Stat 328, Summer 2005

Exam #2, 6/18/05

Name (print) ______________________

UnivID ______________________

I have neither given nor received any unauthorized aid in completing this exam.

Signed ______________________

Answer each question completely—showing your work where appropriate (for possible partial credit).
Round your answers to **4 decimal places**.

Questions 1 to 7 Many mutual funds compare their performance with that of a benchmark, an index of the returns of all securities of the kind the fund buys. The Vanguard International Growth (VIG) Fund, for example, takes as its benchmark the Morgan Stanley Europe, Australia, Far East (EAFE) index of overseas stock market performance. The data for this analysis are the percent returns for the fund and for the EAFE from 1982 to 2000 (19 years total).

1. Which best describes the relationship between the VIG Fund and the EAFE Index?

   (A) These two variables have no clear relationship.
   (B) In years where the EAFE performs better, the VIG shows poor performance.
   (C) The correlation between VIG and EAFE is 0.806906.
   (D) These variables have a positive, approximately linear relationship.
   (E) None of the above

2. Report the $P-$value for testing $\beta_1 = 0$ vs. $\beta_1 \neq 0$ and the result of this test.

   (A) $< .0001$, fail to reject $\beta_1 = 0$.
   (B) $< .0001$, reject $\beta_1 = 0$.
   (C) 0.2038, fail to reject $\beta_1 = 0$.
   (D) 0.2038, reject $\beta_1 = 0$.
   (E) None of the above

3. If the EAFE Index is zero next year, what would this model predict for the value of the VIG Fund?

   (A) 16.34526 (B) 3.505144
   (C) 0.8278888 (D) 9.461562
   (E) None of the above

4. Is the prediction of VIG when EAFE is zero an extrapolation?

   (A) Yes
   (B) No
   (C) This can't be determined from the information given.

5. A simple rule some people use to identify outliers in a regression analysis is the "3 times RMSE" rule. The rule is applied as follows: a point whose residual is greater than $3 \times$ RMSE is considered to be an outlier. Apply this rule to the regression model for VIG vs. EAFE.

   (A) There is at least one outlier.
   (B) There are no outliers.
   (C) There are too many outliers to count.
   (D) This can't be determined from the information given.
   (E) None of the above

6. Refer to the regression of VIG vs EAFE (Output Pages 1–2). Calculate an 80% confidence interval for the intercept. Calculate a 99.9% confidence interval for the slope. Be sure to show your work for both. Also, clearly indicate any JMP output values and/or table values you use in your work.

7. Refer to the regression of VIG vs EAFE (Output Pages 1–2) as well as the quadratic model (see Output Page 3). Comparing 2 or 3 values from the linear model's output and the quadratic model's output, explain why the linear model is preferable over the quadratic model. Be sure to indicate the 2 or 3 values you used from each model as well as how each of these values indicate that the linear model is preferable to the quadratic model.

Questions 8 to 14 The data for these questions are for insured commercial banks by state and other U.S. properties. The variables are as follows:

ASSETS average bank assets for the state or property (billions of dollars)

NUMBER number of commercial banks in the state or property

DEPOSITS average amount on deposit with banks in the state or property (billions of dollars)

We are interested in describing how assets are explained by deposits and the number of banks in a state or property.

8. Model#1 includes the variable Number*Deposits. This is an example of what type of explanatory variable?

   (A) response
   (B) indicator
   (C) additive
   (D) interaction
   (E) None of the above

9. In Model#1, does the $P-$value for Number*Deposits indicate that this variable can be dropped from the model if we desire a simpler model?

   (A) Yes
   (B) No
   (C) This can't be determined from the information given.

10. In Model#1, which single $x-$variable appears to be the most significant given the other variables in the model?

    (A) Intercept
    (B) Number
    (C) Deposits
    (D) Number*Deposits
    (E) This can't be determined from the information given.

11. In Model#2, what does the $P-$value for the ANOVA $F-$test indicate about this model?

    (A) Both of the explanatory variables are useful for predicting Assets.
    (B) At least one of the explanatory variables is useful for predicting Assets.
    (C) None of the explanatory variables are useful for predicting Assets.
    (D) Model#1 is better than Model#2.
    (E) None of the above

12. OUTPUT PAGE #7 contains many columns of output related to Model#2. Using this output, identify (by Obs#) all observations that have unusually large studentized residuals and/or unusually large "hat" values (h Assets column) and/or unusually large Cook's D values. Indicate how you decided if an observation had an "unusually large" value for these three quantities.

13. Refer to the insured commercial banks data and models (Output Page 4–6). List the 5 models in order from "best Assets predictor" to "worst Assets predictor" and record the value from each model's output you used to rank the models in this way. Then, beside each model's name, record the value of RSquare Adj from each model's output. What do you notice about the RSquare Adj values as you move down your list? Which model has the best (i.e. largest) RSquare Adj value? Which model has the worst (i.e. smallest) RSquare Adj value?

14. Using the output from Model#5, calculate a 95% confidence interval for σ. (You will need to use the extension of the χ^2-table provided below.)

Chi-Square Distribution (Upper Tail) Critical Values

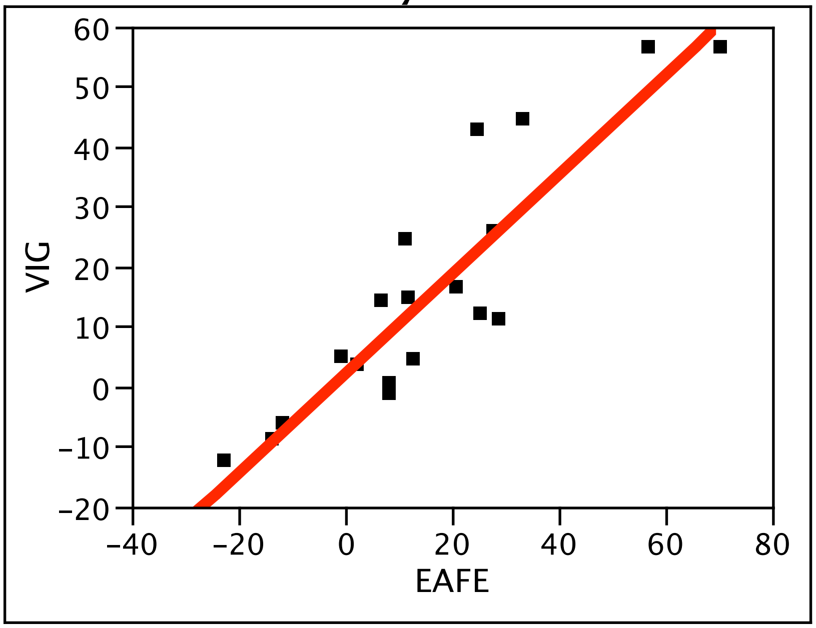
DF	0.995	0.99	0.975	0.95	0.9	0.1	0.05	0.025	0.01	0.005
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
41	21.421	22.906	25.215	27.326	29.907	52.949	56.942	60.561	64.950	68.053
42	22.138	23.650	25.999	28.144	30.765	54.090	58.124	61.777	66.206	69.336
43	22.859	24.398	26.785	28.965	31.625	55.230	59.304	62.990	67.459	70.616
44	23.584	25.148	27.575	29.787	32.487	56.369	60.481	64.201	68.710	71.893
45	24.311	25.901	28.366	30.612	33.350	57.505	61.656	65.410	69.957	73.166
46	25.041	26.657	29.160	31.439	34.215	58.641	62.830	66.617	71.201	74.437
47	25.775	27.416	29.956	32.268	35.081	59.774	64.001	67.821	72.443	75.704
48	26.511	28.177	30.755	33.098	35.949	60.907	65.171	69.023	73.683	76.969
49	27.249	28.941	31.555	33.930	36.818	62.038	66.339	70.222	74.919	78.231
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
51	28.735	30.475	33.162	35.600	38.560	64.295	68.669	72.616	77.386	80.747
52	29.481	31.246	33.968	36.437	39.433	65.422	69.832	73.810	78.616	82.001
53	30.230	32.018	34.776	37.276	40.308	66.548	70.993	75.002	79.843	83.253
54	30.981	32.793	35.586	38.116	41.183	67.673	72.153	76.192	81.069	84.502
55	31.735	33.570	36.398	38.958	42.060	68.796	73.311	77.380	82.292	85.749
56	32.490	34.350	37.212	39.801	42.937	69.919	74.468	78.567	83.513	86.994
57	33.248	35.131	38.027	40.646	43.816	71.040	75.624	79.752	84.733	88.236
58	34.008	35.913	38.844	41.492	44.696	72.160	76.778	80.936	85.950	89.477
59	34.770	36.698	39.662	42.339	45.577	73.279	77.931	82.117	87.166	90.715
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952

Questions 15 to 16 A process to fill plastic 500ml bottles with water is expected to produce bottles with a mean water content of 505ml and a standard deviation of 12ml. The company plans to use an $\overline{x}-$chart and an $s-$chart to monitor this process. The company plans to measure the water content in a sample of 9 bottles. A sample of 9 bottles will be taken every 2 hours.

15. Calculate the centerline, lower control limit, and upper control limit for the $\overline{x}-$chart.

16. Calculate the centerline, lower control limit, and upper control limit for the $s-$chart.

Bivariate Fit of VIG By EAFE

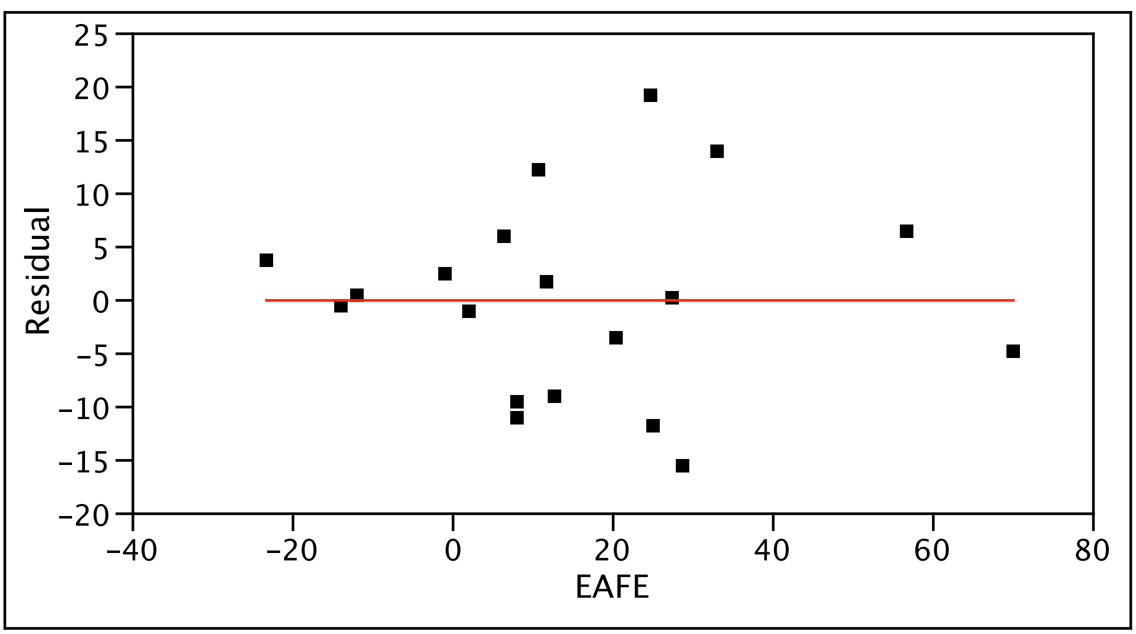


Summary of Fit

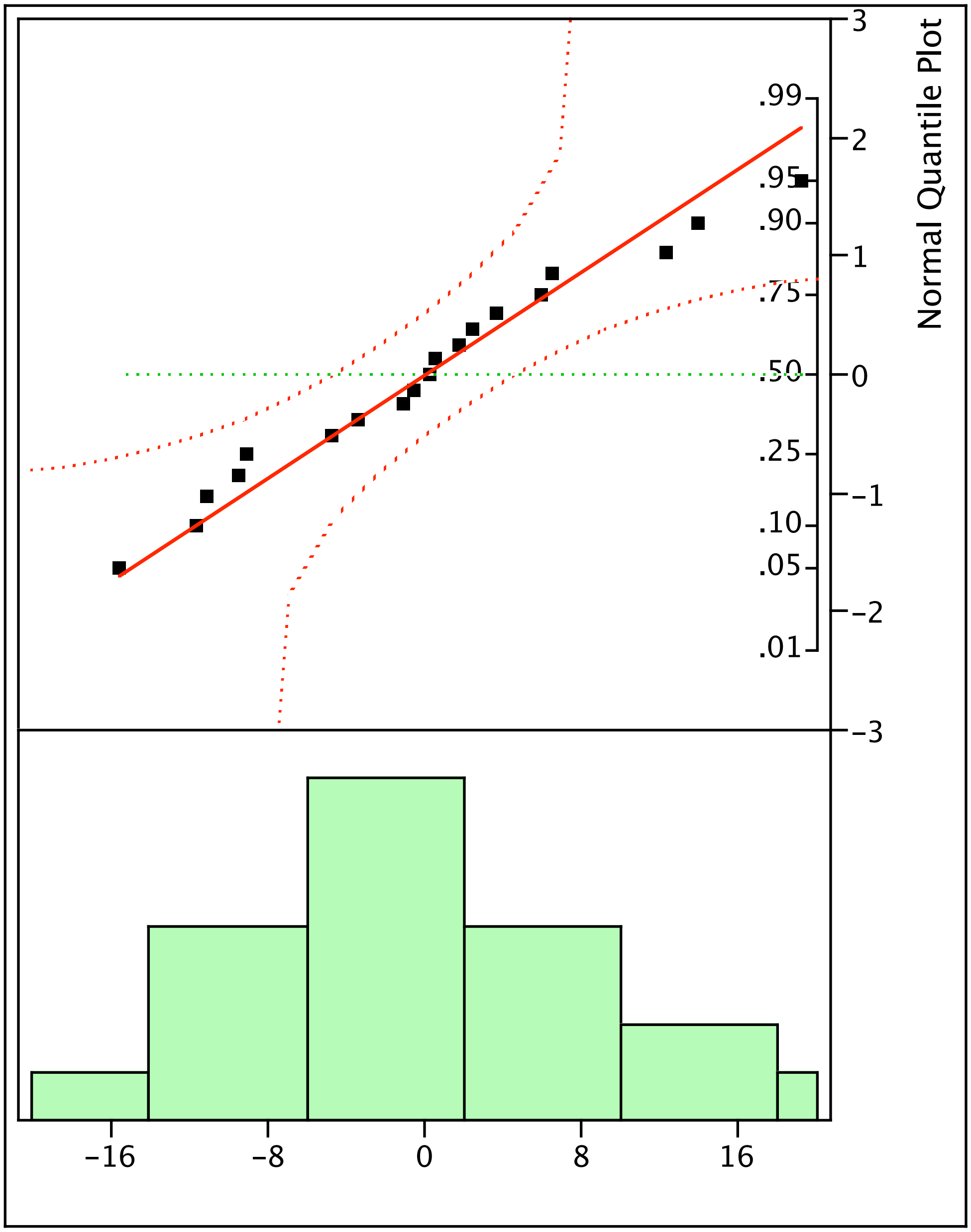
RSquare	0.806906
RSquare Adj	0.795547
Root Mean Square Error	9.461562
Mean of Response	16.34526
Observations (or Sum Wgts)	19

Parameter Estimates

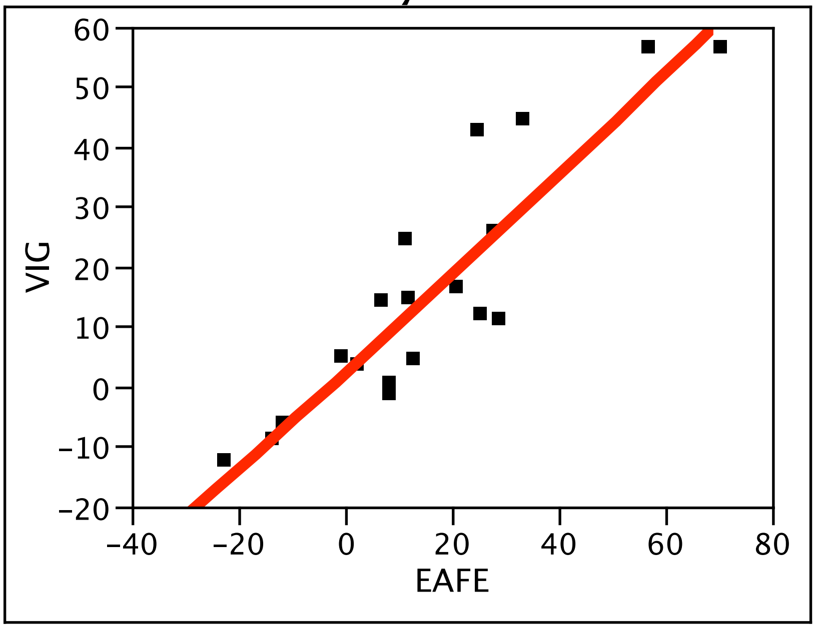
Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.505144	2.651873	1.32	0.2038
EAFE	0.8278888	0.098225	8.43	<.0001



Distributions
Residuals VIG



Bivariate Fit of VIG By EAFE



Polynomial Fit Degree=2

VIG = 3.4894594 + 0.8054971 EAFE + 0.000498 EAFE^2

Summary of Fit

RSquare	0.807194
RSquare Adj	0.783093
Root Mean Square Error	9.745474
Mean of Response	16.34526
Observations (or Sum Wgts)	19

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	3.4894594	2.733329	1.28	0.2200
EAFE	0.8054971	0.176631	4.56	0.0003
EAFE^2	0.000498	0.00322	0.15	0.8790

Response Assets [MODEL#1]
Summary of Fit

RSquare	0.987109
RSquare Adj	0.986336
Root Mean Square Error	20.29439
Mean of Response	94.20556
Observations (or Sum Wgts)	54

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	1576942.7	525648	1276.27
Error	50	20593.1	412	**Prob > F**
C. Total	53	1597535.8		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	−6.130404	4.600183	−1.33	0.1887
Number	−0.019404	0.026573	−0.73	0.4687
Deposits	1.7671981	0.042781	41.31	<.0001
Number*Deposits	−0.000579	0.000187	−3.10	0.0032

Response Assets [MODEL#2]
Summary of Fit

RSquare	0.984634
RSquare Adj	0.984031
Root Mean Square Error	21.93928
Mean of Response	94.20556
Observations (or Sum Wgts)	54

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	1572987.9	786494	1633.994
Error	51	24547.9	481	**Prob > F**
C. Total	53	1597535.8		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	1.5795004	4.182875	0.38	0.7073
Number	−0.085256	0.017246	−4.94	<.0001
Deposits	1.6664173	0.030046	55.46	<.0001

Response Assets [MODEL#3]

Summary of Fit

RSquare	0.977271
RSquare Adj	0.976834
Root Mean Square Error	26.42491
Mean of Response	94.20556
Observations (or Sum Wgts)	54

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1561225.5	1561225	2235.828
Error	52	36310.4	698	**Prob > F**
C. Total	53	1597535.8		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	-9.748559	4.214778	-2.31	0.0247
Deposits	1.6181028	0.034221	47.28	<.0001

Response Assets [MODEL#4]

Summary of Fit

RSquare	0.057807
RSquare Adj	0.039688
Root Mean Square Error	170.135
Mean of Response	94.20556
Observations (or Sum Wgts)	54

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	92348.8	92348.8	3.1904
Error	52	1505187.0	28945.9	**Prob > F**
C. Total	53	1597535.8		0.0799

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	55.966429	31.53345	1.77	0.0818
Number	0.2258957	0.12647	1.79	0.0799

Response Assets [MODEL#5]
Summary of Fit

RSquare	0.986972
RSquare Adj	0.986461
Root Mean Square Error	20.2013
Mean of Response	94.20556
Observations (or Sum Wgts)	54

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	2	1576723.1	788362	1931.82
Error	51	20812.7	408	**Prob > F**
C. Total	53	1597535.8		<.0001

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	−8.512632	3.228347	−2.64	0.0111
Deposits	1.7822271	0.037332	47.74	<.0001
Number*Deposits	−0.000688	0.000112	−6.16	<.0001

Obs#	Number	Assets	Deposits	Residual Assets	Studentized Resid Assets	h Assets	Cook's D Influence Assets	Lower 95% Mean Assets	Upper 95% Mean Assets	Lower 95% Indiv Assets	Upper 95% Indiv Assets
1	175	101.2	72.7	−6.6082	−0.3041	0.0186	0.0006	101.7950	113.8214	63.3547	152.2617
2	6	4.8	3.5	−2.1004	−0.0975	0.0350	0.0001	−1.3357	15.1366	−37.9080	51.7088
3	41	39.3	22.8	3.2217	0.1490	0.0282	0.0002	28.6839	43.4727	−8.5830	80.7396
4	226	101.2	72.7	−2.2601	−0.1041	0.0203	0.0001	97.1839	109.7363	58.9702	147.9500
5	336	474.7	361.4	−100.4766	−5.0167	0.1666	1.6771	557.1986	593.1546	527.6038	622.7493
6	216	33.9	29.3	1.9098	0.0881	0.0233	0.0001	25.2668	38.7135	−12.5650	76.5453
7	26	4.8	4	−1.2285	−0.0569	0.0320	0.0000	−1.8463	13.9033	−38.7149	50.7719
8	34	127.9	50.8	44.5652	2.0613	0.0289	0.0421	75.8481	90.8214	38.6581	128.0115
9	6	1.2	0.9	−1.3677	−0.0635	0.0353	0.0000	−5.7046	10.8400	−42.2473	47.3828
10	266	116.9	92.1	−15.4784	−0.7141	0.0239	0.0042	125.5738	139.1830	87.8109	176.9458
11	353	69.2	46.9	19.5610	0.9110	0.0422	0.0122	40.5939	58.6841	4.6749	94.6031
12	14	22.9	15.7	−3.6487	−0.1691	0.0326	0.0003	18.6012	34.4961	−18.2076	71.3049
13	16	1.4	1.2	−0.8151	−0.0378	0.0337	0.0000	−5.8733	10.3035	−42.5664	46.9966
14	784	265.4	194.8	6.0434	0.3135	0.2278	0.0097	238.3351	280.3782	210.5523	308.1610
15	185	66.5	50.9	−4.1277	−0.1900	0.0192	0.0002	64.5323	76.7232	26.1630	115.0925
16	453	43.3	36	20.3506	0.9647	0.0754	0.0253	10.8574	35.0415	−22.7252	68.6241
17	403	31.3	26.7	19.5854	0.9213	0.0611	0.0184	0.8305	22.5986	−33.6553	57.0844
18	271	51	38.2	8.8678	0.4100	0.0280	0.0016	34.7567	49.5076	−2.5260	86.7904
19	158	46.7	37.6	−4.0663	−0.1872	0.0197	0.0002	44.5814	56.9511	6.2892	95.2434
20	17	4.9	3.7	−1.3959	−0.0647	0.0333	0.0000	−1.7374	14.3292	−38.4757	51.0674
21	83	35.2	26.9	−4.1299	−0.1905	0.0235	0.0003	32.5811	46.0786	−5.2291	83.8888
22	46	123.4	84.2	−14.5700	−0.6744	0.0304	0.0048	130.2931	145.6470	93.2611	182.6790
23	163	118.8	85.3	−11.0281	−0.5076	0.0195	0.0017	123.6828	135.9734	85.3565	174.2997
24	520	131.9	97.9	11.5115	0.5495	0.0884	0.0098	107.2939	133.4831	74.4382	166.3387
25	107	34.4	27.8	−4.3835	−0.2020	0.0218	0.0003	32.2778	45.2891	−5.7393	83.3063
26	404	63.4	53.5	7.1107	0.3333	0.0545	0.0021	46.0024	66.5761	11.0590	101.5195
27	96	9	7.5	3.1070	0.1434	0.0250	0.0002	−1.0660	12.8520	−38.6983	50.4843
28	326	25.9	21.6	16.1194	0.7506	0.0418	0.0082	0.7768	18.7843	−35.1753	54.7364
29	25	25.9	8.1	12.9539	0.6000	0.0316	0.0039	5.1139	20.7782	−31.7898	57.6820
30	21	11.7	8.5	−2.2537	−0.1044	0.0321	0.0001	6.0570	21.8504	−30.7936	58.7009
31	71	79.9	62.4	−19.6107	−0.9050	0.0244	0.0068	92.6354	106.3861	54.9324	144.0891
32	58	11.3	9	−0.3324	−0.0154	0.0276	0.0000	4.3166	18.9482	−33.0160	56.2808
33	153	1119.2	630.7	79.6553	5.9443	0.6269	19.7936	1004.6702	1074.4192	983.3647	1095.7246
34	60	433.1	270.9	−14.7966	−0.7197	0.1218	0.0239	432.5243	463.2689	401.2461	494.5470
35	117	8.9	7.6	4.6307	0.2137	0.0242	0.0004	−2.5756	11.1141	−40.3044	48.8429
36	235	230.6	154.4	−8.2391	−0.3818	0.0323	0.0016	230.9255	246.7527	194.0889	283.5893
37	320	34.1	28	13.1428	0.6110	0.0388	0.0050	12.2761	29.6382	−23.9351	65.8495
38	41	5.8	4.7	−0.1162	−0.0054	0.0300	0.0000	−1.7110	13.5433	−38.7843	50.6166
39	212	267.6	194.8	−40.5233	−1.8928	0.0477	0.0598	298.5029	317.7436	263.0399	353.2066
40	9	77.3	54.8	−14.8319	−0.6877	0.0335	0.0055	84.0703	100.1934	47.3552	136.9085
41	80	17.5	14.5	−1.4220	−0.0656	0.0250	0.0000	11.9615	25.8826	−25.6695	63.5136
42	106	30.3	11.8	18.0939	0.8347	0.0238	0.0057	5.4073	19.0048	−32.3605	56.7726
43	232	75.1	56.3	−0.5193	−0.0239	0.0214	0.0000	69.1736	82.0651	31.1052	120.1334
44	839	235.1	191.8	−14.5683	−0.7753	0.2664	0.0727	226.9362	272.4004	200.1031	299.2335
45	49	39.6	20.1	8.7031	0.4022	0.0274	0.0015	23.6069	38.1869	−13.7472	75.5411
46	21	7.1	5.9	−2.5210	−0.1168	0.0324	0.0002	1.6892	17.5528	−35.1325	54.3744
47	151	77.8	55.9	−4.0585	−0.1867	0.0187	0.0002	75.8276	87.8894	37.4026	126.3144
48	80	11.7	9.9	0.4435	0.0205	0.0256	0.0000	4.2114	18.3016	−33.3483	55.8614
49	100	21.6	17.5	−0.6162	−0.0284	0.0233	0.0000	15.4909	28.9414	−22.3393	66.7716
50	361	72.5	55.4	9.3785	0.4369	0.0426	0.0028	54.0342	72.2088	18.1489	108.0941
51	52	8.3	7.2	−0.8444	−0.0390	0.0284	0.0000	1.7172	16.5716	−35.5224	53.8112
52	13	33.7	21.6	−2.7658	−0.1282	0.0324	0.0002	28.5434	44.3882	−8.2860	81.2176
53	2	0.8	0.7	−1.7755	−0.0824	0.0359	0.0001	−5.7743	10.9253	−42.2539	47.4049
54	2	0.1	0.1	−1.4756	−0.0685	0.0360	0.0001	−6.7827	9.9339	−43.2554	46.4066