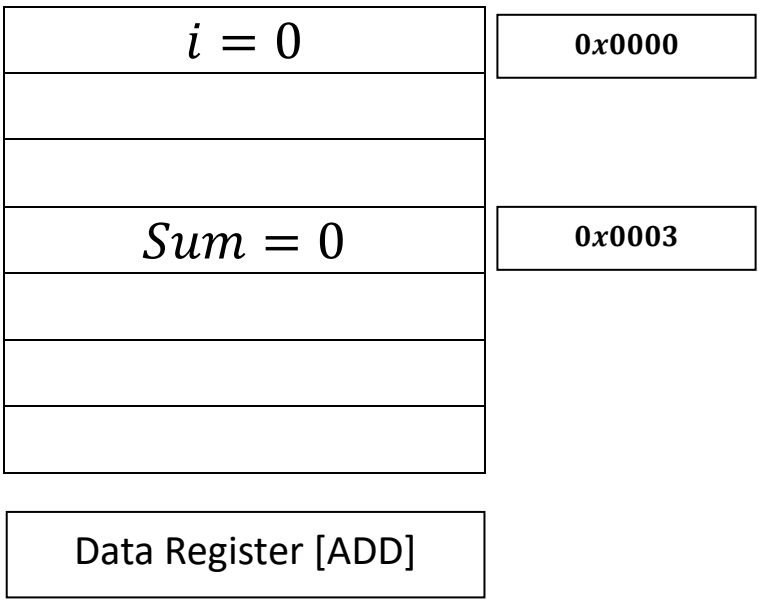
Stack Operation Vs Loop Operation in Memory.

$int\ sum = 0;$

$for(int\ i = 0; i < n; i++)\{$

$sum = sum + i;$

$\}$



Therefore $i\ and\ sum\ will\ get\ popped\ out$

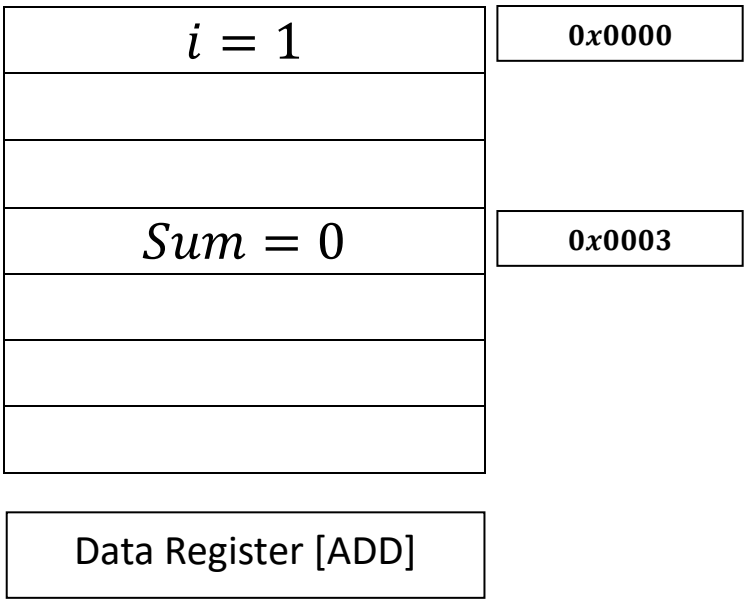
$ADD\ Sum, i\ will\ be\ sent\ to\ Instruction\ register, Along$

$ADD\ i, 1\ i.e\ i = i + 1;$

And we will get $Result = 0\ and\ i = 1,$

$hence\ data\ register\ will\ have\ now\ Sum = 0\ and\ i = 1;$

Push $i = 1\ and\ Sum = 0\ in\ Memory\ Stack$.



Hence the process will continue up to n times at same location. We can state that the statement or operation $sum = sum + i$ runs up to $i = n$ i.e., $n\ times$.

$Generating\ Time\ Complexity : O(n)$.

Where as in Push and Pop operation:

$\underline{Stack\ Push\ Operation\ [Time\ Complexity]}$

$[Single\ Element\ Pushed]$	$\rightarrow O(1)$
$[Single\ Element\ Pushed]$	$\rightarrow O(1)$
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$[Single\ Element\ Pushed]$	$\rightarrow O(1)$
$[Single\ Element\ Pushed]$	$\rightarrow O(1)$
$[Single\ Element\ Pushed]$	$\rightarrow O(1)$
………	
$[Single\ Element\ Pushed]$	$\rightarrow O(1)$

$i.e., Push\ will\ be\ inserted\ at\ each\ Top\ of\ the\ stack.$

$i.e., At\ each\ location\ the\ Push\ operation\ will\ be\ performed\ at\ O(1)\ complexity.$

$Also, if\ we\ see\ there\ is\ lower\ bound\ (1)\ and\ upper\ bound(n\ i.e. size\ of\ the\ stack = n):$

$$1 \leq\ f(n) \leq n$$

***Here if we do average if it runs up to n times*:**

$$\frac{1 + 1 + 1 + 1 \ldots + n\ times}{n} = \frac{n}{n} = 1 = O(1).$$

Stack Pop Operation [Time Complexity]

[***Single Element Popped***]	$\rightarrow O(1)$
[***Single Element Popped***]	$\rightarrow O(1)$
[***Single Element Popped***]	$\rightarrow O(1)$
[***Single Element Popped***]	$\rightarrow O(1)$
[***Single Element Popped***]	$\rightarrow O(1)$
[***Single Element Popped***]	$\rightarrow O(1)$
.....	
[***Single Element Popped***]	$\rightarrow O(1)$

i.e., Pop of element will be done at each Top (First Element) of the stack.

i.e., At each location the Pop operation will be performed at $O(1)$ complexity.

$$\boldsymbol{Also, if\ we\ see\ there\ is\ lower\ bound\ (1)\ and\ upper\ bound(n\ i.e.\ size\ of\ the\ stack = n):}$$

$$\boldsymbol{1 \leq \ \ f(n) \leq n}$$

$$\boldsymbol{Here\ if\ we\ do\ average\ if\ it\ runs\ up\ to\ n\ times:}$$

$$\frac{\boldsymbol{1 + 1 + 1 + 1 \ldots + n\ times}}{\boldsymbol{n}} = \frac{\boldsymbol{n}}{\boldsymbol{n}} = \boldsymbol{1 = O(1).}$$

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