

DAFTAR PUSTAKA

- Berutu, S. S., 2013. Peramalan Penjualan Dengan Metode *Fuzzy Time Series Ruey Chyn Tsaur*. Tesis, Universitas Diponegoro, Semarang.
- Chen, S. M. 1996. *Forecasting Enrollments Based on Fuzzy Time Series*. *Journal of Fuzzy Sets and System*. 311-319.
- Chen, S. M. 2002. *Forecasting Enrollments Based on on High-order Fuzzy Time Series*". *Cybernetics and Systems* 33, 1:1-16.
- Cheng, C. S. dkk. 2008. *Fuzzy time-series based on adaptive expectation model for TAIEX forecasting*. *Expert Systems with Applications*. 34 : 1126 – 1132
- Chrysafiadi, K., dan Virvou, M. 2012. *Evaluating The Integration of Fuzzy Logic Into The Student Model of A Web-Based Learning Environment*. *International Expert System with Application* , Vol. 39
- Dernoncourt, F. 2013. *Introduction to Fuzzy Logic*. Massachusetts: MIT.
- Dewi, U. 2012. *Model Exponential Generalized Autoregressive Conditional Heteroscedasticity (Egarch) Dan Penerapannya Pada Data Indeks Harga Saham (Studi Kasus Pada Saham Pt. Antam (Persero) Tbk)*. S1 Thesis, Universitas Negeri Yogyakarta.
- Elfajar, A. B., Setaiawan, B. D., Dewi, C. 2017. *Peramalan Jumlah Kunjungan Wisatawan Kota Batu Menggunakan Metode Time Invariant Fuzzy Time Series*. *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*. Vol. 1, No. 2
- Fauziah, N., Sri, W., Yuki, K. N. 2016. *Peramalan Menggunakan Fuzzy Time Series Chen (Studi Kasus: Curah Hujan Kota Samarinda)*. *Jurnal Statistika*. Vol. 4, No. 2, Hal 52-61.

- Herjanto, Eddy. 2008. *Manajemen Operasi, Edisi Ketiga*. Jakarta: Grasindo.
- Heizer, Jay dan Render, Barry. 2009. *Manajemen Operasi, Buku 1 Edisi 9*. Jakarta: Salemba Empat.
- Indriyo, G., & Najmudin, M. (2000). *Ramalan Metode Rata-Rata Bergerak Berganda*. Yogyakarta: BPFÉ.
- Jang, S. dan Mizutani. 1997. *Neuro-Fuzzy and Soft Computing*. Upper Saddle River: Prentice Hall.
- Kusumadewi, S., Purnomo, H. 2004. *Aplikasi Logika Fuzzy untuk Pendukung Keputusan*. Graha Ilmu. Yogyakarta.
- Lutvia, C. R., Dian, A., Ahmad, K. 2019. *Fuzzy Time Series Saxena-Easo Pada Peramalan Laju Inflasi Indonesia*. Jurnal ILMU DASAR, Vol. 20, No. 1
- Makridakis, S. dan Wheelwright, S. C. 1999, *Metode dan Aplikasi Peramalan*. Jakarta: Binarupa Aksara.
- Novak, V., Perfilieva, I, dan Mockor, J. 1999. *Mathematical principles of fuzzy logic*. Dodrecht: Kluwer Academic.
- Nugroho, K. 2016. *Model Analisis Prediksi Menggunakan Metode Fuzzy Time Series*. Jurnal INFOKAM, Nomor 1 Th. XII/Maret/16.
- Putra, N. A. 2017. *Prediksi Jumlah Penduduk Menggunakan Fuzzy Time Series Model Chen (Studi Kasus: Kota Tanjungpinang)*. Jurnal Skripsi. FT UMRAH.
- Robandi, I. 2006. *Desain Sistem Tenaga Modern Optimasi Logika Fuzzy Algoritma Genetika*. Yogyakarta: Andi.

- Shakouri, H. G., dan Menhaj, M. 2008. *A Systematic Fuzzy Decision-Making Process to Choose The Best Model Among A Set of Competing Models*. IEEE Transactions on Systems, Man and Cybernetics, Part A: System and Humans, Vol. 38
- Sibigtroth, J.M. 1992. *Implementing Fuzzy Expert Rules in Hardware*. The Magazine of Artificial Intelligence in Practice Vol. 7
- Song, Q. dan Chissom, B.S. 1994. *Forecasting enrollments with fuzzy time series part II*, Fuzzy Sets and Systems, 1-8.
- Supranto. 2001. *Statistik teori dan aplikasi*. Erlangga: Jakarta.
- Sutikno, I.P. 2012. *Perbandingan Metode Deffuzifikasi Sistem Kendali Logika Fuzzy Model Madani*. Jurnal Masyarakat Informatika, 27-38.
- Ujianto, Y., dan Irawan, M. I. 2015. *Perbandingan Performansi Metode Peramalan Fuzzy Time Series yang Dimodifikasi dan Jaringan Syaraf Tiruan Backpropagation (Studi Kasus: Penutupan Harga IHSG)*. Jurnal Sains dan Seni ITS. Vol. 4, No.2
- Viot, G. 1993. *Fuzzy Logic: Concepts to Construct*. The Magazine of Artificial Intelligence in Practice, 26-33.
- Wei, W. S. (2006). *Time Series Analysis, Univariate and Multivariate Method Second Edition*. New York: Pearson Education.
- Zadeh, L. A. (1965). *Fuzzy Set Information and Control*, 338-353.

LAMPIRAN

Lampiran 1 Data jumlah penumpang kapal laut periode Januari 2013 sampai September 2019

TAHUN	BULAN	PENUMPANG	TAHUN	BULAN	PENUMPANG
2013	JANUARY	79,981	2015	JANUARY	70,622
	FEBRUARY	64,271		FEBRUARY	52,694
	MARCH	59,704		MARCH	50,981
	APRIL	54,474		APRIL	79,919
	MAY	54,015		MAY	88,203
	JUNE	63,980		JUNE	101,210
	JULY	88,756		JULY	130,677
	AUGUST	107,475		AUGUST	95,332
	SEPTEMBER	115,009		SEPTEMBER	67,658
	OCTOBER	86,776		OCTOBER	71,783
	NOVEMBER	67,645		NOVEMBER	57,475
	DECEMBER	58,156		DECEMBER	66,330
2014	JANUARY	71,276	2016	JANUARY	57,155
	FEBRUARY	54,955		FEBRUARY	43,436
	MARCH	58,327		MARCH	36,753
	APRIL	54,590		APRIL	38,299
	MAY	61,257		MAY	48,141
	JUNE	94,537		JUNE	86,899
	JULY	120,814		JULY	111,766
	AUGUST	122,296		AUGUST	88,864
	SEPTEMBER	96,317		SEPTEMBER	54,543
	OCTOBER	89,888		OCTOBER	53,644
	NOVEMBER	68,170		NOVEMBER	46,486
	DECEMBER	74,522		DECEMBER	56,017
2018	JANUARY	77,281	2017	JANUARY	55,297
	FEBRUARY	74,253		FEBRUARY	35,006
	MARCH	59,224		MARCH	41,373
	APRIL	44,745		APRIL	37,361
	MAY	45,028		MAY	56,398
	JUNE	53,980		JUNE	93,925
	JULY	88,756		JULY	106,114
	AUGUST	97,475		AUGUST	82,463
	SEPTEMBER	115,009		SEPTEMBER	56,503
	OCTOBER	96,755		OCTOBER	41,465
	NOVEMBER	77,641		NOVEMBER	39,981
	DECEMBER	78,156		DECEMBER	51,665
2019	JANUARY	61,463			
	FEBRUARY	49,202			
	MARCH	58,488			
	APRIL	58,993			
	MAY	98,970			
	JUNE	123,415			
	JULY	118,494			
	AUGUST	71,910			
SEPTEMBER	67,886				

Lampiran 2 Fuzzifikasi untuk data *training* peramalan orde satu

Bulan	Penumpang	Fuzzifikasi	Bulan	Penumpang	Fuzzifikasi
Jan-13	79,981	A4	May-16	48,141	A1
Feb-13	64,271	A3	Jun-16	86,899	A4
Mar-13	59,704	A2	Jul-16	111,766	A6
Apr-13	54,474	A2	Aug-16	88,864	A4
May-13	54,015	A2	Sep-16	54,543	A2
Jun-13	63,980	A3	Oct-16	53,644	A2
Jul-13	88,756	A4	Nov-16	46,486	A1
Aug-13	107,475	A6	Dec-16	56,017	A2
Sep-13	115,009	A6	Jan-17	55,297	A2
Oct-13	86,776	A4	Feb-17	35,006	A1
Nov-13	67,645	A3	Mar-17	41,373	A1
Dec-13	58,156	A2	Apr-17	37,361	A1
Jan-14	71,276	A3	May-17	56,398	A2
Feb-14	54,955	A2	Jun-17	93,925	A5
Mar-14	58,327	A2	Jul-17	106,114	A6
Apr-14	54,590	A2	Aug-17	82,463	A4
May-14	61,257	A2	Sep-17	56,503	A2
Jun-14	94,537	A5	Oct-17	41,465	A1
Jul-14	120,814	A7	Nov-17	39,981	A1
Aug-14	122,296	A7	Dec-17	51,665	A2
Sep-14	96,317	A5			
Oct-14	89,888	A5			
Nov-14	68,170	A3			
Dec-14	74,522	A3			
Jan-15	70,622	A3			
Feb-15	52,694	A2			
Mar-15	50,981	A2			
Apr-15	79,919	A4			
May-15	88,203	A4			
Jun-15	101,210	A5			
Jul-15	130,677	A7			
Aug-15	95,332	A5			
Sep-15	67,658	A3			
Oct-15	71,783	A3			
Nov-15	57,475	A2			
Dec-15	66,330	A3			
Jan-16	57,155	A2			
Feb-16	43,436	A1			
Mar-16	36,753	A1			
Apr-16	38,299	A1			

Lampiran 3 Nilai ramalan untuk data *training* peramalan orde satu

tahun	bulan	nilai	orde1	tahun	bulan	nilai	Orde1
2013	january	79981		2016	may	48141	60059.83
2013	february	64271	69172.5	2016	june	86899	82841.5
2013	march	59704	69172.5	2016	july	111766	96010.5
2013	april	54474	69172.5	2016	august	88864	82841.5
2013	may	54015	69172.5	2016	september	54543	69172.5
2013	june	63980	69172.5	2016	october	53644	69172.5
2013	july	88756	82841.5	2016	november	46486	60059.83
2013	august	107475	96010.5	2016	december	56017	69172.5
2013	september	115009	96010.5	2017	january	55297	69172.5
2013	october	86776	82841.5	2017	february	35006	60059.83
2013	november	67645	69172.5	2017	march	41373	60059.83
2013	december	58156	69172.5	2017	april	37361	60059.83
2014	january	71276	69172.5	2017	may	56398	69172.5
2014	february	54955	69172.5	2017	june	93925	99927.75
2014	march	58327	69172.5	2017	july	106114	96010.5
2014	april	54590	69172.5	2017	august	82463	82841.5
2014	may	61257	69172.5	2017	september	56503	69172.5
2014	june	94537	99927.75	2017	october	41465	60059.83
2014	july	120814	110179.5	2017	november	39981	60059.83
2014	august	122296	110179.5	2017	december	51665	69172.5
2014	september	96317	99927.75				
2014	october	89888	99927.75				
2014	november	68170	69172.5				
2014	december	74522	69172.5				
2015	january	70622	69172.5				
2015	february	52694	69172.5				
2015	march	50981	69172.5				
2015	april	79919	82841.5				
2015	may	88203	82841.5				
2015	june	101210	99927.75				
2015	july	130677	110179.5				
2015	august	95332	99927.75				
2015	september	67658	69172.5				
2015	october	71783	69172.5				
2015	november	57475	69172.5				
2015	december	66330	69172.5				
2016	january	57155	69172.5				
2016	february	43436	60059.83				
2016	march	36753	60059.83				
2016	april	38299	60059.83				

Lampiran 4 Uji Keakuratan untuk data *training* peramalan orde satu

BULAN	PENUMPANG	PERAMALAN	ERROR	ERROR ²	ERROR	ABS PE
Jan-13	79981					
Feb-13	64271	69172.5	-4901.5	24024702.25	4901.5	0.076
Mar-13	59704	69172.5	-9468.5	89652492.25	9468.5	0.159
Apr-13	54474	69172.5	-14698.5	216045902.3	14698.5	0.269
May-13	54015	69172.5	-15157.5	229749806.3	15157.5	0.280
Jun-13	63980	69172.5	-5192.5	26962056.25	5192.5	0.081
Jul-13	88756	82841.5	5914.5	34981310.25	5914.5	0.066
Aug-13	107475	96010.5	11464.5	131434760.3	11464.5	0.106
Sep-13	115009	96010.5	18998.5	360943002.3	18998.5	0.166
Oct-13	86776	82841.5	3934.5	15480290.25	3934.5	0.045
Nov-13	67645	69172.5	-1527.5	2333256.25	1527.5	0.022
Dec-13	58156	69172.5	-11016.5	121363272.3	11016.5	0.189
Oct-15	71783	69172.5	2610.50	6814710.2500	2610.5	0.036
Nov-15	57475	69172.5	-11697.50	136831506.2500	11697.5	0.203
Dec-15	66330	69172.5	-2842.50	8079806.2500	2842.5	0.042
Jan-16	57155	69172.5	-12017.50	144420306.2500	12017.5	0.216
Feb-16	35006	60059.833	-25053.83	627694547.9919	25053.833	0.715
Mar-16	36753	60059.833	-23306.83	543208464.4899	23306.833	0.634
Apr-16	38299	60059.833	-21760.83	473533852.8539	21760.833	0.568
May-16	48141	60059.833	-11918.83	142058580.0819	11918.833	0.247
Jun-16	86899	82841.5	4057.50	16463306.2500	4057.5	0.046
Jul-16	111766	96010.5	15755.50	248235780.2500	15755.5	0.140
Aug-16	88864	82841.5	6022.50	36270506.2500	6022.5	0.067
Sep-16	54543	69172.5	-14629.50	214022270.2500	14629.5	0.268
Oct-16	53644	69172.5	-15528.50	241134312.2500	15528.5	0.289
Nov-16	46486	60059.833	-13573.83	184248942.3119	13573.833	0.292
Dec-16	56017	69172.5	-13155.50	173067180.2500	13155.5	0.234
Jan-17	55297	69172.5	-13875.50	192529500.2500	13875.5	0.250
Feb-17	35006	60059.833	-25053.83	627694547.9919	25053.833	0.715
Mar-17	41373	60059.833	-18686.83	349197727.5699	18686.833	0.451
Apr-17	37361	60059.833	-22698.83	515237019.5619	22698.833	0.609
May-17	56398	69172.5	-12774.50	163187850.2500	12774.5	0.226
Jun-17	93925	99927.75	-6002.75	36033007.5625	6002.75	0.063
Jul-17	106114	96010.5	10103.50	102080712.2500	10103.5	0.095
Aug-17	82463	82841.5	-378.50	143262.2500	378.5	0.004
Sep-17	56503	69172.5	-12669.50	160516230.2500	12669.5	0.224
Oct-17	41465	60059.833	-18594.83	345767814.2979	18594.833	0.448
Nov-17	39981	60059.833	-20078.83	403159534.6419	20078.833	0.502
Dec-17	51665	69172.5	-17507.50	306512556.2500	17507.5	0.338

Lampiran 5 *Fuzzy logic relations group* dan Defuzifikasi untuk data *training* peramalan orde dua

ORDE 2	FLRG	F(t)
1	$A1, A1 \rightarrow A1, A2$	48669
2	$A1, A2 \rightarrow A2, A5$	76007
3	$A1, A4 \rightarrow A6$	110179.5
4	$A2, A1 \rightarrow A1, A2$	48669
5	$A2, A2 \rightarrow A1, A2, A3, A4, A5$	69172.5
6	$A2, A3 \rightarrow A2, A4$	69172.5
7	$A2, A4 \rightarrow A4$	82841.5
8	$A2, A5 \rightarrow A6, A7$	117014
9	$A3, A2 \rightarrow A1, A2, A3$	55503.5
10	$A3, A3 \rightarrow A2, A3$	62338
11	$A3, A4 \rightarrow A6$	110179.5
12	$A4, A2 \rightarrow A1, A2$	48669
13	$A4, A3 \rightarrow A2$	55503.5
14	$A4, A6 \rightarrow A4, A6$	96510.5
15	$A4, A4 \rightarrow A5$	96510.5
16	$A4, A5 \rightarrow A7$	123848.5
17	$A5, A3 \rightarrow A3$	69172.5
18	$A5, A5 \rightarrow A3$	69172.5
19	$A5, A6 \rightarrow A4$	82841.5
20	$A5, A7 \rightarrow A5, A7$	110179.5
21	$A6, A4 \rightarrow A2, A3$	62338
22	$A6, A6 \rightarrow A4$	82841.5
23	$A7, A5 \rightarrow A3, A5$	82841.5
24	$A7, A7 \rightarrow A5$	96510.5

Lampiran 6 nilai peramalan untuk data *training* peramalan orde dua

BULAN	JUMLAH PENUMPANG	PERAMALAN	BULAN	JUMLAH PENUMPANG	PERAMALAN
Jan-13	79981		Jun-16	86899	48669
Feb-13	64271		Jul-16	111766	110179.5
Mar-13	59704	55503.5	Aug-16	88864	96510.5
Apr-13	54474	55503.5	Sep-16	54543	62338
May-13	54015	69172.5	Oct-16	53644	48669
Jun-13	63980	69172.5	Nov-16	46486	69172.5
Jul-13	88756	69172.5	Dec-16	56017	48669
Aug-13	107475	110179.5	Jan-17	55297	76007
Sep-13	115009	96510.5	Feb-17	35006	69172.5
Oct-13	86776	82841.5	Mar-17	41373	48669
Nov-13	67645	62338	Apr-17	37361	48669
Dec-13	58156	55503.5	May-17	56398	48669
Jan-14	71276	55503.5	Jun-17	93925	76007
Feb-14	54955	69172.5	Jul-17	106114	117014
Mar-14	58327	55503.5	Aug-17	82463	82841.5
Apr-14	54590	69172.5	Sep-17	56503	62338
May-14	61257	69172.5	Oct-17	41465	48669
Jun-14	94537	69172.5	Nov-17	39981	48669
Jul-14	120814	117014	Dec-17	51665	48669
Aug-14	122296	110179.5			
Sep-14	96317	96510.5			
Oct-14	89888	82841.5			
Nov-14	68170	69172.5			
Dec-14	74522	69172.5			
Jan-15	70622	62338			
Feb-15	52694	62338			
Mar-15	50981	55503.5			
Apr-15	79919	69172.5			
May-15	88203	82841.5			
Jun-15	101210	96510.5			
Jul-15	130677	123848.5			
Aug-15	95332	110179.5			
Sep-15	67658	82841.5			
Oct-15	71783	69172.5			
Nov-15	57475	62338			
Dec-15	66330	55503.5			
Jan-16	57155	69172.5			
Feb-16	43436	55503.5			
Mar-16	36753	48669			
Apr-16	38299	48669			
May-16	48141	48669			

Lampiran 7 Uji keakuratan untuk data *training* peramalan orde dua

BULAN	PENUMPANG	PERAMALAN	ERROR	ERROR ²	ERROR	PE
Jan-13	79981					
Feb-13	64271					
Mar-13	59704	55503.5	4200.5	17644200.25	4200.5	0.070
Apr-13	54474	55503.5	-1029.5	1059870.25	1029.5	0.018
May-13	54015	69172.5	-15157.5	229749806.3	15157.5	0.280
Jun-13	63980	69172.5	-5192.5	26962056.25	5192.5	0.081
Jul-13	88756	69172.5	19583.5	383513472.3	19583.5	0.220
Aug-13	107475	110179.5	-2704.5	7314320.25	2704.5	0.025
Sep-13	115009	96510.5	18498.5	342194502.3	18498.5	0.160
Oct-13	86776	82841.5	3934.5	15480290.25	3934.5	0.045
Nov-13	67645	62338	5307	28164249	5307	0.078
Dec-13	58156	55503.5	2652.5	7035756.25	2652.5	0.045
Jan-16	57155	69172.5	-12017.50	144420306.2500	12017.5	0.210
Feb-16	43436	55503.5	-12067.50	145624556.2500	12067.5	0.277
Mar-16	36753	48669	-11916.00	141991056.0000	11916	0.324
Apr-16	38299	48669	-10370.00	107536900.0000	10370	0.270
May-16	48141	48669	-528.00	278784.0000	528	0.010
Jun-16	86899	48669	38230.00	1461532900.0000	38230	0.439
Jul-16	111766	110179.5	1586.50	2516982.2500	1586.5	0.014
Aug-16	88864	96510.5	-7646.50	58468962.2500	7646.5	0.086
Sep-16	54543	62338	-7795.00	60762025.0000	7795	0.142
Oct-16	53644	48669	4975.00	24750625.0000	4975	0.092
Nov-16	46486	69172.5	-22686.50	514677282.2500	22686.5	0.488
Dec-16	56017	48669	7348.00	53993104.0000	7348	0.131
Jan-17	55297	76007	-20710.00	428904100.0000	20710	0.374
Feb-17	35006	69172.5	-34166.50	1167349722.2500	34166.5	0.976
Mar-17	41373	48669	-7296.00	53231616.0000	7296	0.176
Apr-17	37361	48669	-11308.00	127870864.0000	11308	0.302
May-17	56398	48669	7729.00	59737441.0000	7729	0.137
Jun-17	93925	76007	17918.00	321054724.0000	17918	0.190
Jul-17	106114	117014	-10900.00	118810000.0000	10900	0.102
Aug-17	82463	82841.5	-378.50	143262.2500	378.5	0.004
Sep-17	56503	62338	-5835.00	34047225.0000	5835	0.103
Oct-17	41465	48669	-7204.00	51897616.0000	7204	0.173
Nov-17	39981	48669	-8688.00	75481344.0000	8688	0.217
Dec-17	51665	48669	2996.00	8976016.0000	2996	0.057

Lampiran 8 *Fuzzy logic relations group* dan Defuzzifikasi untuk data *training* peramalan orde tiga

GRUP ORDE 3	FLRG	F(t)	GRUP ORDE 3	FLRG	F(t)
1	A1,A1,A1→A1,A2,A4	60059.83	24	A3,A4,A6→A6	110179.5
2	A1,A1,A2→A5	96510.5	25	A4,A3,A2→A2,A3	62338
3	A1,A1,A4→A6	110179.5	26	A4,A2,A2→A1	41834.5
4	A1,A2,A2→A1	41834.5	27	A4,A2,A1→A1	41834.5
5	A1,A2,A5→A6	110179.5	28	A4,A4,A5→A7	123848.5
6	A1,A4,A6→A4	82841.5	29	A4,A5,A7→A5	96510.5
7	A2,A1,A1→A1,A2	48669	30	A4,A6,A4→A2	55503.5
8	A2,A2,A1→A1,A2	48669	31	A4,A6,A6→A4	82841.5
9	A2,A1,A2→A2	55503.5	32	A5,A3,A3→A2,A3	62338
10	A2,A2,A2→A2,A3,A5	73728.83	33	A5,A5,A3→A3	69172.5
11	A2,A2,A3→A4	82841.5	34	A5,A6,A4→A2	55503.5
12	A2,A3,A2→A1,A2	48669	35	A5,A7,A5→A3	69172.5
13	A2,A2,A4→A4	82841.5	36	A5,A7,A7→A5	96510.5
14	A2,A2,A5→A7	123848.5	37	A6,A4,A2→A1,A2	48669
15	A2,A3,A4→A6	110179.5	38	A6,A4,A3→A2	55503.5
16	A2,A4,A4→A5	96510.5	39	A6,A6,A4→A3	69172.5
17	A2,A5,A6→A4	82841.5	40	A7,A5,A3→A3	69172.5
18	A2,A5,A7→A7	123848.5	41	A7,A5,A5→A3	69172.5
19	A3,A2,A2→A2,A4	69172.5	42	A7,A7,A5→A5	96510.5
20	A3,A2,A3→A2	55503.5			
21	A3,A3,A2→A2,A3	62338			
22	A3,A2,A1→A1	41834.5			
23	A3,A3,A3→A2	55503.5			

Lampiran 9 nilai peramalan untuk data *training* peramalan orde tiga

BULAN	JUMLAH PENUMPANG	PERAMALAN	BULAN	JUMLAH PENUMPANG	PERAMALAN
Jan-13	79981		Jun-16	86899	60059.83
Feb-13	64271		Jul-16	111766	110179.5
Mar-13	59704		Aug-16	88864	82841.5
Apr-13	54474	62338	Sep-16	54543	55503.5
May-13	54015	69172.5	Oct-16	53644	48669
Jun-13	63980	73728.833	Nov-16	46486	41834.5
Jul-13	88756	82841.5	Dec-16	56017	48669
Aug-13	107475	110179.5	Jan-17	55297	55503.5
Sep-13	115009	110179.5	Feb-17	35006	41834.5
Oct-13	86776	82841.5	Mar-17	41373	48669
Nov-13	67645	69172.5	Apr-17	37361	48669
Dec-13	58156	55503.5	May-17	56398	60059.83
Jan-14	71276	62338	Jun-17	93925	96510.5
Feb-14	54955	55503.5	Jul-17	106114	110179.5
Mar-14	58327	48669	Aug-17	82463	82841.5
Apr-14	54590	69172.5	Sep-17	56503	55503.5
May-14	61257	73728.833	Oct-17	41465	48669
Jun-14	94537	73728.833	Nov-17	39981	41834.5
Jul-14	120814	123848.5	Dec-17	51665	48669
Aug-14	122296	123848.5			
Sep-14	96317	96510.5			
Oct-14	89888	96510.5			
Nov-14	68170	69172.5			
Dec-14	74522	69172.5			
Jan-15	70622	62338			
Feb-15	52694	55503.5			
Mar-15	50981	62338			
Apr-15	79919	69172.5			
May-15	88203	82841.5			
Jun-15	101210	96510.5			
Jul-15	130677	123848.5			
Aug-15	95332	96510.5			
Sep-15	67658	69172.5			
Oct-15	71783	69172.5			
Nov-15	57475	62338			
Dec-15	66330	62338			
Jan-16	57155	55503.5			
Feb-16	43436	48669			
Mar-16	36753	41834.5			
Apr-16	38299	48669			
May-16	48141	60059.833			

Lampiran 10 Uji Keakuratan untuk data *training* peramalan orde tiga

BULAN	PENUMPANG	PERAMALAN	<i>ERROR</i>	<i>ERROR</i> ²	<i>ERROR</i>	<i>PE</i>
Jan-13	79981					
Feb-13	64271					
Mar-13	59704					
Apr-13	54474	62338	-7864	61842496	7864	0.144
May-13	54015	69172.5	-15157.5	229749806.3	15157.5	0.280
Jun-13	63980	73728.833	-9748.833	95039744.86	9748.833	0.152
Jul-13	88756	82841.5	5914.5	34981310.25	5914.5	0.066
Aug-13	107475	110179.5	-2704.5	7314320.25	2704.5	0.025
Sep-13	115009	110179.5	4829.5	23324070.25	4829.5	0.041
Oct-13	86776	82841.5	3934.5	15480290.25	3934.5	0.045
Nov-13	67645	69172.5	-1527.5	2333256.25	1527.5	0.022
Dec-13	58156	55503.5	2652.5	7035756.25	2652.5	0.045
Jan-16	57155	55503.5	1651.50	2727452.2500	1651.5	0.028
Feb-16	43436	48669	-5233.00	27384289.0000	5233	0.128
Mar-16	36753	41834.5	-5081.50	25821642.2500	5081.5	0.138
Apr-16	38299	48669	-10370.00	107536900.0000	10370	0.270
May-16	48141	60059.833	-11918.83	142058580.0819	11918.833	0.247
Jun-16	86899	60059.833	26839.17	720340885.2539	26839.167	0.308
Jul-16	111766	110179.5	1586.50	2516982.2500	1586.5	0.014
Aug-16	88864	82841.5	6022.50	36270506.2500	6022.5	0.067
Sep-16	54543	55503.5	-960.50	922560.2500	960.5	0.017
Oct-16	53644	48669	4975.00	24750625.0000	4975	0.092
Nov-16	46486	41834.5	4651.50	21636452.2500	4651.5	0.100
Dec-16	56017	48669	7348.00	53993104.0000	7348	0.131
Jan-17	55297	55503.5	-206.50	42642.2500	206.5	0.003
Feb-17	35006	41834.5	-6828.50	46628412.2500	6828.5	0.195
Mar-17	41373	48669	-7296.00	53231616.0000	7296	0.176
Apr-17	37361	48669	-11308.00	127870864.0000	11308	0.302
May-17	56398	60059.833	-3661.83	13409020.9199	3661.833	0.064
Jun-17	93925	96510.5	-2585.50	6684810.2500	2585.5	0.027
Jul-17	106114	110179.5	-4065.50	16528290.2500	4065.5	0.038
Aug-17	82463	82841.5	-378.50	143262.2500	378.5	0.004
Sep-17	56503	55503.5	999.50	999000.2500	999.5	0.017
Oct-17	41465	48669	-7204.00	51897616.0000	7204	0.173
Nov-17	39981	41834.5	-1853.50	3435462.2500	1853.5	0.046
Dec-17	51665	48669	2996.00	8976016.0000	2996	0.057

Lampiran 11 *Fuzzy logic relations group* dan Defuzzifikasi untuk data *training* peramalan orde empat

ORDE 4	FLRG	F(t)	ORDE 4	FLRG	F(t)
1	A1,A1,A1,A1→A4	82841.5	42	A5,A3,A3,A2→A3	69172.5
2	A1,A1,A1,A4→A6	110179.5	43	A5,A5,A3,A3→A3	69172.5
3	A1,A1,A4,A6→A4	82841.5	44	A5,A6,A4,A2→A1	41834.5
4	A1,A4,A6,A4→A2	55503.5	45	A5,A7,A5,A3→A3	69172.5
5	A1,A1,A1,A2→A5	96510.5	46	A5,A7,A7,A5→A5	96510.5
6	A1,A1,A2,A5→A6	110179.5	47	A6,A4,A2,A1→A1	41834.5
7	A1,A2,A2,A1→A1	41834.5	48	A6,A4,A2,A2→A1	41834.5
8	A1,A2,A5,A6→A4	82841.5	49	A6,A6,A4,A3→A2	55503.5
9	A2,A1,A1,A1→A1,A2	48669	50	A6,A4,A3,A2→A3	69172.5
10	A2,A1,A2,A2→A1	41834.5	51	A7,A5,A3,A3→A2	55503.5
11	A2,A2,A1,A2→A2	55503.5	52	A7,A5,A5,A3→A3	69172.5
12	A2,A2,A1,A1→A1	41834.5	53	A7,A7,A5,A5→A3	69172.5
13	A2,A2,A2,A2→A5	96510.5			
14	A2,A2,A2,A3→A4	82841.5			
15	A2,A2,A2,A5→A7	123848.5			
16	A2,A2,A3,A4→A6	110179.5			
17	A2,A2,A5,A7→A7	123848.5			
18	A2,A2,A4,A4→A5	96510.5			
19	A2,A3,A4,A6→A6	110179.5			
20	A2,A4,A4,A5→A7	123848.5			
21	A2,A3,A2,A1→A1	41834.5			
22	A2,A3,A2,A2→A2	55503.5			
23	A2,A5,A6,A4→A2	55503.5			
24	A2,A5,A7,A7→A5	96510.5			
25	A3,A2,A2,A2→A2,A3	62338			
26	A3,A2,A2,A4→A4	82841.5			
27	A3,A2,A1,A1→A1	41834.5			
28	A3,A2,A3,A2→A1,A2	48669			
29	A3,A3,A2,A3→A2	55503.5			
30	A3,A4,A6,A6→A4	82841.5			
31	A3,A3,A3,A2→A2	55503.5			
32	A3,A3,A2,A2→A4	82841.5			
33	A4,A3,A2,A2→A2	55503.5			
34	A4,A3,A2,A3→A2	55503.5			
35	A4,A2,A1,A1→A2	55503.5			
36	A4,A2,A2,A1→A2	55503.5			
37	A4,A6,A4,A2→A2	55503.5			
38	A4,A6,A6,A4→A3	69172.5			
39	A4,A4,A5,A7→A5	96510.5			
40	A4,A5,A7,A5→A3	69172.5			
41	A5,A3,A3,A3→A2	55503.5			

Lampiran 12 nilai peramalan dan *error* untuk data *training* peramalan orde empat

BULAN	JUMLAH PENUMPANG	NILAI PERAMALAN	<i>ERROR</i>	<i>ERROR</i> ²	<i>ABS ERROR</i>	<i>ABS PE</i>
Jan-13	79981					
Feb-13	64271					
Mar-13	59704					
Apr-13	54474	62338	-7864	61842496	7864	0.144
May-13	54015	69172.5	-15157.5	229749806.3	15157.5	0.280
Jun-13	63980	73728.833	-9748.833	95039744.86	9748.833	0.152
Jul-13	88756	82841.5	5914.5	34981310.25	5914.5	0.066
Aug-13	107475	110179.5	-2704.5	7314320.25	2704.5	0.025
Sep-13	115009	110179.5	4829.5	23324070.25	4829.5	0.041
Oct-13	86776	82841.5	3934.5	15480290.25	3934.5	0.045
Nov-13	67645	69172.5	-1527.5	2333256.25	1527.5	0.022
Dec-13	58156	55503.5	2652.5	7035756.25	2652.5	0.045
Aug-15	37361	48669	-11308.00	127870864.0000	11308	0.302
Sep-15	67658	69172.5	-1514.50	2293710.2500	1514.5	0.022
Oct-15	71783	69172.5	2610.50	6814710.2500	2610.5	0.036
Nov-15	57475	62338	-4863.00	23648769.0000	4863	0.084
Dec-15	66330	62338	3992.00	15936064.0000	3992	0.060
Jan-16	57155	55503.5	1651.50	2727452.2500	1651.5	0.028
Feb-16	43436	48669	-5233.00	27384289.0000	5233	0.120
Mar-16	36753	41834.5	-5081.50	25821642.2500	5081.5	0.138
Apr-16	38299	48669	-10370.00	107536900.0000	10370	0.270
May-16	48141	60059.833	-11918.83	142058580.0819	11918.833	0.247
Jun-16	86899	60059.833	26839.17	720340885.2539	26839.167	0.308
Jul-16	111766	110179.5	1586.50	2516982.2500	1586.5	0.019
Aug-16	88864	82841.5	6022.50	36270506.2500	6022.5	0.067
Sep-16	54543	55503.5	-960.50	922560.2500	960.5	0.017
Oct-16	53644	48669	4975.00	24750625.0000	4975	0.092
Nov-16	46486	41834.5	4651.50	21636452.2500	4651.5	0.100
Dec-16	56017	48669	7348.00	53993104.0000	7348	0.131
Jan-17	55297	55503.5	-206.50	42642.2500	206.5	0.003
Feb-17	35006	41834.5	-6828.50	46628412.2500	6828.5	0.195
Mar-17	41373	48669	-7296.00	53231616.0000	7296	0.176
Apr-17	37361	48669	-11308.00	127870864.0000	11308	0.302
May-17	56398	60059.833	-3661.83	13409020.9199	3661.833	0.064
Jun-17	93925	96510.5	-2585.50	6684810.2500	2585.5	0.027
Jul-17	106114	110179.5	-4065.50	16528290.2500	4065.5	0.038
Aug-17	82463	82841.5	-378.50	143262.2500	378.5	0.004
Sep-17	56503	55503.5	999.50	999000.2500	999.5	0.017
Oct-17	41465	48669	-7204.00	51897616.0000	7204	0.173
Nov-17	39981	41834.5	-1853.50	3435462.2500	1853.5	0.046
Dec-17	51665	48669	2996.00	8976016.0000	2996	0.057

Lampiran 13 nilai peramalan dan *error* untuk data *testing* peramalan orde satu.

Bulan	Penumpang	Peramalan	<i>Error</i>	<i>Error</i> ²	<i>Abs error</i>	<i>Abs PE</i>
Jan-18	77281					
Feb-18	74253	60476	13777	189805729	13777	0.185
Mar-18	59224	60476	-1252	1567504	1252	0.021
Apr-18	44745	78834.67	-34089.7	1162105601	34089.67	0.761
May-18	45028	78834.67	-33806.7	1142890936	33806.67	0.750
Jun-18	53980	78834.67	-24854.7	617754620.8	24854.67	0.460
Jul-18	88756	84080	4676	21864976	4676	0.052
Aug-18	97475	99816	-2341	5480281	2341	0.024
Sep-18	115009	94570.67	20438.33	417725333.2	20438.33	0.177
Oct-18	96755	99816	-3061	9369721	3061	0.031
Nov-18	77641	84080	-6439	41460721	6439	0.082
Dec-18	78156	84080	-5924	35093776	5924	0.075
Jan-19	61463	60476	987.00	974169.0000	987	0.016
Feb-19	49202	78834.67	-29632.67	878095131.3289	29632.67	0.602
Mar-19	58488	78834.67	-20346.67	413986980.0889	20346.67	0.347
Apr-19	58993	78834.67	-19841.67	393691868.3889	19841.67	0.336
May-19	98970	99816	-846.00	715716.0000	846	0.008
Jun-19	123415	94570.67	28844.33	831995373.1489	28844.33	0.233
Jul-19	118494	94570.67	23923.33	572325718.2889	23923.33	0.201
Aug-19	71910	60476	11434.00	130736356.0000	11434	0.159
Sep-19	67886	60476	7410.00	54908100.0000	7410	0.109

Lampiran 14 *Fuzzy logic relations group* dan Defuzzifikasi untuk data *testing* peramalan orde satu dan dua

GRUP ORDE 1	FLRG	Nilai Peramalan
1	$A1 \rightarrow A1, A3, A4$	78834.67
2	$A2 \rightarrow A1, A2$	60476
3	$A3 \rightarrow A2, A3, A4$	84080
4	$A4 \rightarrow A3, A5$	99816
5	$A5 \rightarrow A2, A4, A5$	94570.67

GRUP ORDE 2	FLRG	F(t)
1	$A1, A1 \rightarrow A1, A3, A4$	78834.67
2	$A1, A3 \rightarrow A4$	99816
3	$A1, A4 \rightarrow A5$	115552
4	$A2, A1 \rightarrow A1$	52608
5	$A2, A2 \rightarrow A1$	52608
6	$A3, A2 \rightarrow A1$	52608
7	$A3, A2 \rightarrow A2$	68344
8	$A3, A3 \rightarrow A2$	68344
9	$A3, A4 \rightarrow A5$	115552
10	$A4, A3 \rightarrow A3$	84080
11	$A4, A5 \rightarrow A4, A5$	107684
12	$A5, A2 \rightarrow A2$	68344
13	$A5, A4 \rightarrow A3$	84080
14	$A5, A5 \rightarrow A2$	68344

Lampiran 15 Nilai peramalan dan *error* untuk data *testing* peramalan orde dua

Bulan	Penumpang	Peramalan	<i>Error</i>	<i>Error</i> ²	<i>Abs error</i>	<i>Abs PE</i>
Jan-18	77281					
Feb-18	74253					
Mar-18	59224	68344	-9120	83174400	9120	0.153
Apr-18	44745	52608	-7863	61826769	7863	0.175
May-18	45028	52608	-7580	57456400	7580	0.168
Jun-18	53980	78834.67	-24854.7	617754620.8	24854.67	0.460
Jul-18	88756	78834.67	9921.33	98432788.97	9921.33	0.111
Aug-18	97475	99816	-2341	5480281	2341	0.024
Sep-18	115009	115552	-543	294849	543	0.004
Oct-18	96755	107684	-10929	119443041	10929	0.112
Nov-18	77641	84080	-6439	41460721	6439	0.082
Dec-18	78156	84080	-5924	35093776	5924	0.075
Jan-19	61463	68344	-6881.00	47348161.0000	6881	0.111
Feb-19	49202	68344	-19142.00	366416164.0000	19142	0.389
Mar-19	58488	52608	5880.00	34574400.0000	5880	0.100
Apr-19	58993	78834.67	-19841.67	393691868.3889	19841.67	0.336
May-19	98970	78834.67	20135.33	405431514.2089	20135.33	0.203
Jun-19	123415	115552	7863.00	61826769.0000	7863	0.061
Jul-19	118494	107684	10810.00	116856100.0000	10810	0.091
Aug-19	71910	68344	3566.00	12716356.0000	3566	0.049
Sep-19	67886	68344	-458.00	209764.0000	458	0.006

Lampiran 16 *Fuzzy logic relations group* dan Defuzzifikasi untuk data *testing* peramalan orde tiga

GRUP ORDE 3	FLRG	F(t)
1	A1,A1,A1→A3,A4	91948
2	A1,A1,A3→A4	99816
3	A1,A1,A4→A5	115552
4	A1,A3,A4→A5	115552
5	A1,A4,A5→A5	115552
6	A2,A1,A1→A1	52608
7	A2,A2,A1→A1	52608
8	A3,A2,A2→A1	52608
9	A3,A2,A1→A1	52608
10	A3,A3,A2→A1	52608
11	A3,A4,A5→A4	99816
12	A4,A3,A3→A2	68344
13	A4,A5,A4→A3	84080
14	A4,A5,A5→A2	68344
15	A5,A4,A3→A3	84080
16	A5,A5,A2→A2	68344

Lampiran 17 Nilai peramalan dan *error* untuk data *testing* peramalan orde tiga

Bulan	Penumpang	Peramalan	<i>Error</i>	<i>error</i> ²	<i>ABS Error</i>	<i>ABS PE</i>
Jan-18	77281					
Feb-18	74253					
Mar-18	59224					
Apr-18	44745	52608	-7863	61826769	7863	0.175
May-18	45028	52608	-7580	57456400	7580	0.168
Jun-18	53980	52608	1372	1882384	1372	0.025
Jul-18	88756	91948	-3192	10188864	3192	0.035
Aug-18	97475	99816	-2341	5480281	2341	0.024
Sep-18	115009	115552	-543	294849	543	0.004
Oct-18	96755	99816	-3061	9369721	3061	0.031
Nov-18	77641	84080	-6439	41460721	6439	0.082
Dec-18	78156	84080	-5924	35093776	5924	0.075
Jan-19	61463	68344	-6881.00	47348161.0000	6881	0.111
Feb-19	49202	52608	-3406.00	11600836.0000	3406	0.069
Mar-19	58488	52608	5880.00	34574400.0000	5880	0.100
Apr-19	58993	52608	6385.00	40768225.0000	6385	0.108
May-19	98970	91948	7022.00	49308484.0000	7022	0.070
Jun-19	123415	115552	7863.00	61826769.0000	7863	0.063
Jul-19	118494	115552	2942.00	8655364.0000	2942	0.024
Aug-19	71910	68344	3566.00	12716356.0000	3566	0.049
Sep-19	67886	68344	-458.00	209764.0000	458	0.006