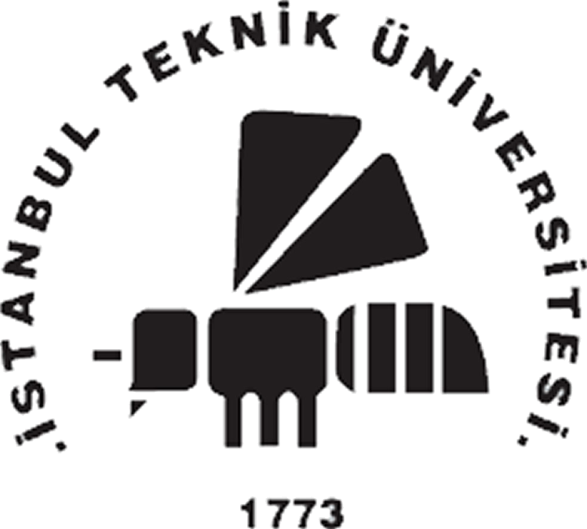
**Istanbul Technical University**

**Faculty of Computer and Informatics**



**BLG335E Analysis of Algorithms I**

**Project 1**

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1. Bubble sort is consist of two loops. Assuming length of array is , outer loop runs times, and inner loop runs times, where is equal to iterator of outer loop.

An asymptotic upper bound can be selected as , which satisfies for all , where and are constants and and .

Selecting and c,

Merge sort is consist of recursive calls of itself to divide the problem into two parts, and some operations to sorting and collecting divided parts.

An asymptotic upper bound can be selected as . Using Master Theorem, where .

is true. Then

1. Completion times of algorithms for different array sizes are shown below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| N  Algorithm | 1000 | 10000 | 1000000 | 1000000 |
| Bubble Sort | 0.013769 | 0.691353 | 72.5555 | 6905.35 |
| Merge Sort | 0.000893 | 0.006381 | 0.034509 | 0.393132 |

1. It is clear that merge sort is always better than bubble sort for given array size conditions. This plot below also proves that increases faster than , especially after .