UNIVERSIDAD DE GRANADA

ALGORITMICA

PRACTICA 1: EFICIENCIA DE ALGORITMOS

INDICE

ALGORITMICA – PRACTICA 1

ALGORITMOS DE EFICIENCIA O(n²)

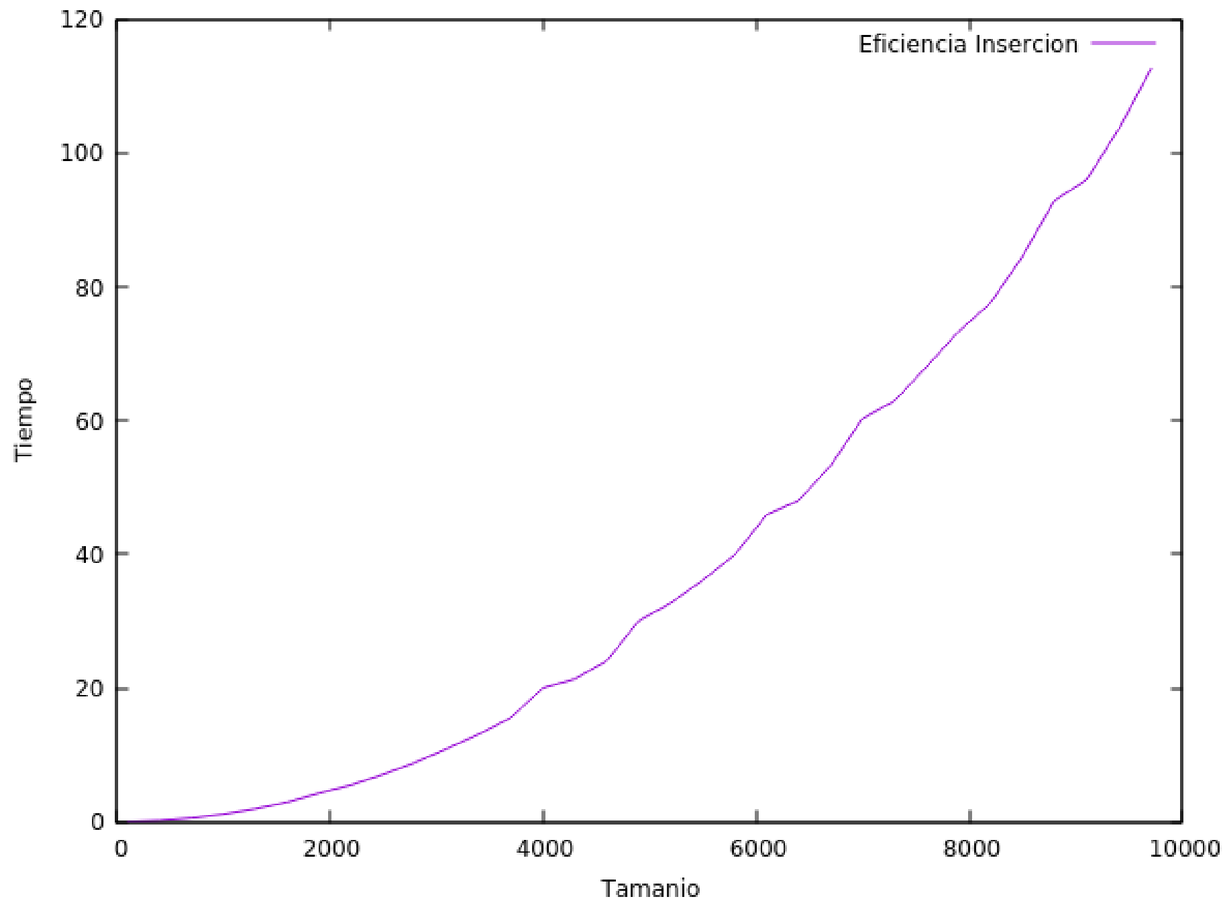
ALGORITMICA – PRACTICA 1

```
static void insercion_lims(int T[], int inicial, int final)
{
  int i, j;
  int aux;
  for (i = inicial + 1; i < final; i++) {                    O(n²)
    j = i;
    while ((T[j] < T[j-1]) && (j > 0)) {                     O(n)
      aux = T[j];
      T[j] = T[j-1];
      T[j-1] = aux;
      j--;
    }
  }
}
```

ALGORITMO DE INSERCIÓN

Eficiencia empírica

Tamaño	Tiempo(ms)
100	0,018997
400	0,201002
700	0,579019
1000	1,15315
1300	1,94089
1600	2,92321
1900	4,27198
2200	5,51283
2500	7,10065
2800	8,87176
3100	10,9348
3400	13,1025
3700	15,589
4000	19,9958
4300	21,3625
4600	24,0529
4900	30,0697
5200	32,7272
5500	36,1417
5800	39,9314
6100	45,9216
6400	48,0513
6700	53,2654
7000	60,3208
7300	62,9419
7600	68,0132
7900	73,2851
8200	77,5785
8500	84,5497
8800	92,9203
9100	95,9472
9400	103,526
9700	112,564

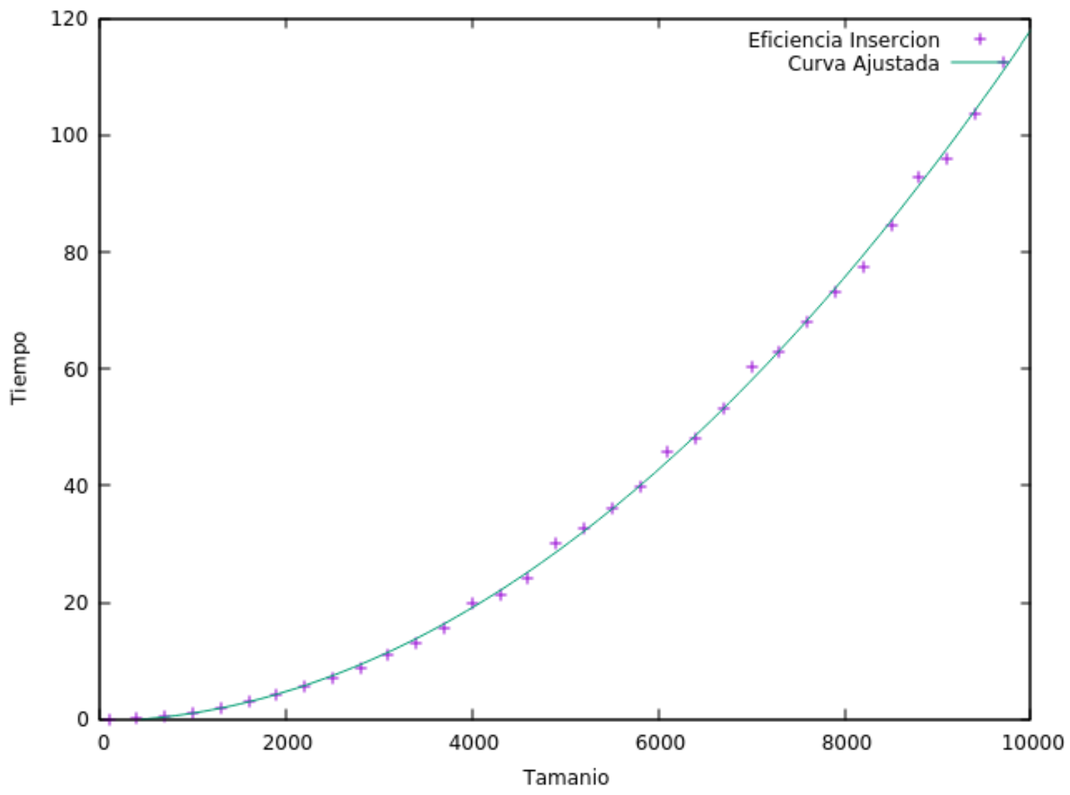


ALGORITMO DE INSERCIÓN

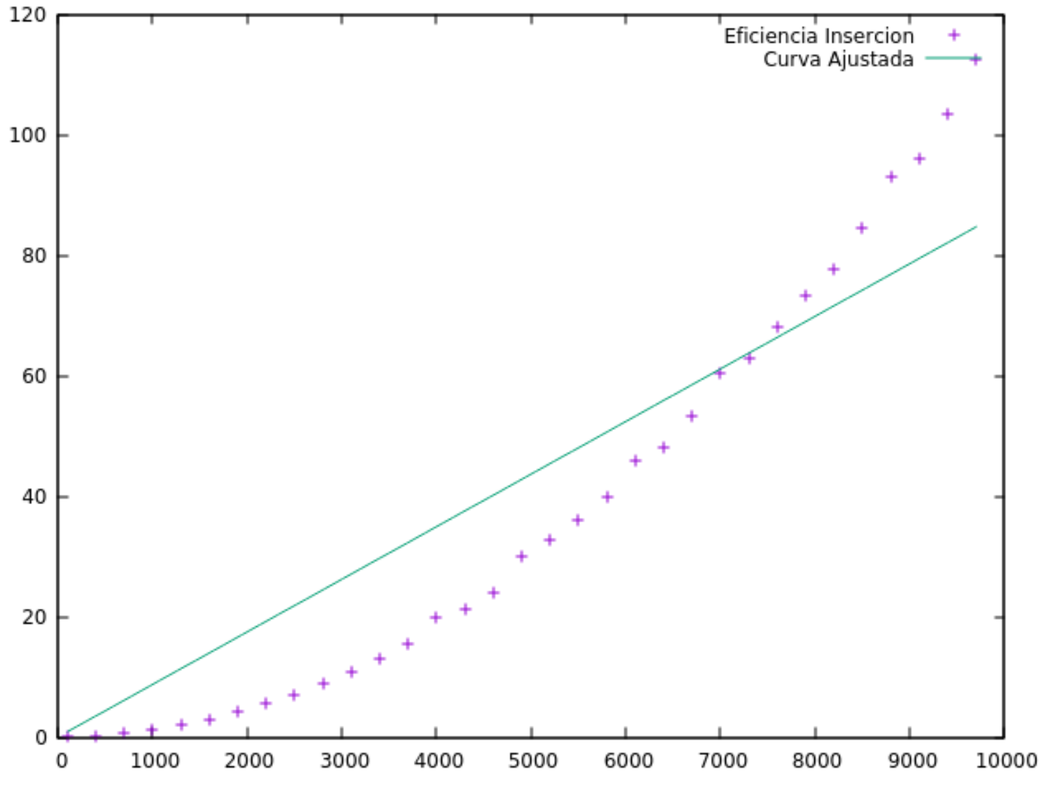
Eficiencia híbrida

function used for fitting: f(x)=a0*x*x+a1*x+a2

Final set of parameters		Asymptotic Standard Error	
a0	= 1.15966e-06	+/- 2.343e-08	(2.021%)
a1	= 0.000220519	+/- 0.0002373	(107.6%)
a2	= -0.345331	+/- 0.5029	(145.6%)



Ajuste correcto

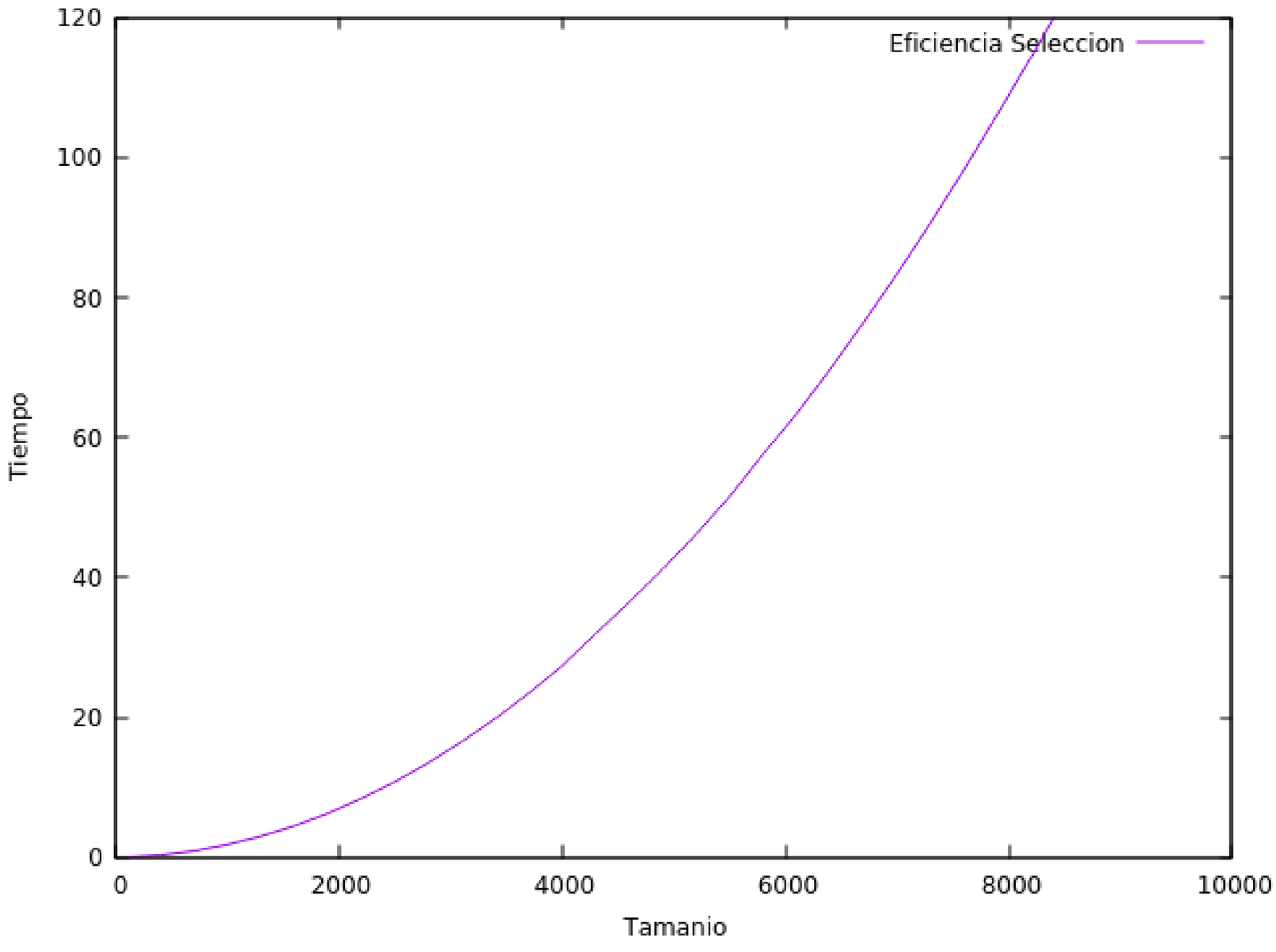


Ajuste con orden lineal

ALGORITMO DE SELECCIÓN

Eficiencia empírica

Tamaño	Tiempo(ms)
100	0,029747
400	0,303136
700	0,892665
1000	1,78741
1300	2,98411
1600	4,47788
1900	6,26304
2200	8,36624
2500	10,7788
2800	13,4803
3100	16,4879
3400	19,808
3700	23,4211
4000	27,3599
4300	31,9379
4600	36,423
4900	41,1592
5200	46,1751
5500	51,5625
5800	57,6133
6100	63,3416
6400	69,7053
6700	76,4284
7000	83,3656
7300	90,6833
7600	98,2396
7900	106,173
8200	114,341
8500	122,9
8800	132,758
9100	141,336
9400	152,435
9700	161,066

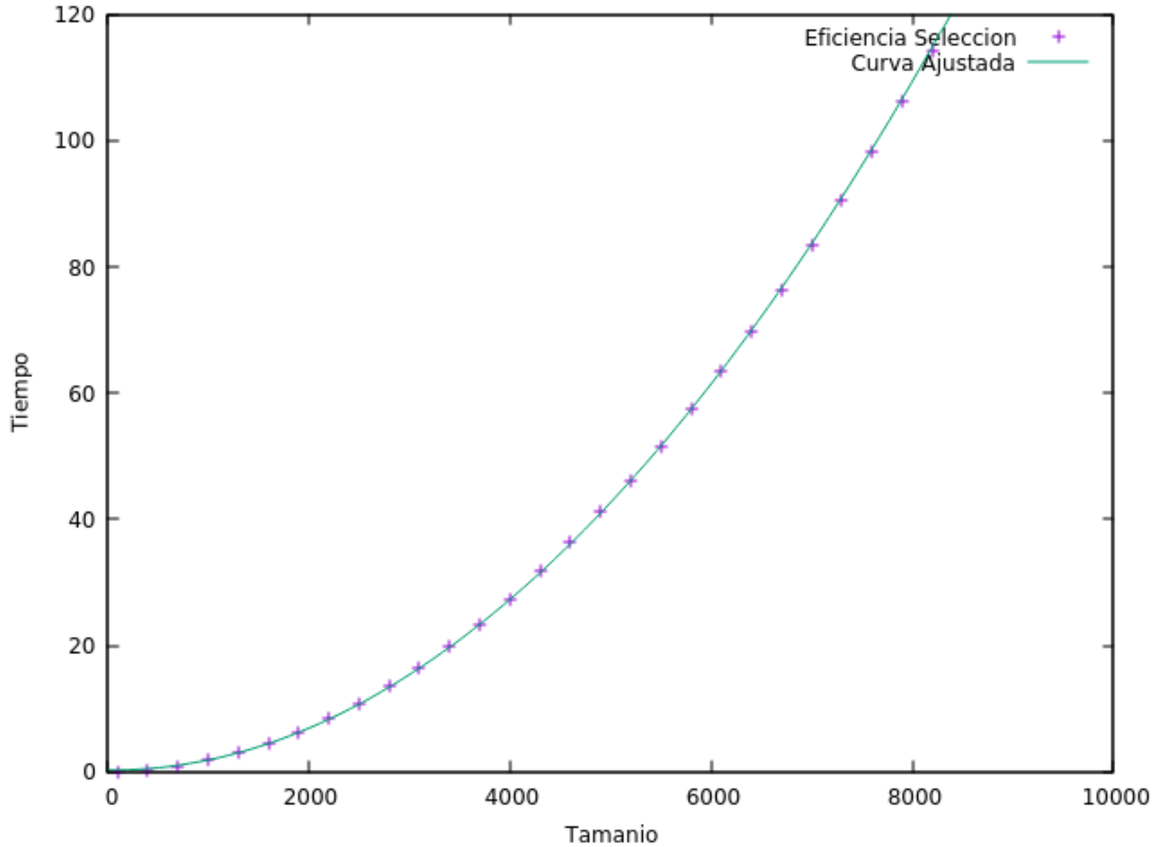


ALGORITMO DE SELECCIÓN

Eficiencia híbrida

function used for fitting: f(x)=a0*x*x+a1*x+a2

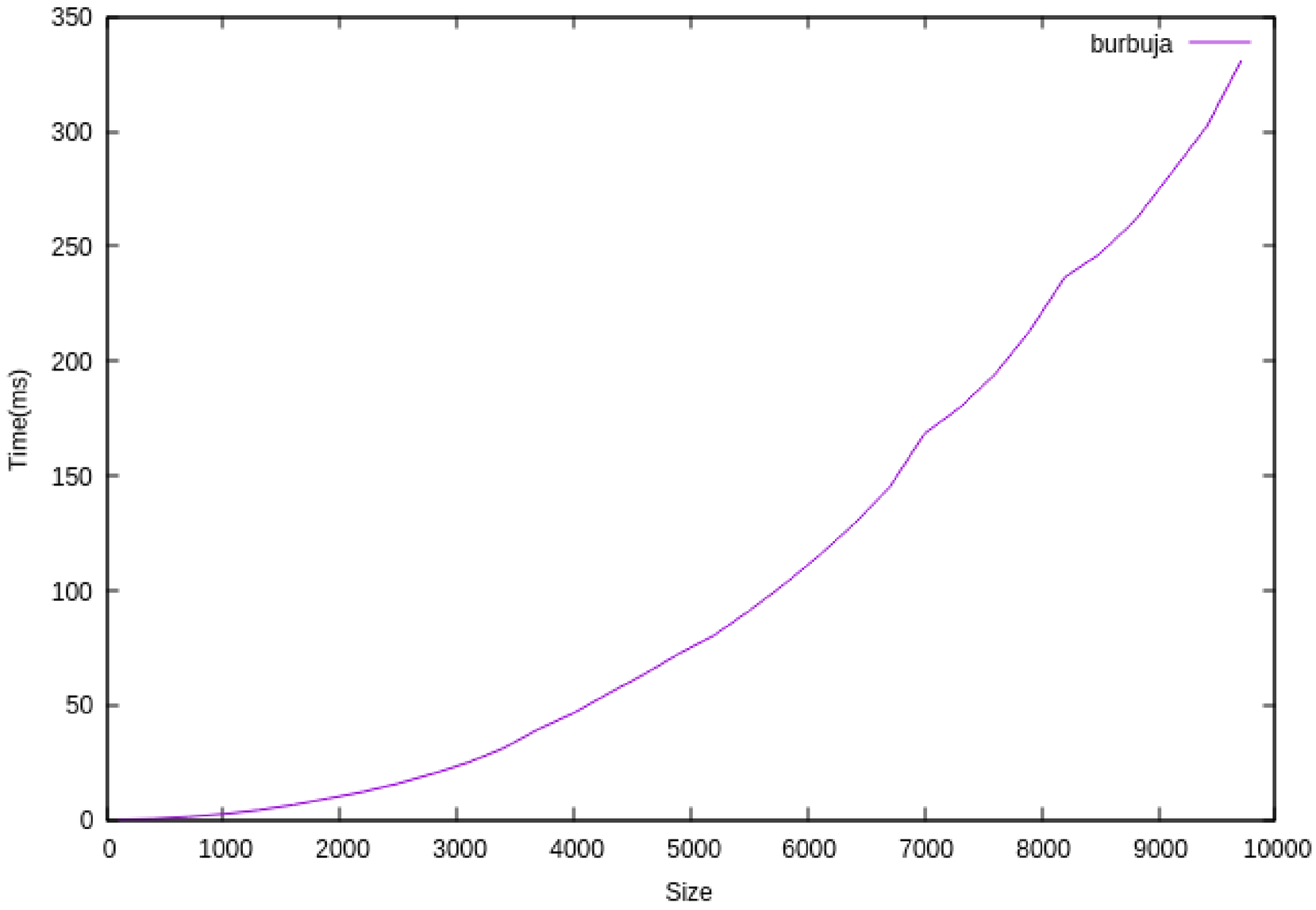
Final set of parameters		Asymptotic Standard Error	
a0	= 1.72088e-06	+/- 8.671e-09	(0.5039%)
a1	= -0.000131272	+/- 8.781e-05	(66.89%)
a2	= 0.254852	+/- 0.1861	(73.02%)



ALGORITMO DE ORDENACIÓN BURBUJA

Eficiencia empírica

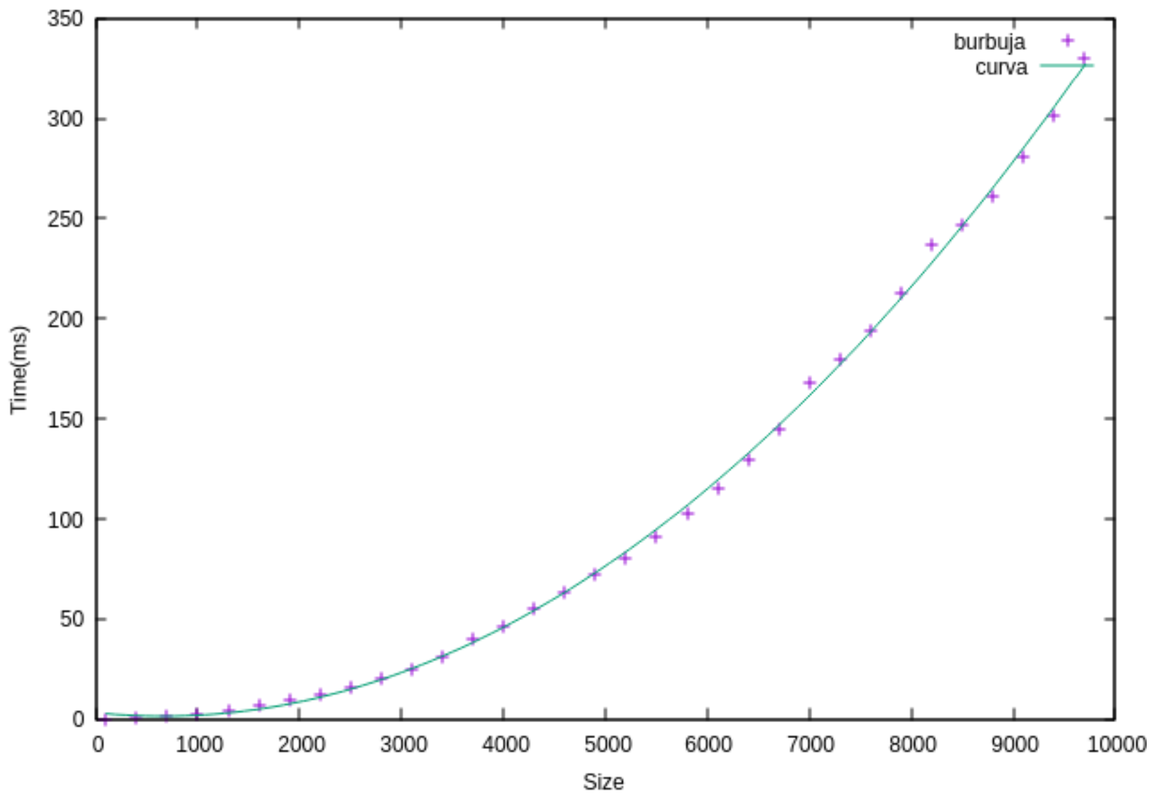
Tamaño	Tiempo(ms)
100	0,044867
400	0,451264
700	1,30026
1000	2,58446
1300	4,28663
1600	6,49397
1900	9,41792
2200	12,2197
2500	15,8972
2800	20,1811
3100	25,1522
3400	31,2958
3700	39,6335
4000	46,5931
4300	55,1726
4600	63,4595
4900	72,4835
5200	80,4542
5500	91,2036
5800	102,721
6100	115,294
6400	129,133
6700	144,983
7000	168,32
7300	179,576
7600	194,109
7900	213,047
8200	236,498
8500	246,749
8800	261,183
9100	281,075
9400	301,282
9700	330,404



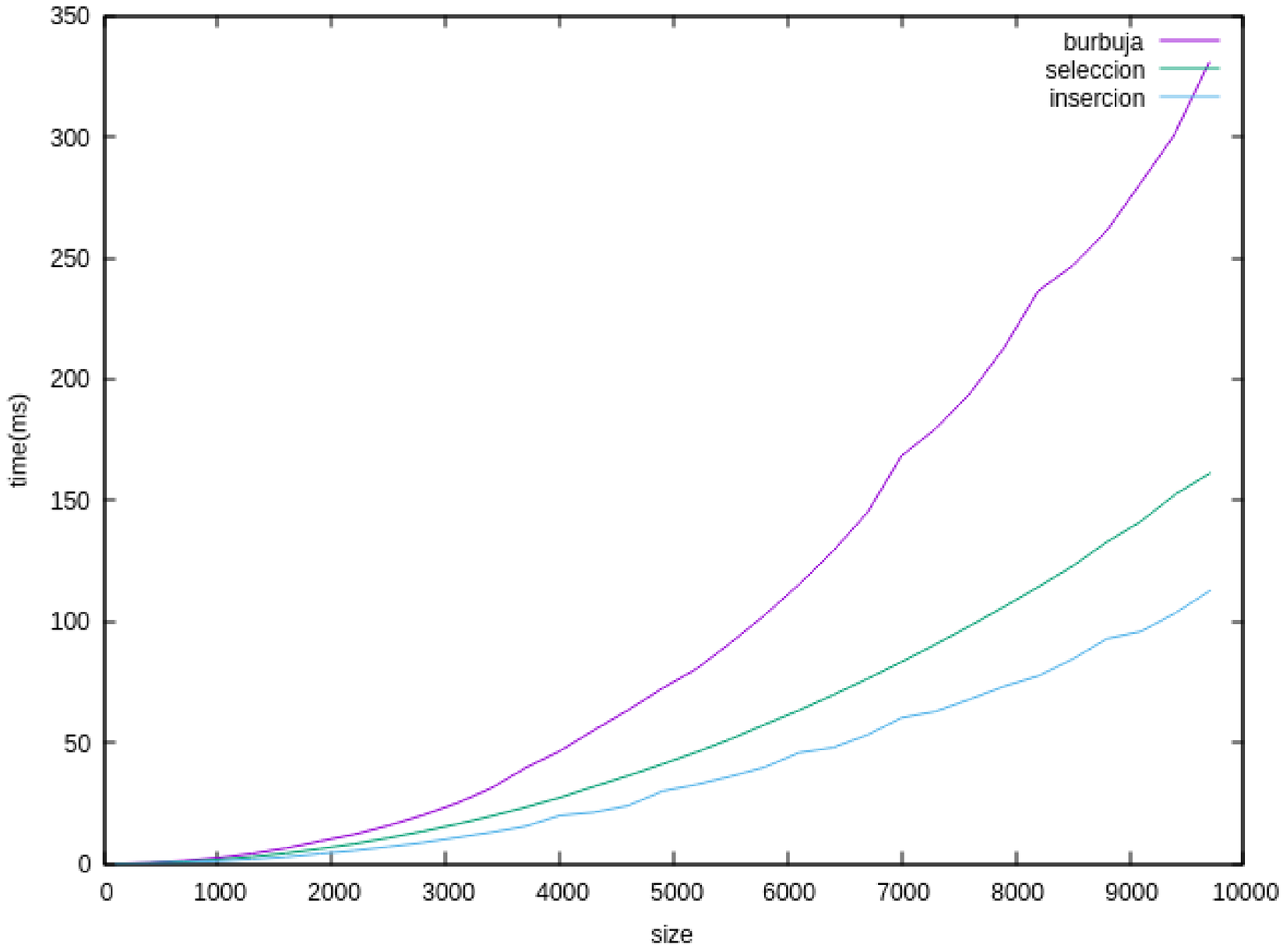
ALGORITMO DE ORDENACIÓN BURBUJA

Eficiencia híbrida

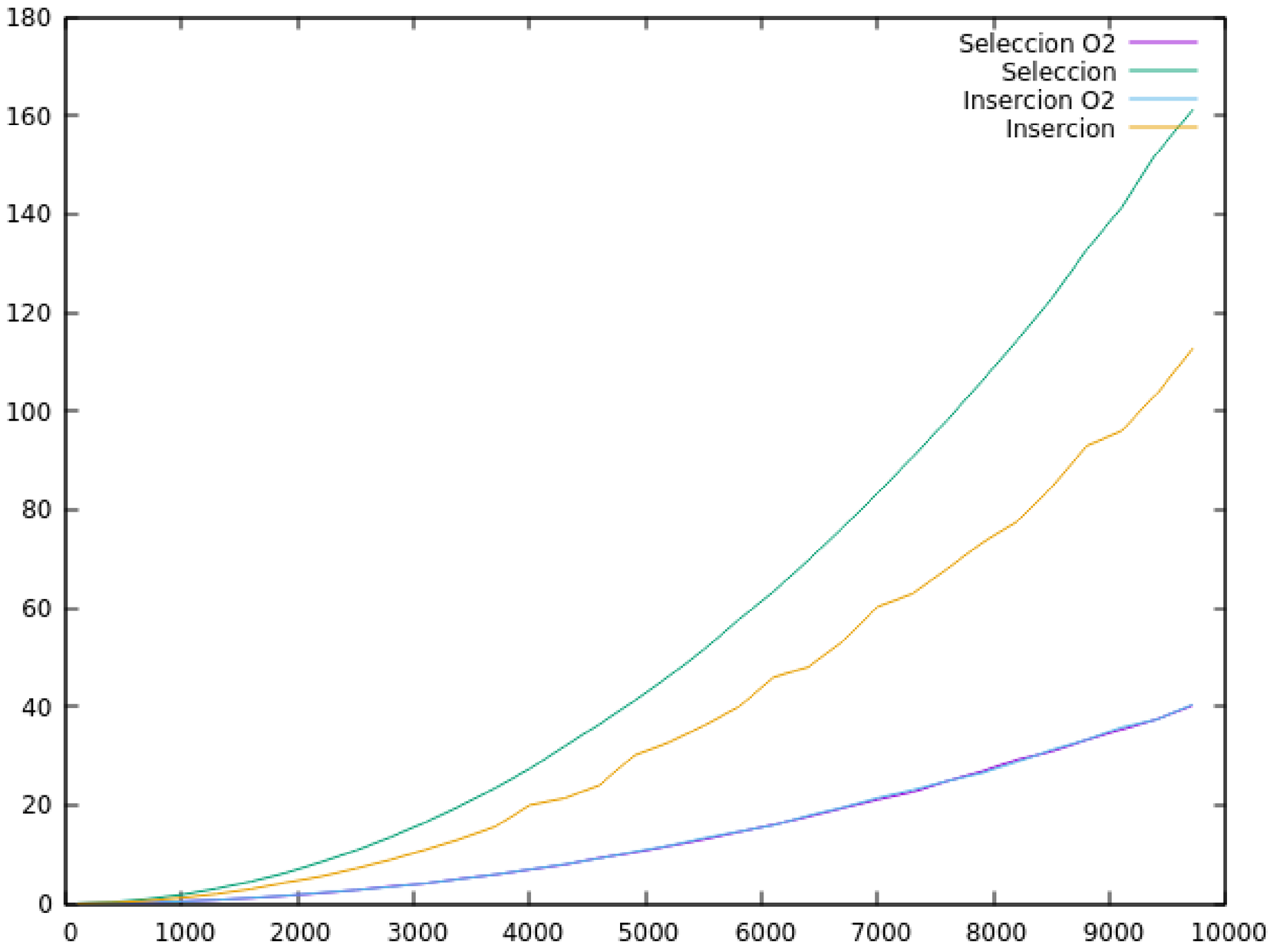
function used for fitting: f(x)=a0*x*x+a1*x+a2
Final set of parameters Asymptotic Standard Error
==========
a0 = 3.98334e-06 +/- 7.47e-08 (1.875%)
a1 = -0.00527518 +/- 0.0007565 (14.34%)
a2 = 3.24064 +/- 1.603 (49.47%)



COMPARATIVA DE ÓRDENES CUADRÁTICOS



COMPARATIVAS CON -O2



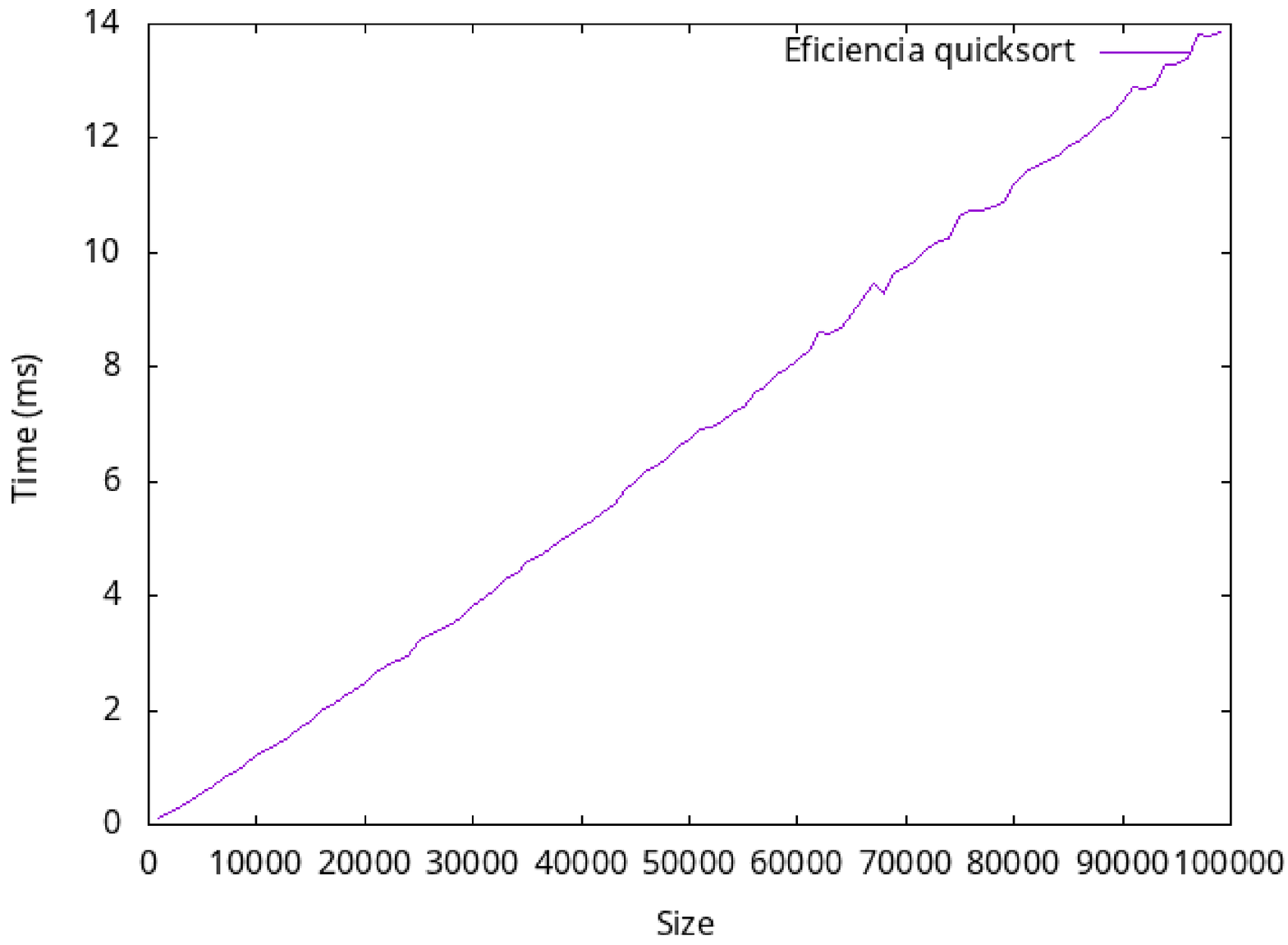
ALGORITMOS O(n log(n))

```
static void quicksort_lims(int T[], int inicial, int final)
{
  int k;
  if (final - inicial < UMBRAL_QS) {
          insercion_lims(T, inicial, final);
  } else {
          dividir_qs(T, inicial, final, k);          O(n)
          quicksort_lims(T, inicial, k);
          quicksort_lims(T, k + 1, final);           O(log n)
  };
}
```

ALGORITMO QUICKSORT

Eficiencia empírica

Tamaño	Tiempo(ms)
1000	0,09226578
4000	0,44128881
7000	0,80291796
10000	1,1955096
13000	1,5312903
16000	1,9718562
19000	2,3324038
22000	2,7493278
25000	3,230856
28000	3,4983627
31000	3,9762733
34000	4,4020308
37000	4,8190289
40000	5,2258262
43000	5,5833395
46000	6,2023307
49000	6,6151365
52000	6,954689
55000	7,3037725
58000	7,8652237
61000	8,2770307
64000	8,6958086
67000	9,4626056
70000	9,7636351
73000	10,1969965
76000	10,733433
79000	10,886826
82000	11,512773
85000	11,869777
88000	12,291895
91000	12,891397
94000	13,286371
97000	13,818452

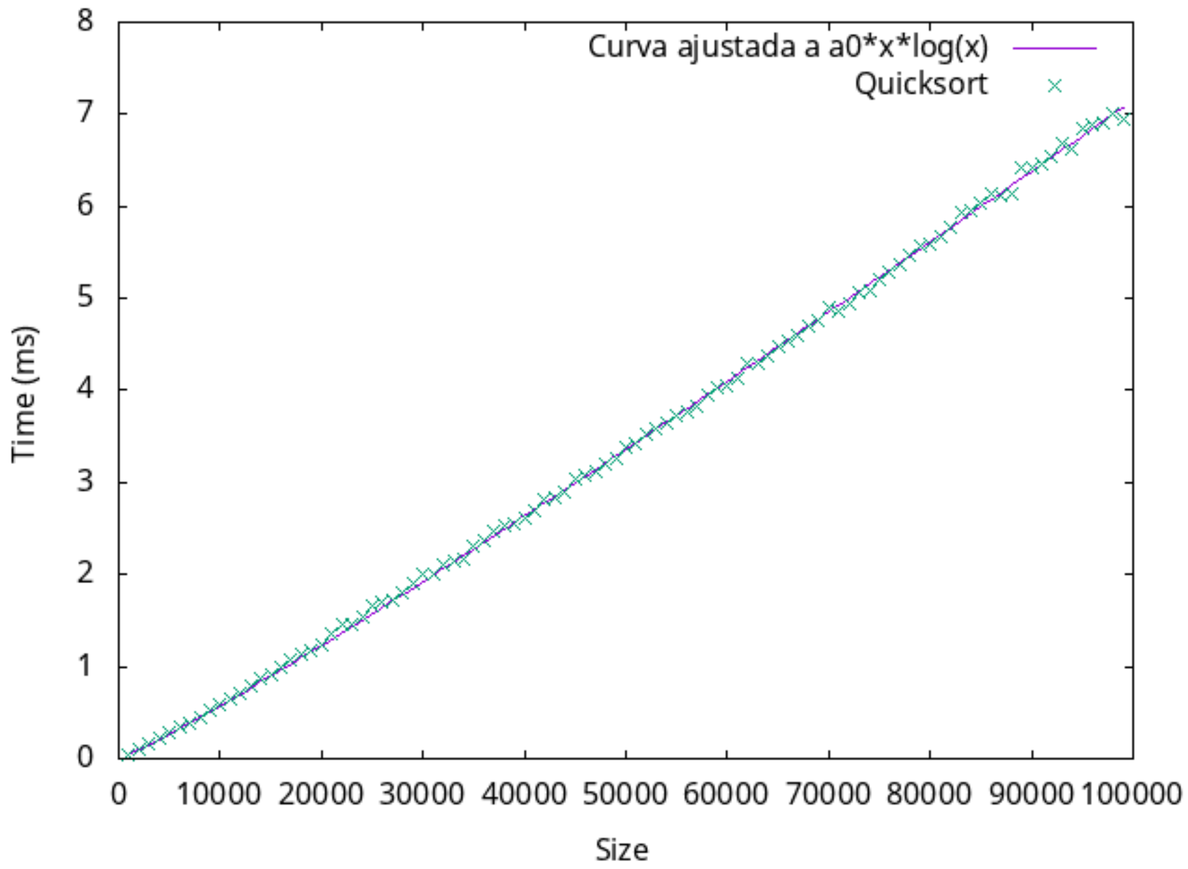


ALGORITMO DE QUICKSORT

Eficiencia híbrida

function used for fitting: f(x) = a0*x*log(x)

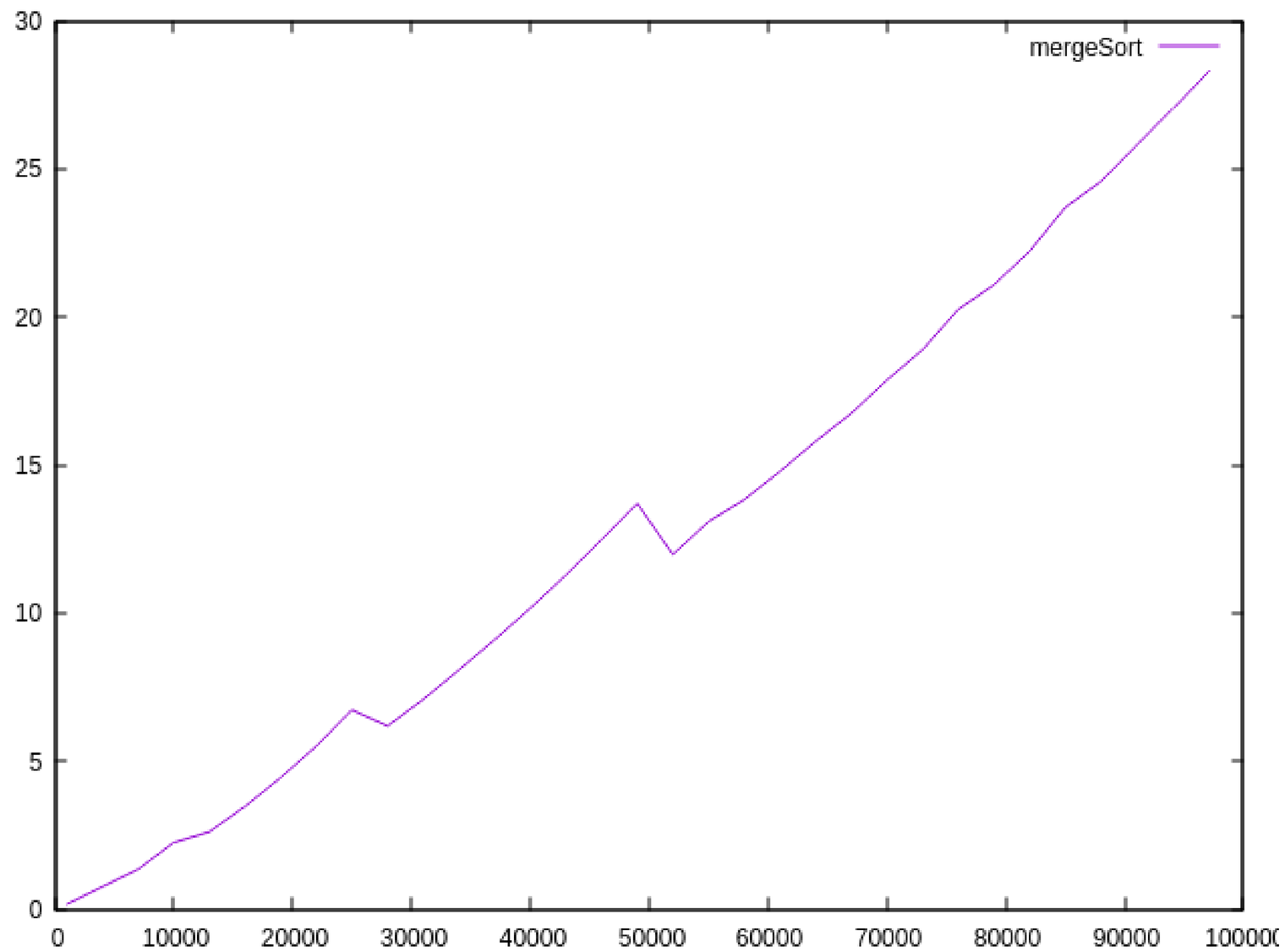
Final set of parameters		Asymptotic Standard Error
a0	= 6.21492e-06	+/- 6.51e-09 (0.1047%)



ALGORITMO MERGESORT

Eficiencia empírica

Tamaño	Tiempo(ms)
1000	0,054742
4000	0,223404
7000	0,333123
10000	0,468899
13000	0,69822
16000	0,847162
19000	1,01421
22000	1,1943
25000	1,85262
28000	1,70086
31000	1,83628
34000	2,01396
37000	2,182
40000	2,36243
43000	2,55231
46000	2,7582
49000	2,96541
52000	3,49397
55000	3,68855
58000	3,83114
61000	4,07245
64000	4,23567
67000	4,39933
70000	4,70587
73000	5,24299
76000	5,26641
79000	5,52066
82000	5,79934
85000	6,0796
88000	6,09011
91000	5,9936
94000	6,19331
97000	6,36997

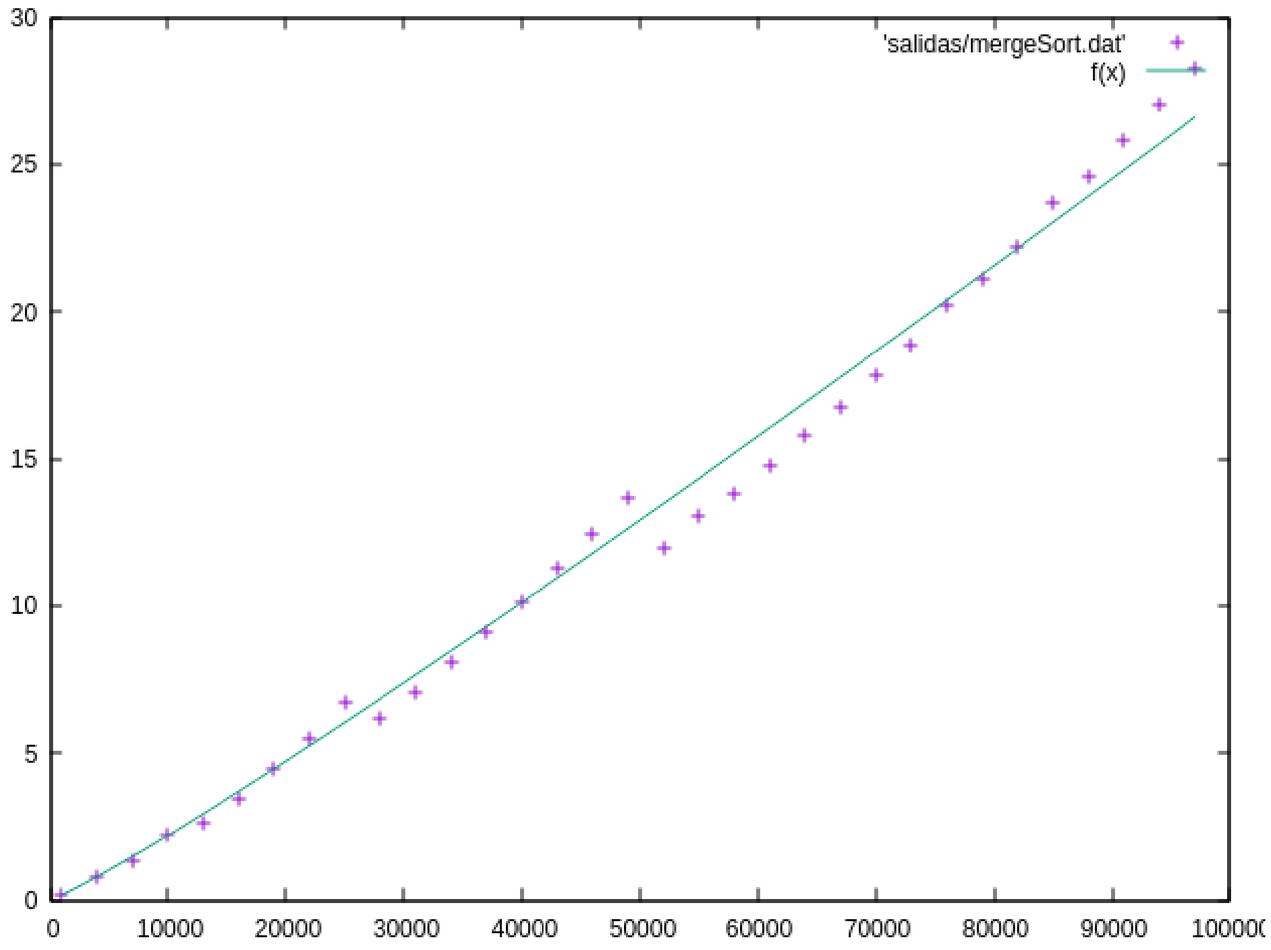


ALGORITMO MERGESORT

Eficiencia híbrida

function used for fitting: f(x)=a0*x*log(x)

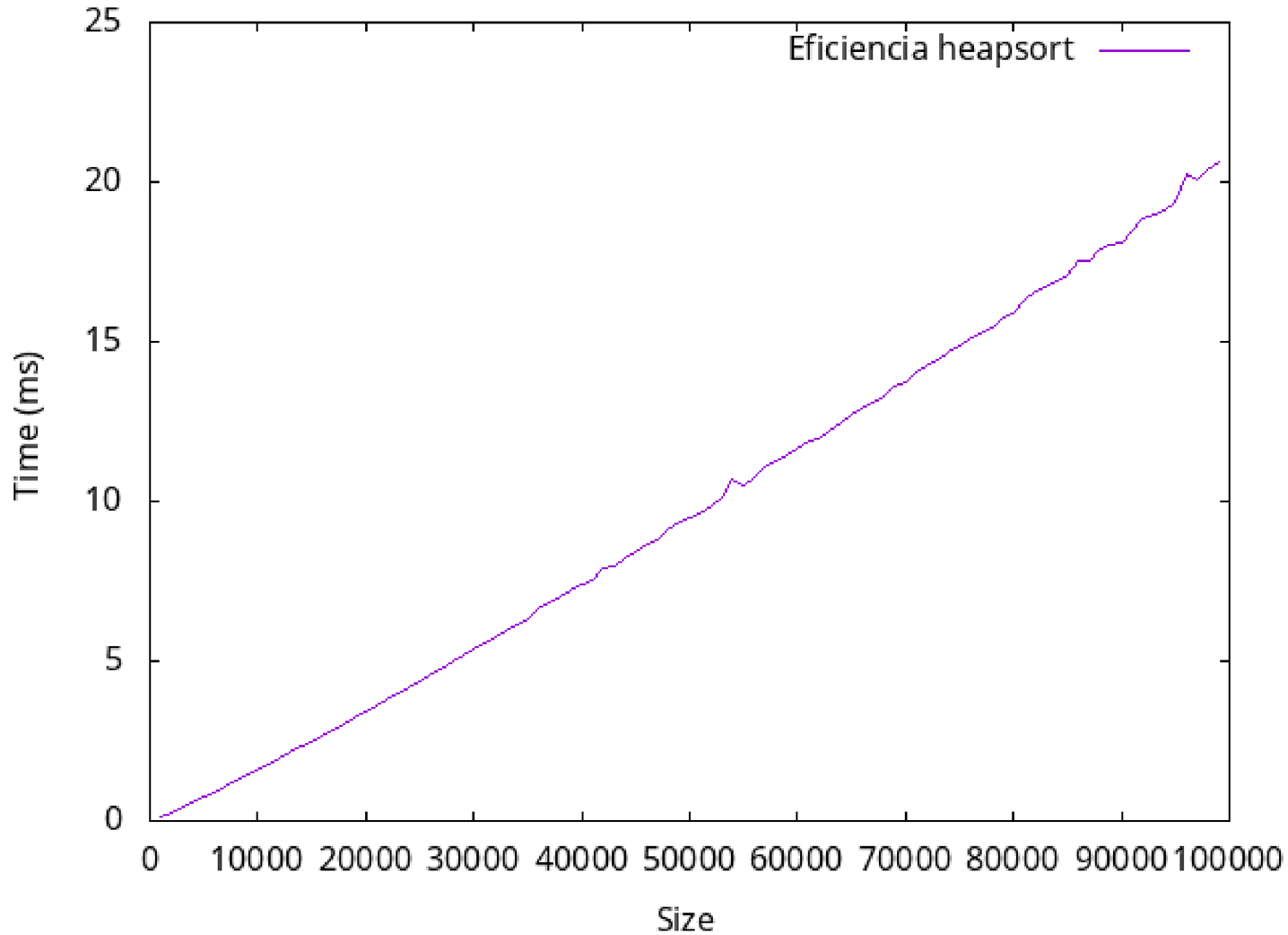
Final set of parameters		Asymptotic Standard Error
a0	= 2.38757e-05	+/- 2.2e-07 (0.9213%)



ALGORITMO HEAPSHORT

Eficiencia empírica

Tamaño	Tiempo(ms)
1000	0,12037841
4000	0,58227857
7000	1,0864724
10000	1,5936302
13000	2,1490249
16000	2,6596617
19000	3,2007926
22000	3,7901708
25000	4,3649581
28000	5,0197501
31000	5,5643928
34000	6,1455152
37000	6,848974
40000	7,4264587
43000	7,9935542
46000	8,6506421
49000	9,3451443
52000	9,8565943
55000	10,491525
58000	11,2557
61000	11,882194
64000	12,473078
67000	13,07127
70000	13,734465
73000	14,461762
76000	15,109737
79000	15,771536
82000	16,610012
85000	17,103487
88000	17,909018
91000	18,471557
94000	19,094739
97000	20,068536

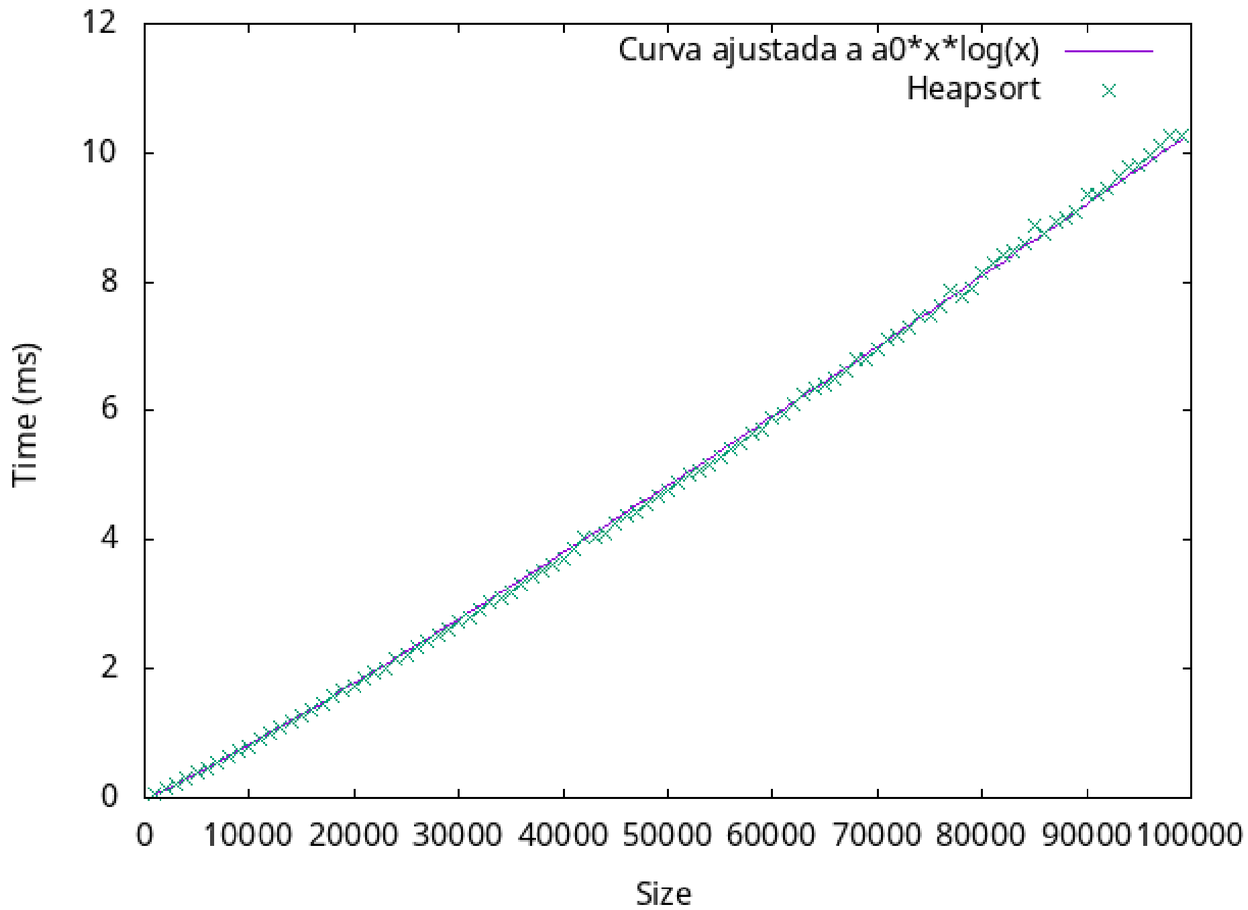


ALGORITMO HEAPSHORT

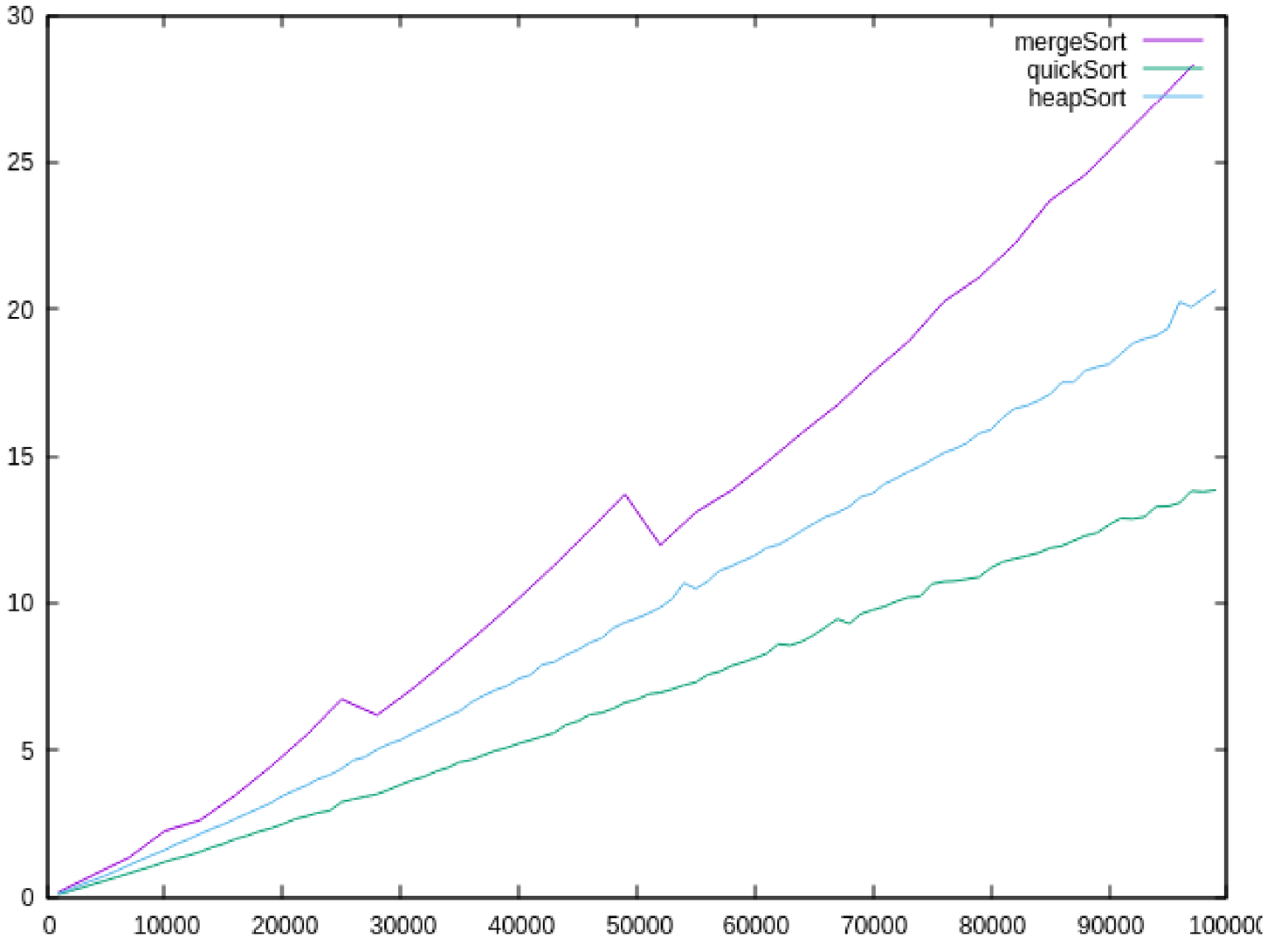
Eficiencia híbrida

function used for fitting: f(x)=a0*x*log(x)

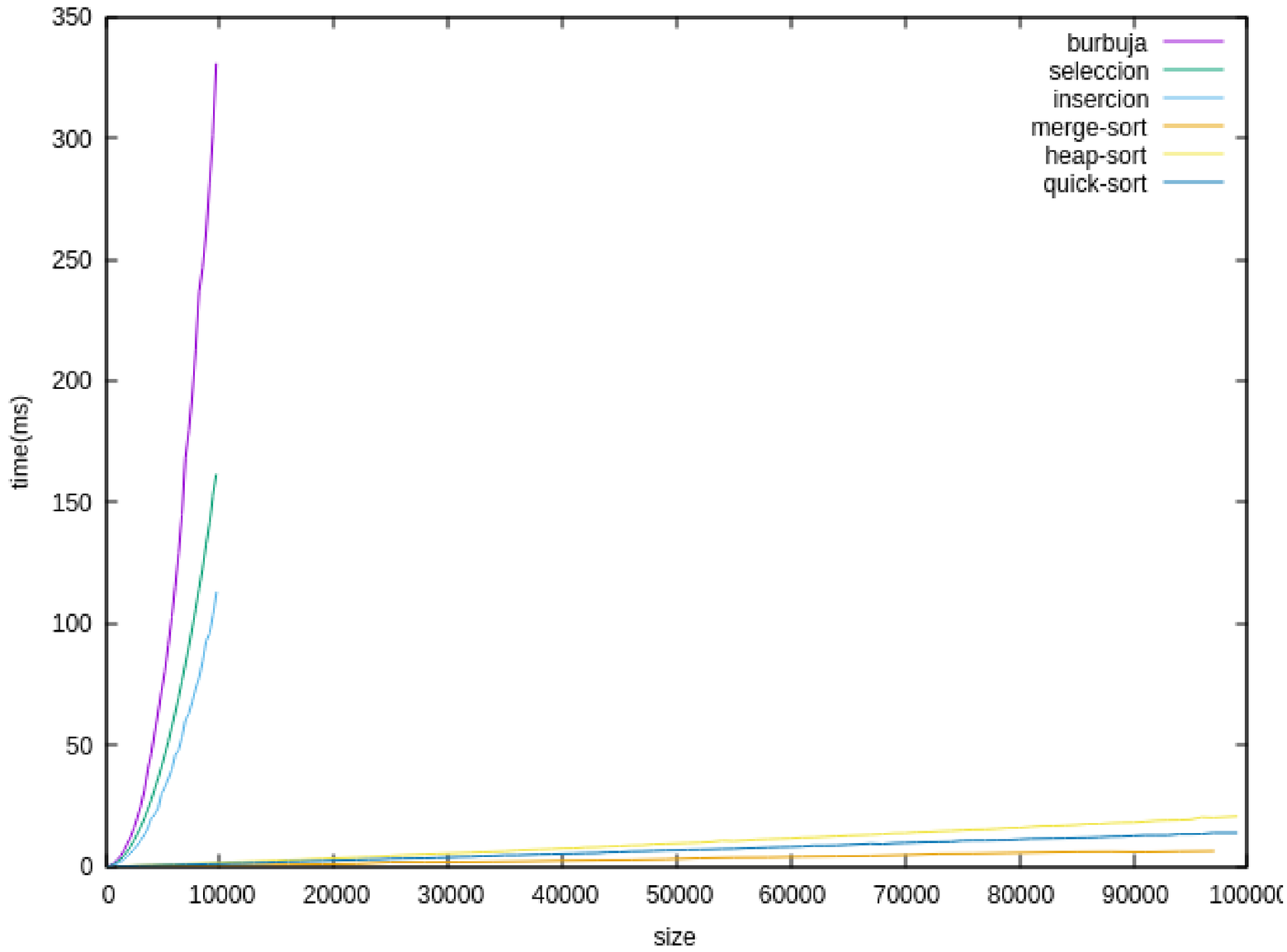
Final set of parameters		Asymptotic Standard Error
a0	= 8.9647e-06	+/- 1.051e-08(0.1172%)



COMPARATIVA ALGORITMOS DE ORDEN CUASILINEAL



COMPARATIVA O(n²) y O(n log(n))



ALGORITMO DE FLOYD: $O(n^3)$

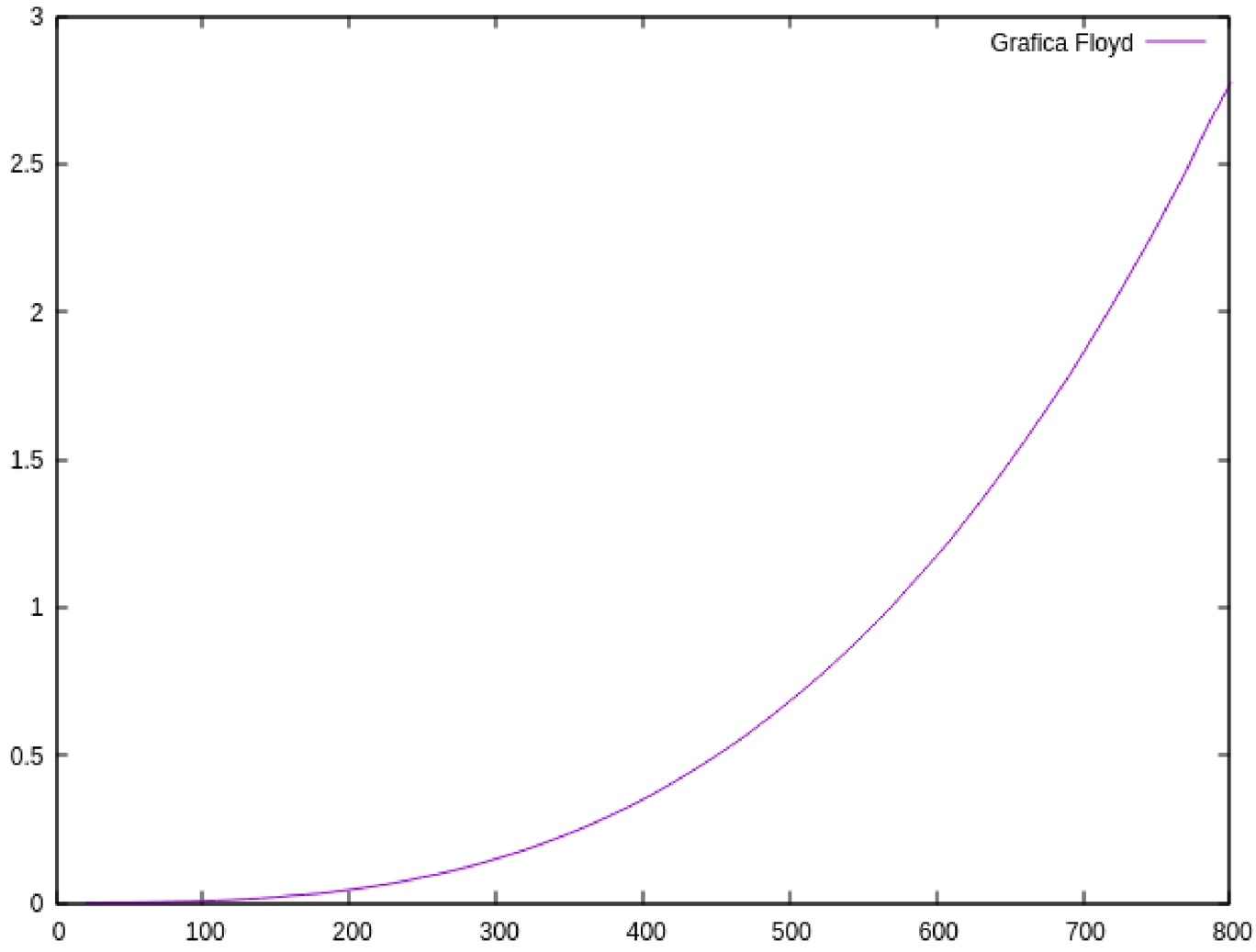
ALGORITMICA – PRACTICA 1

```
void Floyd(int **M, int dim) {
  for (int k = 0; k < dim; k++)                          O(n³)
    for (int i = 0; i < dim;i++)                    O(n²)
      for (int j = 0; j < dim;j++) {          O(n)
        int sum = M[i][k] + M[k][j];
        M[i][j] = (M[i][j] > sum) ? sum : M[i][j];
      }
}
```

ALGORITMO DE FLOYD

Eficiencia empírica

Tamaño	Tiempo(seg)
20	0.000166
30	0.00035
40	0.000871
100	0.00638
110	0.007595
120	0.01062
130	0.01294
200	0.044344
210	0.051193
220	0.058786
300	0.148222
310	0.163352
320	0.179883
400	0.35182
410	0.378203
420	0.406157
430	0.436645
500	0.683943
510	0.724357
520	0.765658
600	1.17276
610	1.23703
620	1.29764
700	1.8663
710	1.94651
720	2.02504
780	2.58089
790	2.69022
800	2.78273

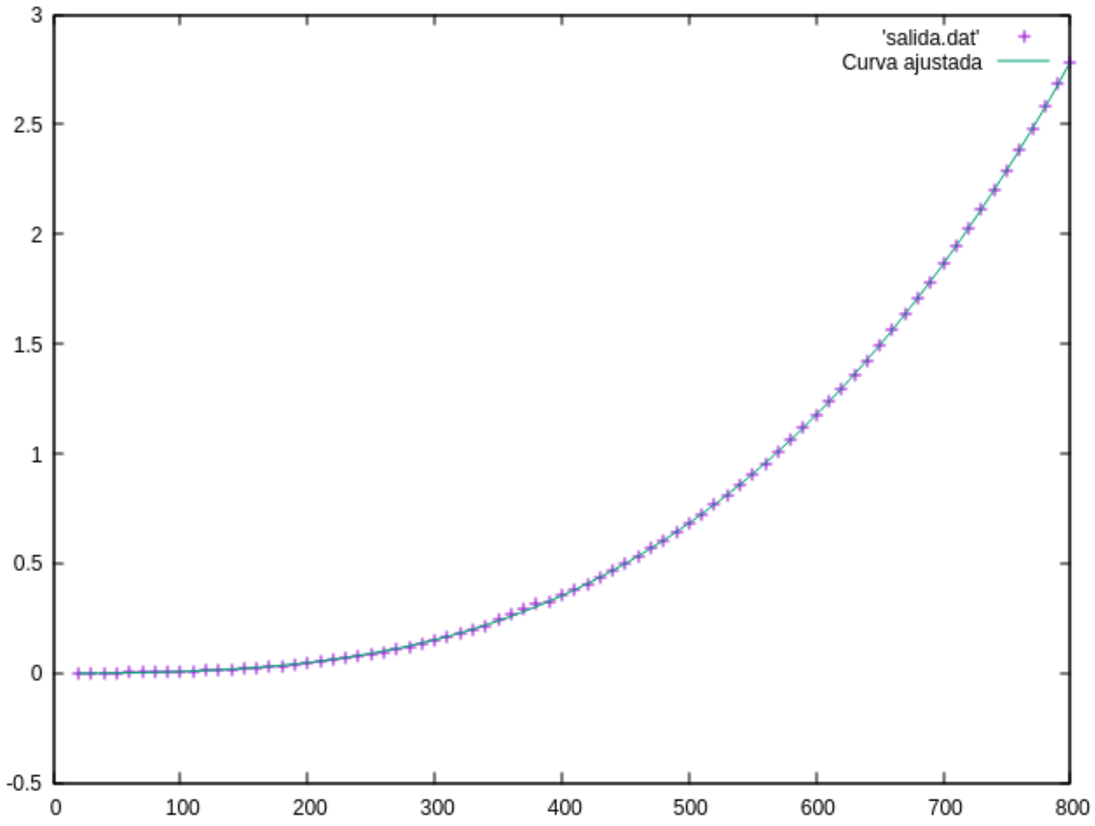


ALGORITMO DE FLOYD

Eficiencia híbrida

*function used for fitting: f(x)=a0*x*x*x+a1*x*x+a2*x+a3*

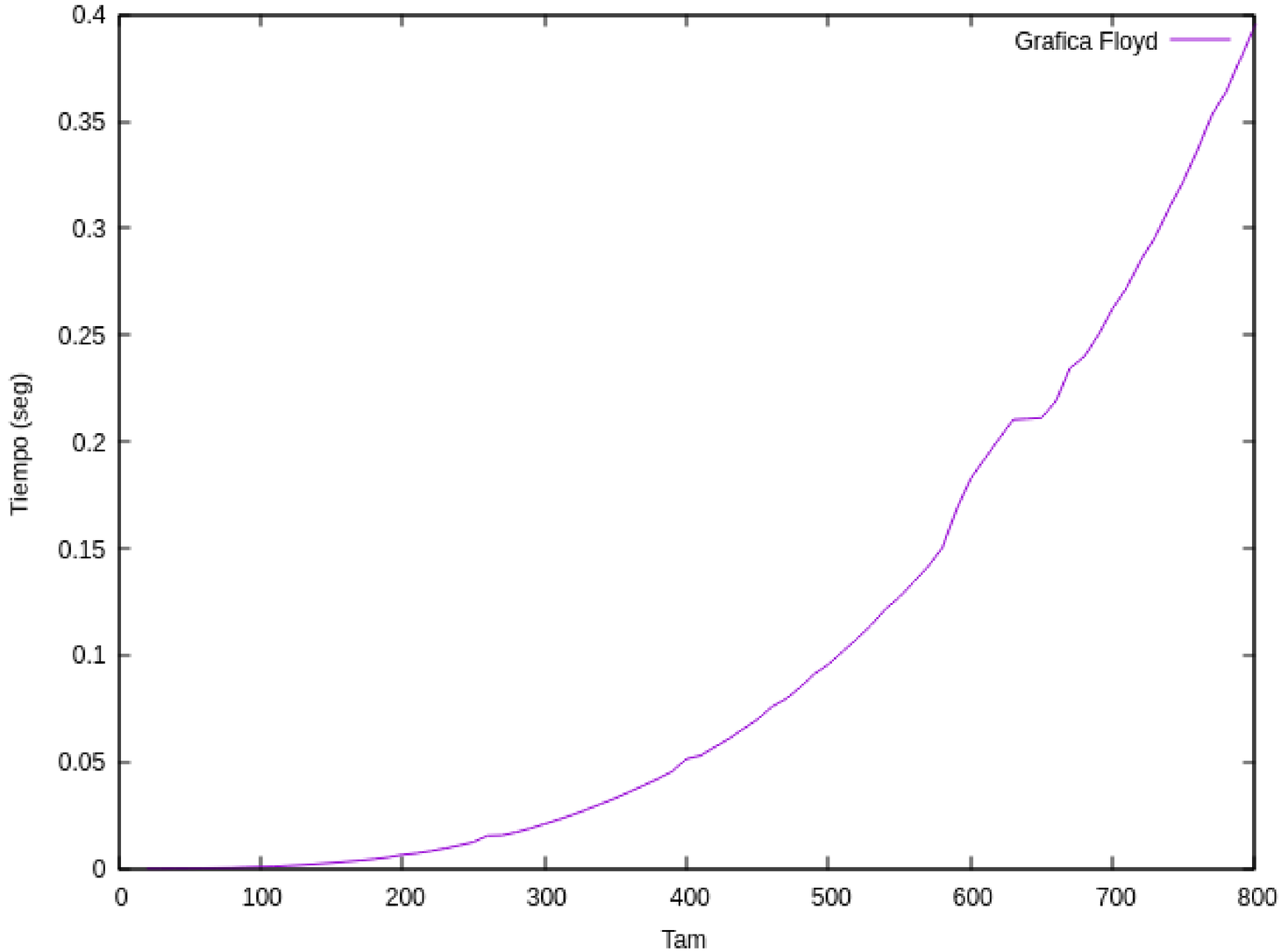
Final set of parameters	*Asymptotic Standard Error*
a0 = 5.48785e-09	*+/- 4.583e-11 (0.8351%)*
a1 = -1.03719e-07	*+/- 5.711e-08 (55.06%)*
a2 = 5.12045e-05	*+/- 2.036e-05 (39.75%)*
a3 = -0.00312988	*+/- 0.001966 (62.81%)*



ALGORITMO DE FLOYD

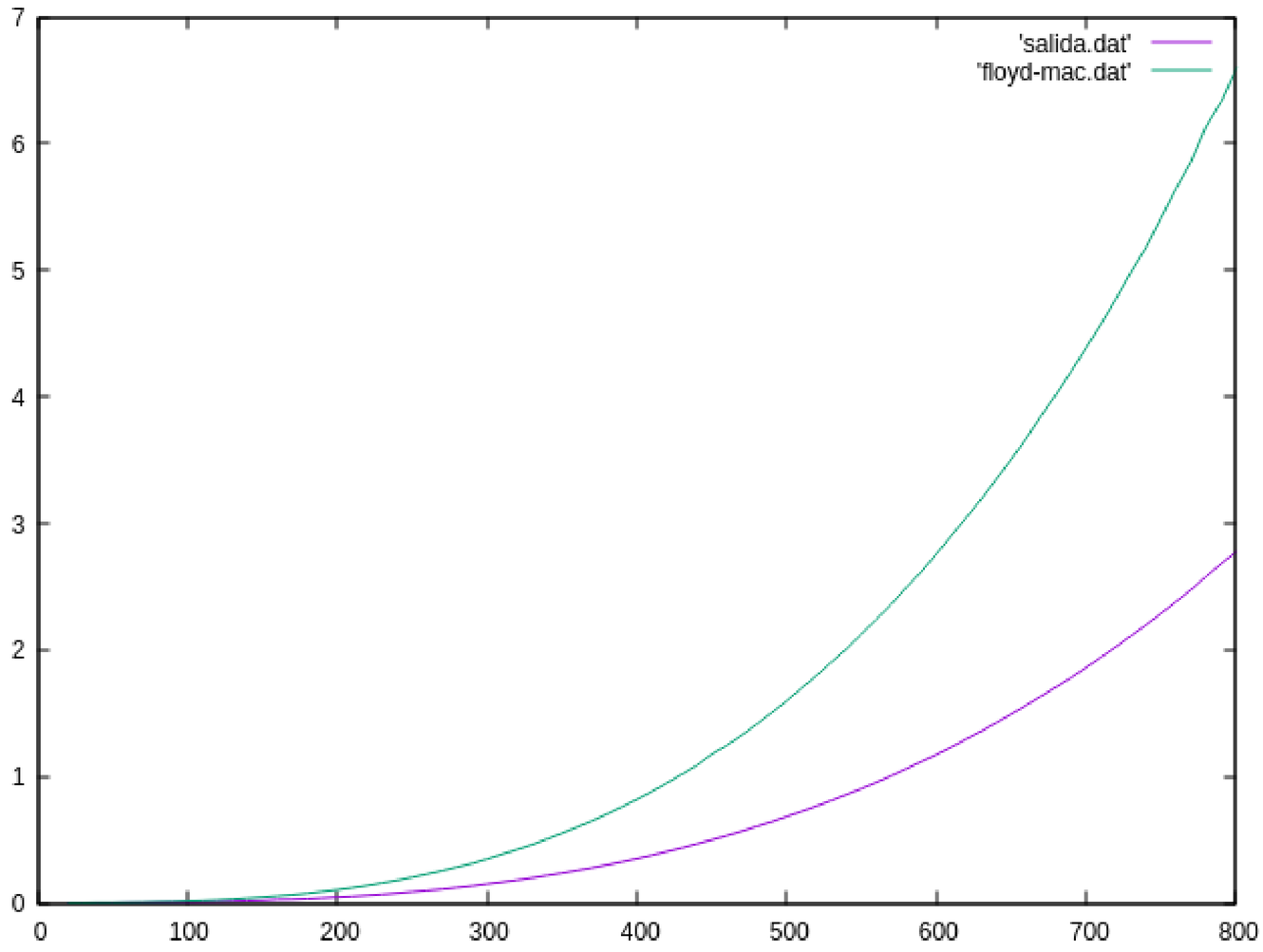
Variaciones : Con optimización -O2

Tamaño	Tiempo(seg)
20	9.00E-06
30	2.60E-05
40	6.40E-05
100	0.000962
110	0.001233
120	0.001605
130	0.00203
200	0.00631
210	0.007368
220	0.008349
300	0.021007
310	0.023088
320	0.025349
410	0.053049
420	0.057046
430	0.061029
500	0.09585
510	0.101888
520	0.108901
530	0.114083
610	0.197445
620	0.196238
630	0.191886
700	0.263618
710	0.274978
720	0.288814
780	0.367284
790	0.388104
800	0.402286



ALGORITMO DE FLOYD

Variaciones : Comparación entre procesadores

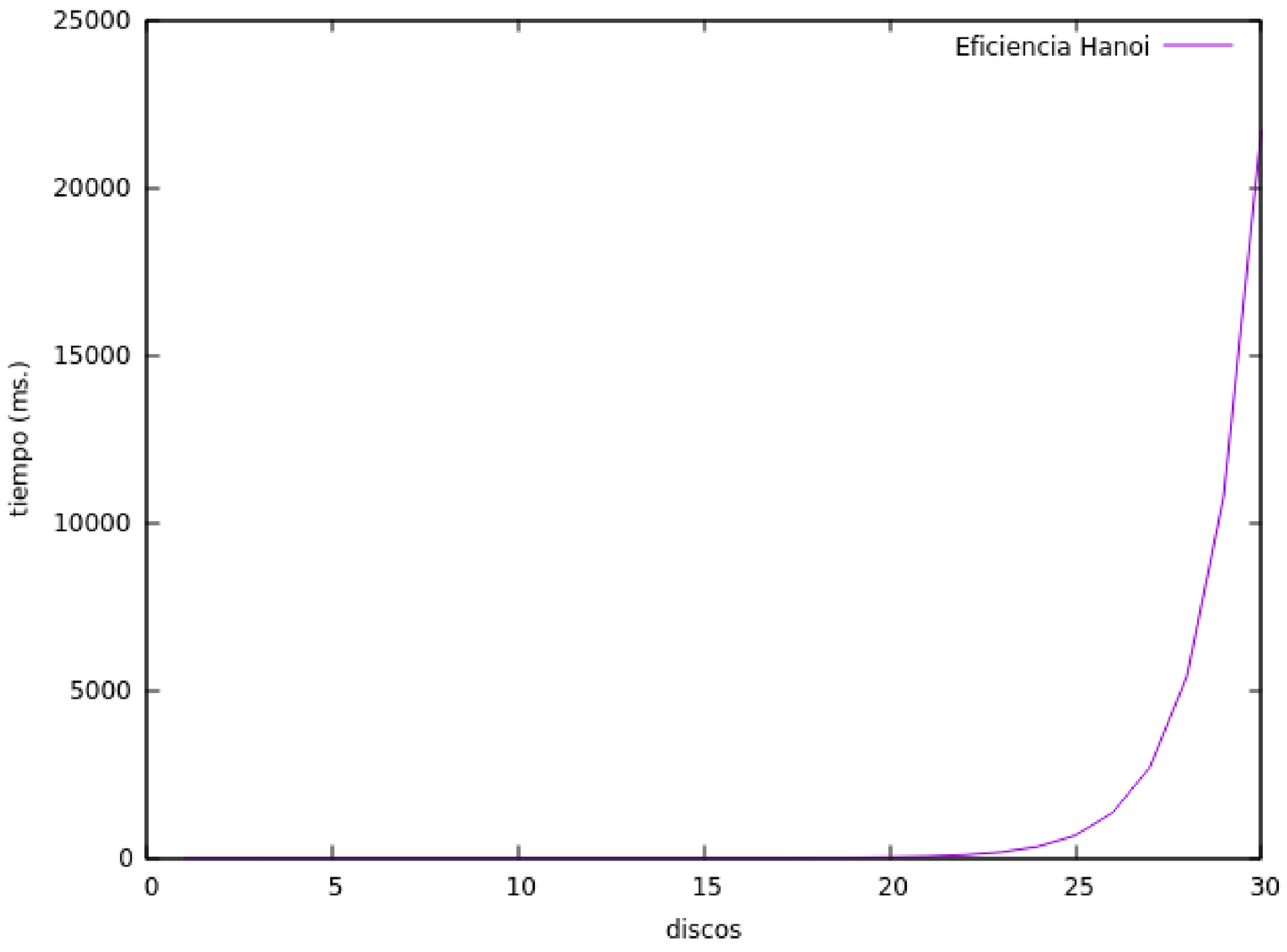


salida.dat → i5-7200K 2.5GHz
floyd-mac.dat → Core 2 Duo 2.4GHz

ALGORITMO DE LAS TORRES DE HANOI: O(2^n)

Eficiencia empírica

Nº discos	Tiempo (ms)
1	0.00088
2	0.00092
3	0.00104
4	0.00128
5	0.00168
6	0.00248
7	0.00416
8	0.00652
9	0.012401
10	0.023761
11	0.050843
12	0.088805
13	0.17681
14	0.352779
15	0.672797
16	1.34783
17	2.69639
18	5.3883
19	10.7773
20	21.5522
21	42.8662
22	85.214
23	169.931
24	338.678
25	676.949
26	1353.34
27	2706.91
28	5411.98
29	10829
30	21686.6

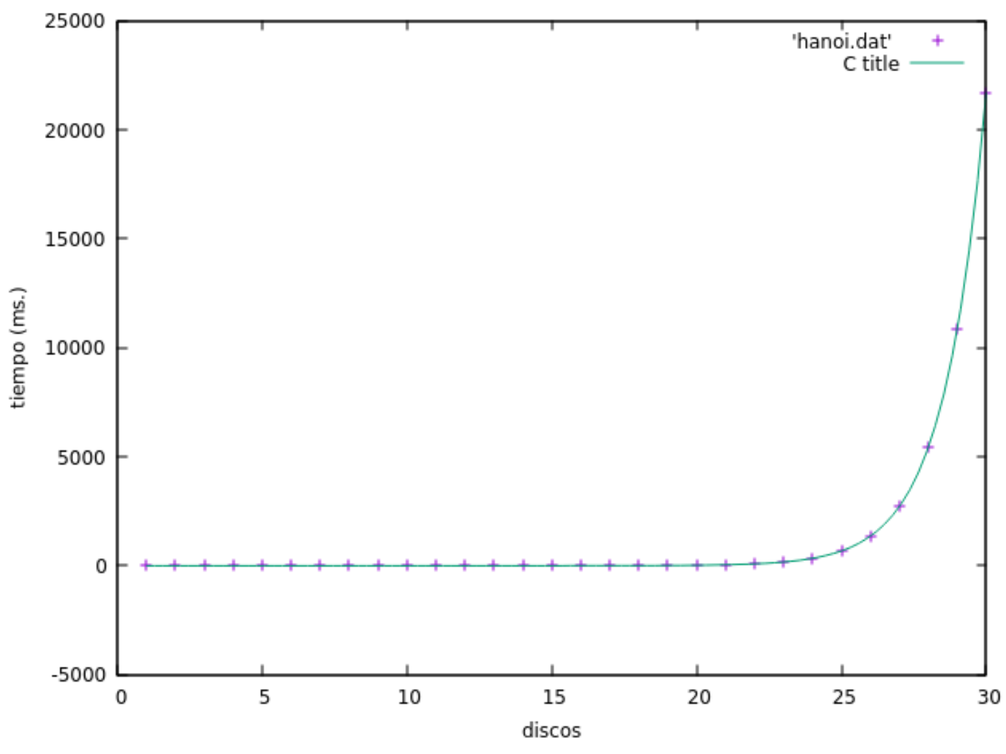


ALGORITMO DE LAS TORRES DE HANOI

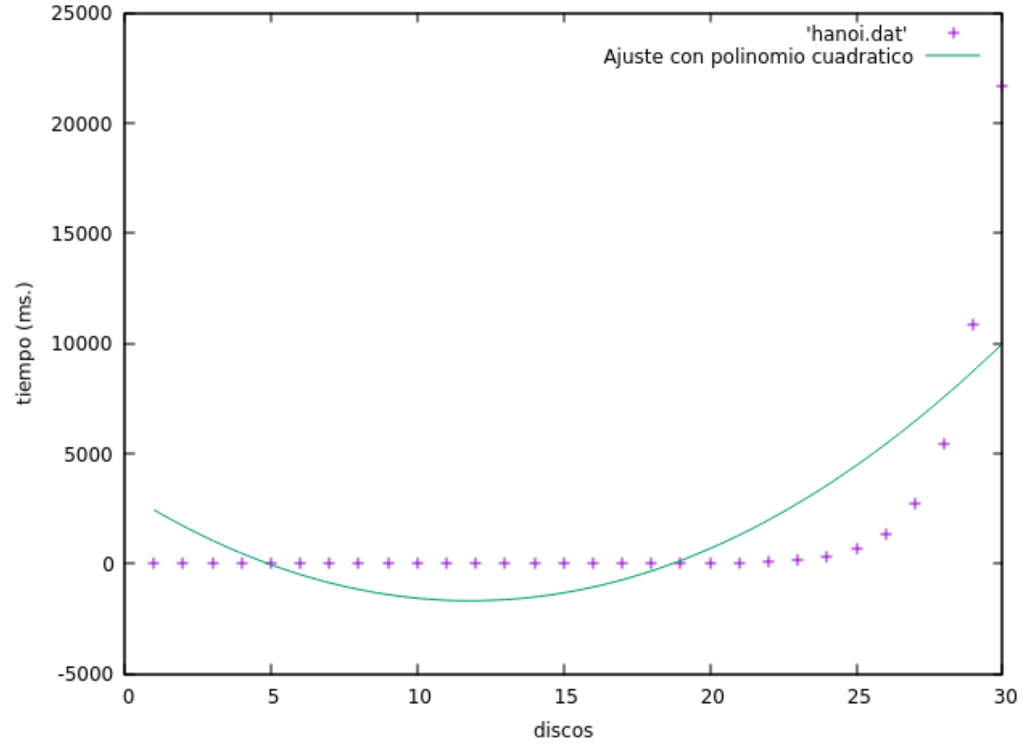
Eficiencia híbrida

function used for fitting: f(x)=a0*2**x

Final set of parameters	Asymptotic Standard Error
a0 = 2.01915e-05	+/- 2.497e-09 (0.01237%)



Ajuste correcto



Ajuste cuadrático

GRACIAS POR SU ATENCIÓN

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Práxedes Martínez Moreno
Francisco José González García