Analysis of Insertion Sort Algorithm

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1 Overview

The following pseudocode and math is from Introduction to Algorithms by CLRS. Insertion sort algorithm is an inplace sorting algorithm which we will analyze for best and worst case scenarios.

INSERTION-SORT(A)	*cost*	*times*
1: **for** $j = 2$ **to** $A.length$	c_1	n
2: $key = A[j]$	c_2	$n-1$
3: // Insert $A[j]$ to the sorted sequence $A[1..j-1]$	0	$n-1$
4: $i = j - 1$	c_4	$n-1$
5: **while** $i > 0$ **and** $A[i] > key$	c_5	$\sum_{j=2}^{n} t_j$
6: $A[i+1] = A[i]$	c_6	$\sum_{j=2}^{n}(t_j - 1)$
7: $i = i - 1$	c_7	$\sum_{j=2}^{n}(t_j - 1)$
8: $A[i+1] = key$	c_8	$n-1$

2 Analysis

The above pseudocode also has 2 columns where each row lists cost of a single step of computation and how many times that computation is carried out. To compute *T(n)*, the runniing time of INSERTION-SORT on an input of n values, we sum the products of the *cost* and *times* columns, obtaining