Ege Ipekci

CS201 Homework 2

21902333

06.04.2022

My Computer's Properties:

Model name: MSI GE 76 10UG

Processor: Intel(R) Core(TM) i7-10870H CPU @ 2.20GHz 2.21 GHz

Ram: DDR IV 32 gb 3200 Mhz

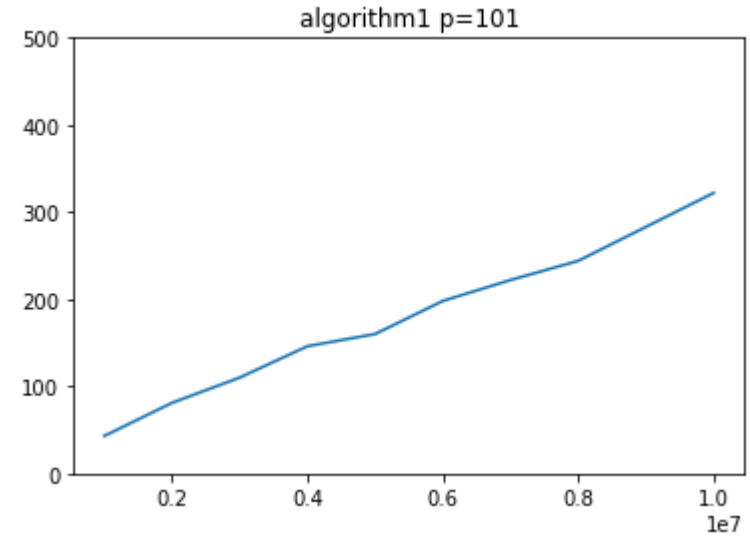
Graphics card: 8 gb Nvidia RTX3070

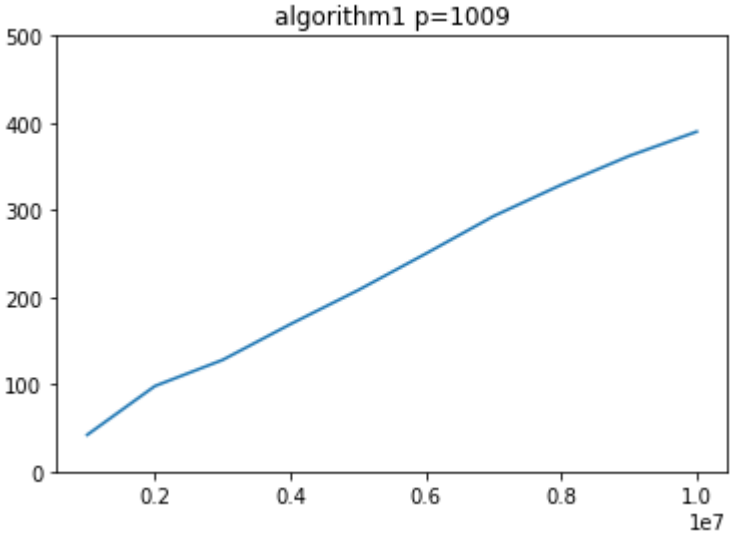
1) Algorithm 1 has a for loop inside which works n times due to it's condition. Therefore, time complexity is equal to O(n).

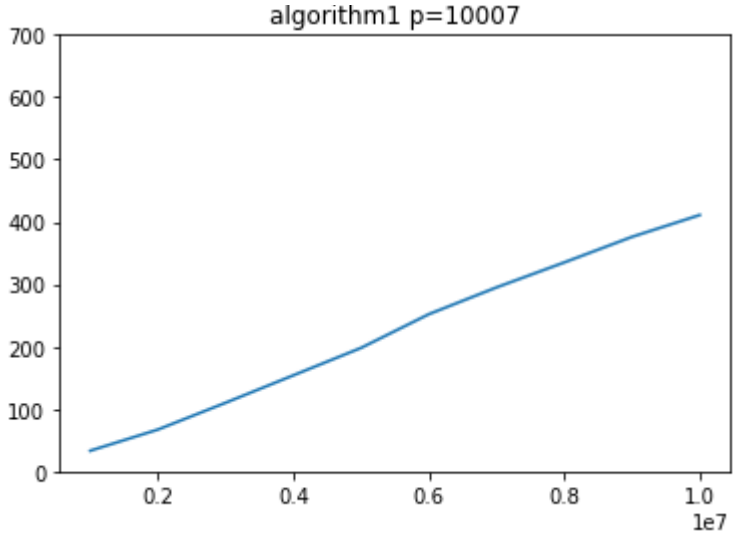
2) a^i $\equiv 1(mod\ p)$ determines a number which can drastically reduce the proces of a^n when $n\ mod(i)$ used. Therefore, the Algorithm2 's time complexity is O(1) since n mod(i) makes the n's size insignificant in the matter of time amount.

3) The algorithm 3 has an tree structure due to it's recursion. n/2^k is equivalent of log n. Therefore, the time complexity is equal to O(log n).

n	Algorithm 1			Algorithm 2			Algorithm 3		
	p=101	p=1009	p=10007	p=101	p=1009	p=10007	p=101	p=1009	p=10007
10^6	43	42	33	0.005	2.31	1.16	150	150	130
$2*10^6$	81	98	67	0.001	1.89	0.99	630	480	370
$3*10^6$	110	128	100	0.005	0.94	0.66	870	760	570
$4*10^6$	166	169	134	0.003	1.72	0.35	1060	890	840
$5*10^6$	160	208	178	0.006	2.55	1.32	1310	1270	1120
$6*10^6$	198	250	252	0.003	1.32	1.02	1580	1430	1440
$7*10^6$	242	293	295	0.002	2.15	0.71	1750	1670	1660
$8*10^6$	234	329	335	0.005	0.88	0.38	1970	1800	1870
$9*10^6$	283	342	376	0.002	1.57	1.31	2180	2010	2020
10^7	332	390	411	0.005	2.24	0.99	2210	2090	2080


algorithm1 p=101
500
400
300
200
100
0
0.2
0.4
0.6
0.8
1.0
1e7


algorithm1 p=1009
500
400
300
200
100
0
0.2
0.4
0.6
0.8
1.0
1e7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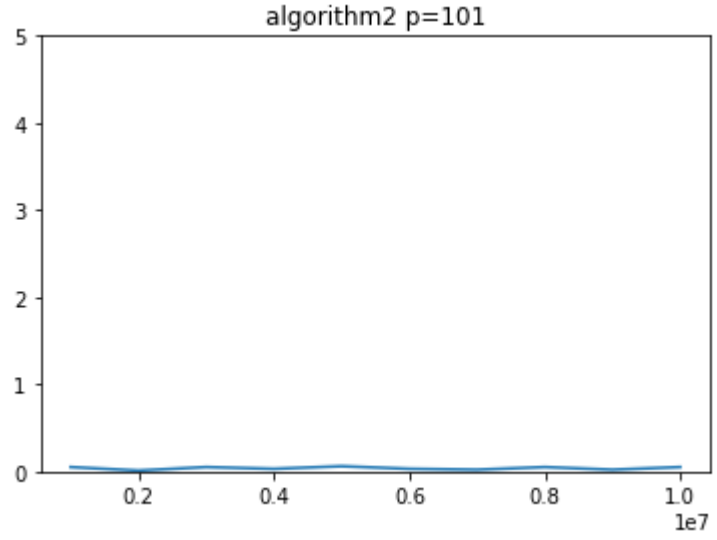
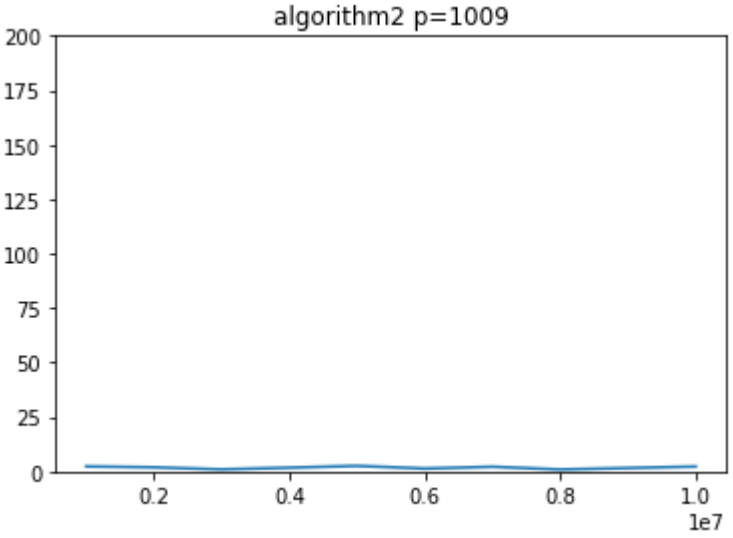
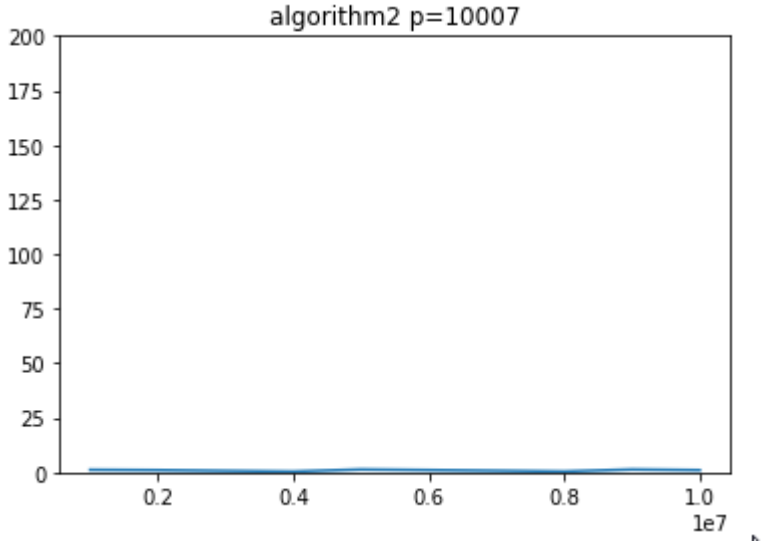
700
600
500
400
300
200
100
0
0.2
0.4
0.6
0.8
1.0
1e7


algorithm2 p=101
5
4
3
2
1
0
0.2
0.4
0.6
0.8
1.0
1e7


algorithm2 p=1009
200
175
150
125
100
75
50
25
0
0.2
0.4
0.6
0.8
1.0
1e7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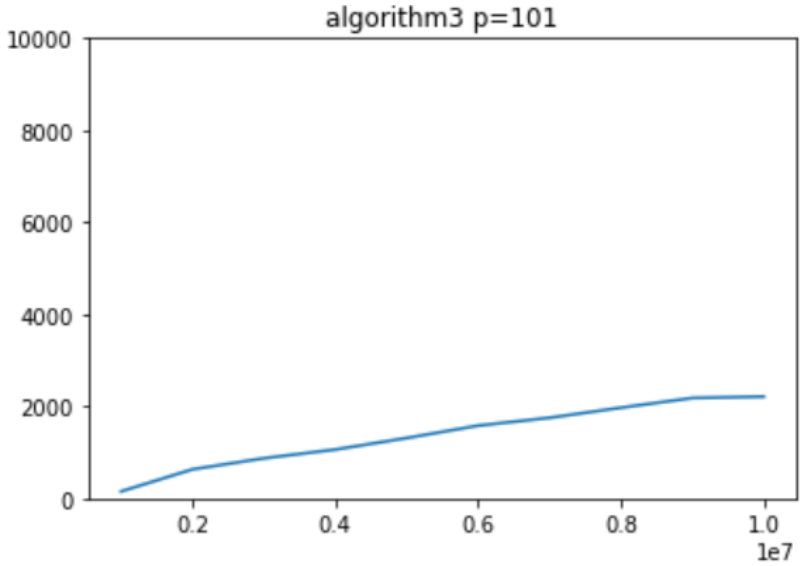
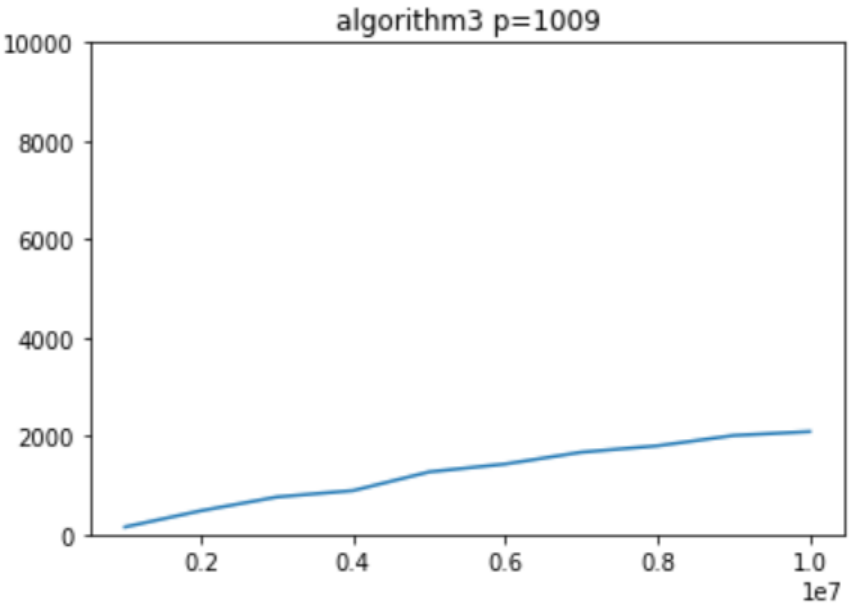
200
175
150
125
100
75
50
25
0
0.2
0.4
0.6
0.8
1.0
1e7


algorithm3 p=101
10000
8000
6000
4000
2000
0
0.2
0.4
0.6
0.8
1.0
1e7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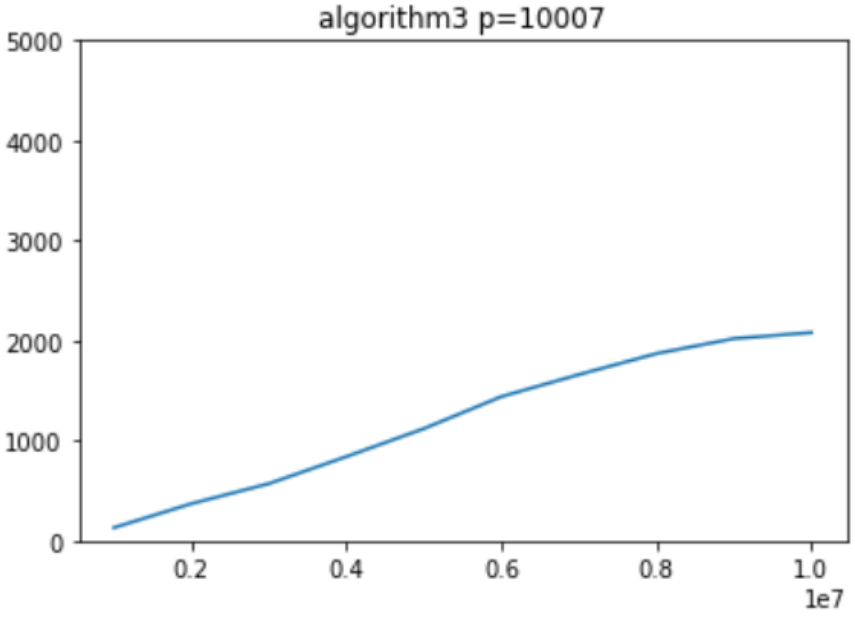
10000
8000
6000
4000
2000
0
0.2
0.4
0.6
0.8
1.0
1e7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5000
4000
3000
2000
1000
0
0.2
0.4
0.6
0.8
1.0
1e7