Elijah Hauber

CS 251

Section: LE1

Tricoche, Xavier

<center>Project 2: Collinear Analysis</center>

Estimate Using Tilde

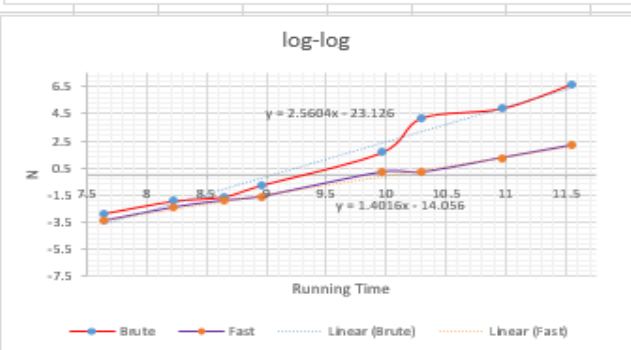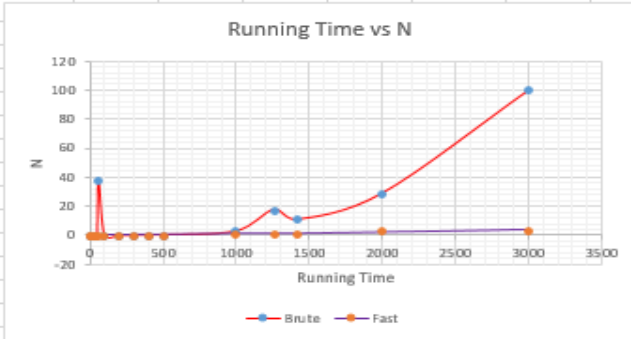Fast: $n + n^2\log(n) + n^2 \sim O(n^2\log(n))$

read in data + sorting + printing

Brute: $n + \frac{1}{3}(n-3)^4 \sim O(n^4)$

read in data + sorting & printing combined with optimizations

continued ---------v

Empirical Evidence

Excel Work:

N	Fast	Brute
6	0.047	0.047
8	0.047	0.047
50	0.062	0.068
59	0.063	38.342
100	0.109	0.218
200	0.094	0.125
300	0.172	0.203
400	0.203	0.265
500	0.391	0.562
200	0.094	0.141
300	0.187	0.266
400	0.265	0.328
500	0.328	0.594

Princeton Test Cases			
N	Fast	Brute	Name
29	0.078	0.292	inarow
49	0.047	0.11	grid6x6
100	0.078	0.078	vertical25
300	0.203	0.265	vertical75
200	0.125	0.125	input200
400	0.313	0.39	input400
1000	1.14	3.139	input1000
1260	1.141	18.146	kw1260
1423	1.203	11.239	rs1423
2000	2.37	29.282	input2000
3000	4.515	100.42	input3000

Test Cases Used for Graphs			
N	Fast	Brute	Cases
6	0.047	0.047	provided
8	0.047	0.047	provided
29	0.078	0.292	princeton
49	0.047	0.11	princeton
59	0.063	38.342	mine
100	0.109	0.218	provided
200	0.094	0.141	mine
300	0.187	0.266	mine
400	0.265	0.328	mine
500	0.328	0.594	mine
1000	1.14	3.139	princeton
1260	1.141	18.146	princeton
1423	1.203	11.239	princeton
2000	2.37	29.282	princeton
3000	4.515	100.42	princeton

The N that are in red is when a collinear line of length seven was added to the N that are in blue because they had no collinear lines before because of random generation.

Running Time vs N

log-log

Equation for estimated times

Fast
T(N)=5.87114E-05(N^1.4016)

Brute
T(N)=1.0924E-07(N^2.5604)

log base 2

a=2^c
T(N)=aN^b
log(T(n))=blgN+c

Removed some points to better fit the data in the log-log plot

Log(N)	Log(Fast)	Log(Brute)		Fast Alg	Brute Alg	N
7.6439	-3.411	-2.8262	b=	1.4016	2.5604	200
8.2288	-2.419	-1.9105	c=	-14.056	-23.126	300
8.6439	-1.916	-1.6082	a=	5.871E-05	1.09E-07	400
8.9658	-1.608	-0.7515				500
9.9658	0.189	1.65031				1000
10.299	0.1903	4.18158				1260
10.966	1.2449	4.87194				2000
11.551	2.1747	6.64983				3000

Graph + log-log:

required

Running Time vs N
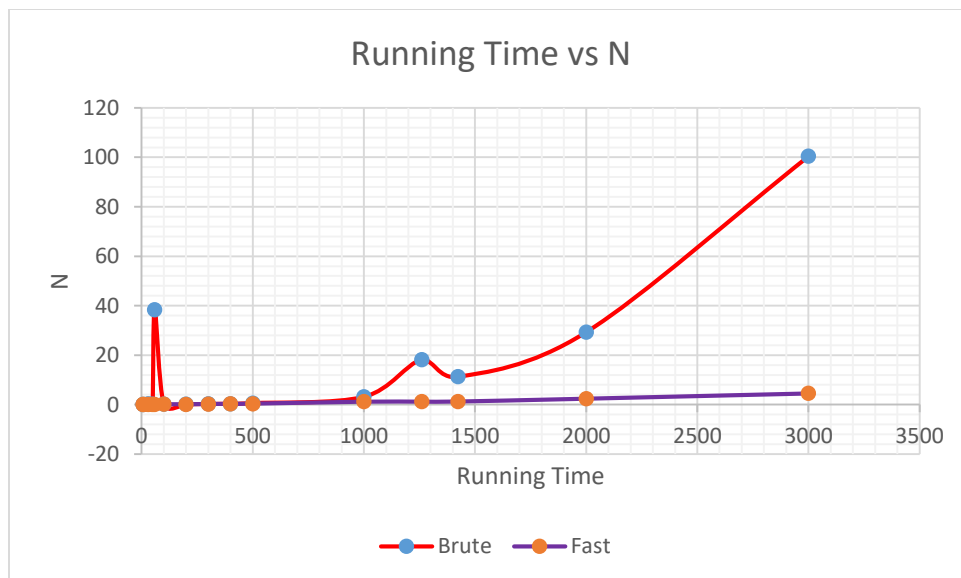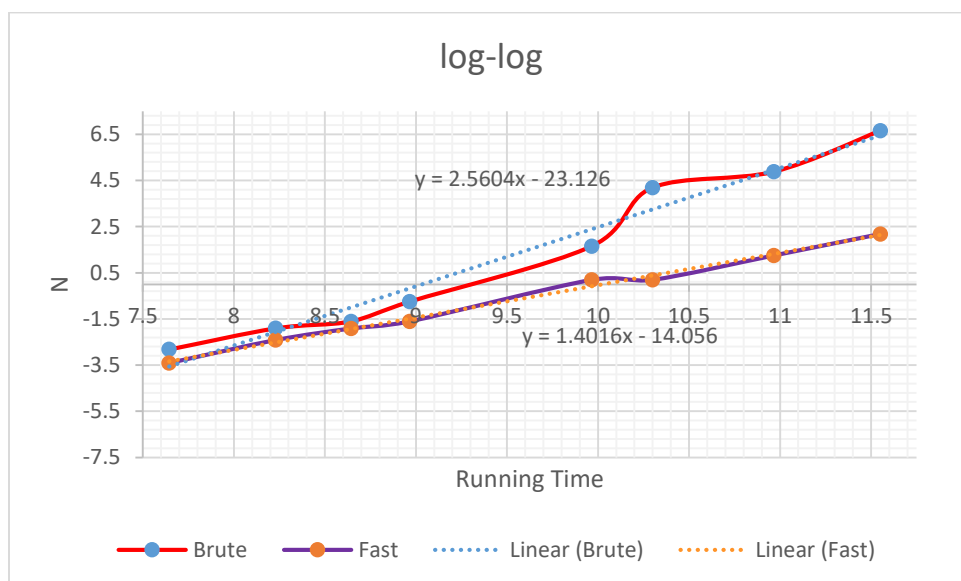

The jump in the begging for Brute happened because I purposefully made a test case that would be difficult for brute.

This difficulty is due to the fact that Brute scales less efficiently than Fast for collinear lines with longer lengths.

log-log

log-log chart with Brute, Fast, Linear (Brute), Linear (Fast). Equations shown: $y = 2.5604x - 23.126$ and $y = 1.4016x - 14.056$

Estimated Time for N = 1,000,000

Fast: 15007.26 seconds

Brute: 251641167.5 seconds

Work from Excel:

1,000,000 for N in secs			in hours	in hours			in days			in years	
Fast	Brute										
15077.26	251641167.5										
in mins			in hours	in hours			in days			in years	
251.2877	4194019.5		4.188127897	69900.3243			0.174505	2912.514		0.000478	7.979489