of ***A*** and exchanging it with the first element of the array, i.e. ***A[1]***. Them find the second smallest element of ***A***, and exchange it with ***A[2]***. Continue in this manner for the first *n-1* elements of ***A***.

a) Write a pseudo-code for this algorithm which is known as "**Selection Sort**".

```
SelectionSort(A):
 n = length(A)  // Number of elements in array A

 for i from 0 to n-1 do:
    // Find the index of the smallest element in the unsorted part of the array
    minIndex = i

    for j from i+1 to n-1 do:
       if A[j] < A[minIndex] then:
          minIndex = j

    // Swap the smallest element with the first element of the unsorted part
    swap(A[i], A[minIndex])
```

b) What is the time complexity of the Selection Sort algorithm?

G(n)= O(n^2)

Problem 3. *(40 points)* Using the pseudo-code for **Merge Sort** algorithm given at the lecture, write a program implementing the **Merge Sort** algorithm. Use any programming language you know. Upload your

source code with instructions how to compile/run it. Give the input data and the program output in the space below.

The way of compile:

1. On the terminal, put “javac MergeSort.java”
2. There are 3 classes, so put “java MergeSort” on the terminal again.
3. Put the num. you will put and put the num for sorting.

Input 5 5 4 3 2 1
Output 1 2 3 4 5