# Exercise 4

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## Time Measurement

we will discuss in here two exercises in java couse 1DV507. first we will discuss about concatenation with plus sign and with string builder. we will look there difference, by looking which one is faster .

**Experimental setup**
In this report All experiment was done on a MacBook pro with Intel core i5 Ram 8. we used the clock System.nanoTime().

## Exercise Two
**Concatenation with plus sign vs Stringbuilder.**

The problem that we are handling in this report is how many characters can be concatenated or appended in one second.

In this program we used two variables named shortC and longC with string data type, and two variable names numberOfLongConcat and numberOfShortConcat with data type of long , also time for long. As well as the clock System.nanoTime();

In the program we defined time and called in the while condition to subtract the System.nanoTime (the time that the while loop was running) to get how long the concatenation took. Below we will show some data that the program run in 3 times.

| First | Length of the String | Number of concatenation |
|---|---|---|
| short concatenation | 71664 | 71664 |
| short append | 140086 | 140086 |
| Long concatenation | 449520 | 5619 |
| Long append | 1252320 | 15654 |

| Second | Length of the String | Number of concatenation |
|---|---|---|
| short concatenation | 93438 | 93438 |
| short append | 143104 | 143104 |
| Long concatenation | 652640 | 8158 |
| Long append | 1243760 | 15547 |

| Third | Length of the String | Number of concatenation |
|---|---|---|
| short concatenation | 89179 | 89179 |
| short append | 136208 | 136208 |
| Long concatenation | 619200 | 7740 |
| Long append | 1231520 | 15394 |

The results shows that Stringbuilder is much faster than concatenation with plus. The reason is that concatenation with plus always creates a new string while it copies the old string but Stringbuilder takes every new string and buts its array.

## Exercise Three

**Sorting Algorithm**
In this part the report will show three results we took from sorting althoriths with different ways like Inserting and merg. In the program will be sorted an array size of 1000 and the results will be shown below.

| First | Sorted Integer/ String |
|---|---|
| Insertion string | 85500 |
| Insertion Integer | 7916000 |
| merge Integer | 10143000 |

| Second | Sorted Integer/ String |
|---|---|
| Insertion string | 874000 |
| Insertion Integer | 10412000 |
| merge Integer | 11501000 |

| Third | Sorted Integer/ String |
|---|---|
| Insertion string | 860000 |
| Insertion Integer | 10271000 |
| merge Integer | 11430000 |

According to the results it shows that merge is faster in sorting when its compared with insertion.