Exercise 1: Computational Complexity

1.PrefixAverages1 uses two loops whilst PrefixAverages2 uses one loop. The second one computes the sum of elements by adding a new element to the current sum whereas the first one computes it in a separate loop starting from the first element every time.

2.Time complexity:

PrefixAverages1: O(n^2).

PrefixAverages2: O(n).

PrefixAverages2 is more effective algorithm.

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Algorithm 4.1. PrefixAverages1(X)
 1) Let A = an empty 1-D numerical array of size n // n
 2) For i = 0 to n-1 // 2n + 2
 3)     Let s = X[0] // n
 4)     For j = 1 to n-1 // n * (2n)
 5)         If j ≤ i Then //n*(n-1)
 6)             Let s = s + X[j] //n*(n-1)
 7)         End If
 8)     End For
 9)     Let A[i] = s /(i+1)// 3n
10) End For
T(n) = n + 2n + 2 + n + 2n^2 + n^2 – n + n^2 – n + 3n =
= 4n^2 + 5n + 2;


Algorithm 4.2. PrefixAverages2(X)
1) Let A = an empty 1-D numerical array of size n // n
2) Let s = 0 // 1
3) For i = 0 to n-1 // 2n + 2
4)     Let s = s + X[i] // 2n
5)     Let A[i] = s / (i+1) //3n
6) End For
T(n) = n + 1 + 2n + 2 + 2n + 3n = 8n + 3;
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Exercise 2: Implementation

N	Time is sec	
10000	0,079	0,001
50000	1,718	0,001
100000	7,08	0,003
200000	46,686	0,004
250000	70,901	0,005