# Worksheet 15 - Group 1

**Worksheet Group 1 Members**

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**Worksheet 15: Amortized Constant Execution Time**

*To compute the average, count 1 "unit" of cost each time a value is added to the dynamic array without requiring a reallocation. When the reallocation occurs, count one "unit" of cost for each assignment performed as part of the reallocation process, plus one more for placing the new element into the newly enlarged array. How many "units" are spent in the entire process of inserting these ten elements? What is the average "unit" cost for an insertion?*

A total of 15 units are spent in the process of inserting the ten elements into the array.  Below is a table showing the number of units that each operation costs:

| 1 | 1 | 1 | 1 | 1 | 5 + 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|-------|---|---|---|---|

As can be seen above, the sixth insertion operation costs 6, whereas all other operations cost only 1; this occurs because the array needs to be resized to accommodate for new elements being added to it.

A total of 10 insertion operations occur, which cost a total of 15 units.  The average unit cost for an insertion is 1.5 units.  Not too bad.

*Do a similar analysis for 25 consecutive add operations, assuming that the internal array begins with 5 elements (as shown). What is the cost when averaged over this range?*

A total of 60 units are spent in the process of inserting the ten elements into the array. Below is a table showing the number of units that each operation costs:

| 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|
| 5 + 1 | 1 | 1 | 1 | 1 |
| 10 + 1 | 1 | 1 | 1 | 1 |

| 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|
| 20 + 1 | 1 | 1 | 1 | 1 |

As can be seen above, the sixth, eleventh, and twenty-first operations cost more than normal; this occurs because the array needs to be accommodate for new elements being added.

A total of 25 elements are inserted for a cost of 60 operations.  The average unit cost for an insertion is 2.4.

**Group Minutes**

Our Minutes are available on Piazza at the following URL:

https://piazza.com/class/ib2kus4hsie528?cid=72