Project 3 - Forecasting

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Part 1

1.1

In this case, I am taking value of m = 3

Training Data vs Fitted Data for Simple Moving Average Model at M = 3
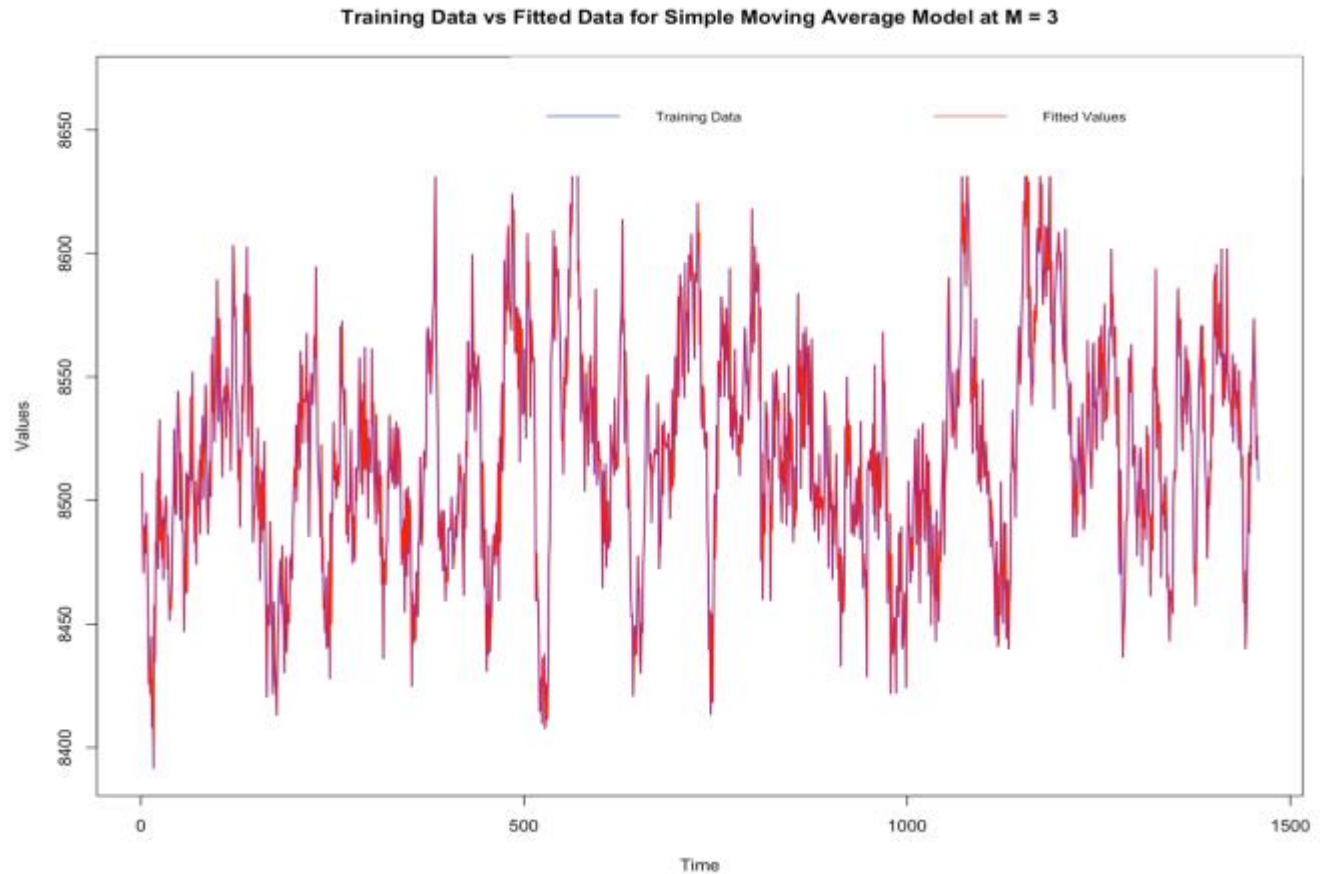
1.2

The RMSE value obtained from the model at m = 3 is: **24.22457**

1.3

Now, we are varying values of m from 0 to 100 in order find the best value of m with lowest corresponding RMSE value.

M	RMSE	M	RMSE	M	RMSE
1	25.11553	35	42.6016	68	44.2591
2	22.84046	36	42.79674	69	44.23476
3	24.22457	37	42.98989	70	44.21765
4	25.3994	38	43.17758	71	44.20381
5	26.85595	39	43.36082	72	44.19329
6	28.19926	40	43.52531	73	44.19143
7	29.37931	41	43.68047	74	44.18922
8	30.57135	42	43.81992	75	44.19454
9	31.59843	43	43.9411	76	44.19456
10	32.60263	44	44.0452	77	44.19897
11	33.50408	45	44.14166	78	44.20361
12	34.37462	46	44.22264	79	44.21284

13	35.1638	47	44.28158	80	44.22079
14	35.90575	48	44.32617	81	44.23261
15	36.59692	49	44.36454	82	44.24693
16	37.2196	50	44.39082	83	44.26517
17	37.8057	51	44.4101	84	44.27935
18	38.31359	52	44.43324	85	44.29175
19	38.77306	53	44.45395	86	44.30091
20	39.18695	54	44.47079	87	44.30724
21	39.57755	55	44.4794	88	44.30791
22	39.93894	56	44.47622	89	44.29615
23	40.25317	57	44.4659	90	44.27684
24	40.54327	58	44.45775	91	44.2556
25	40.7892	59	44.44474	92	44.22862
26	41.02156	60	44.42683	93	44.20254
27	41.21622	61	44.41112	94	44.1791
28	41.39044	62	44.39144	95	44.153
29	41.56193	63	44.3707	96	44.13113
30	41.72719	64	44.35083	97	44.10805
31	41.88969	65	44.32853	98	44.09247
32	42.05265	66	44.30871	99	44.07678
33	42.22186	67	44.28258	100	44.06102
34	42.41066				

1.4

On observation of the m values in the table above, the **lowest RMSE value = 22.84046** at **M = 2**

RMSE values for Simple Moving Average
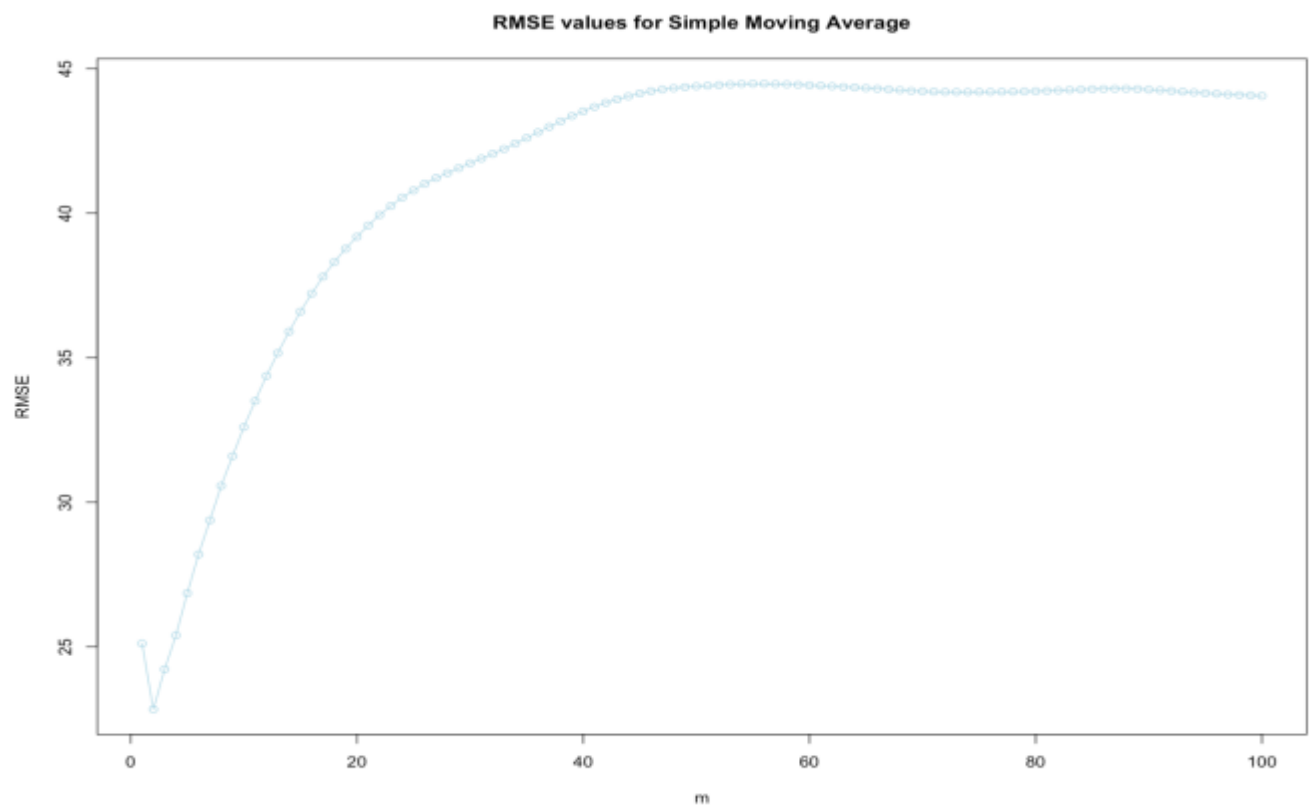
Now as we have out M value, we will test the model against the training data:

Training Data vs Fitted Data for Simple Moving Average Model at M = 2
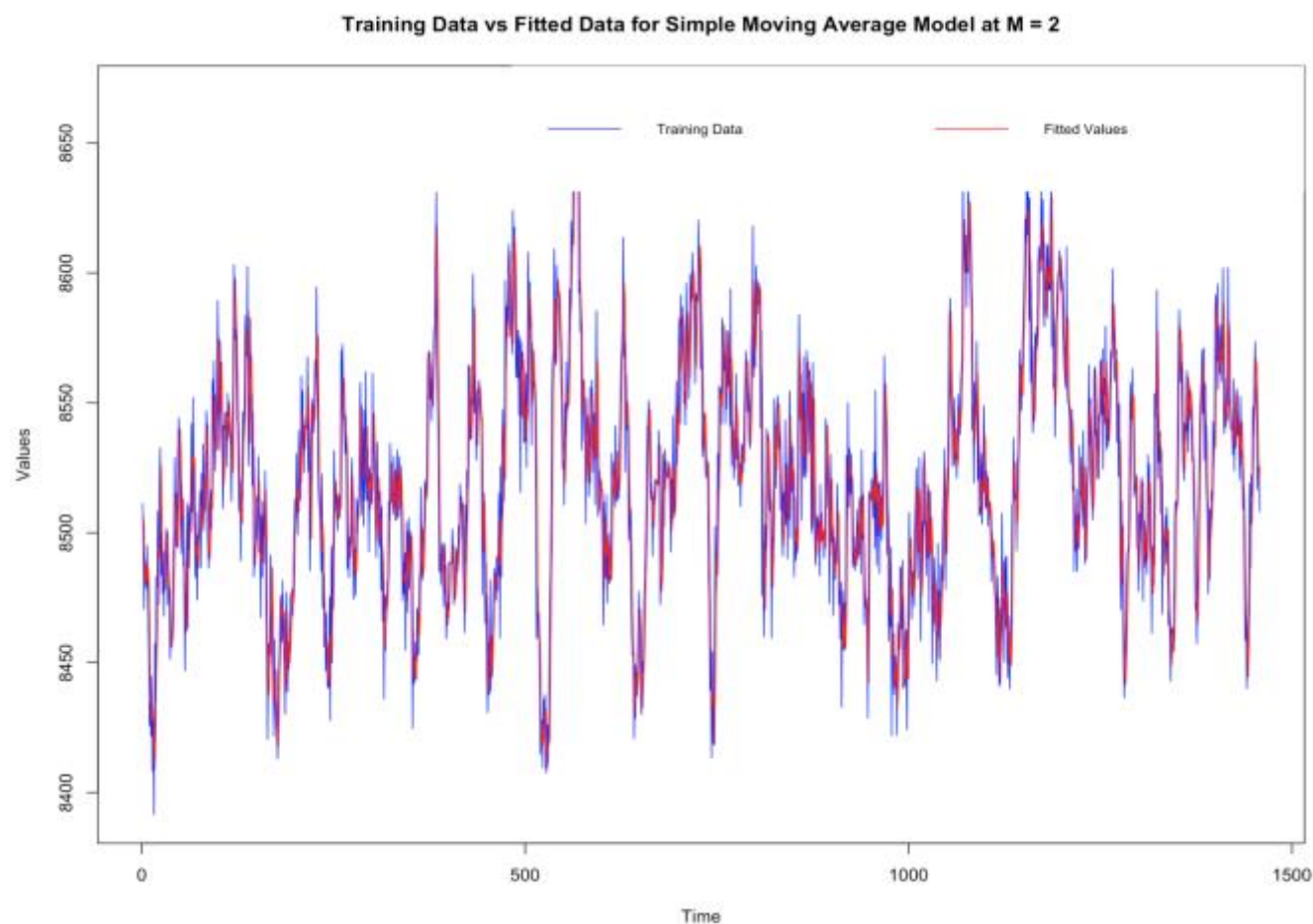
Part 2

2.1

I have taken value for alpha = 0.45 in order to show how the model works at the particular value.
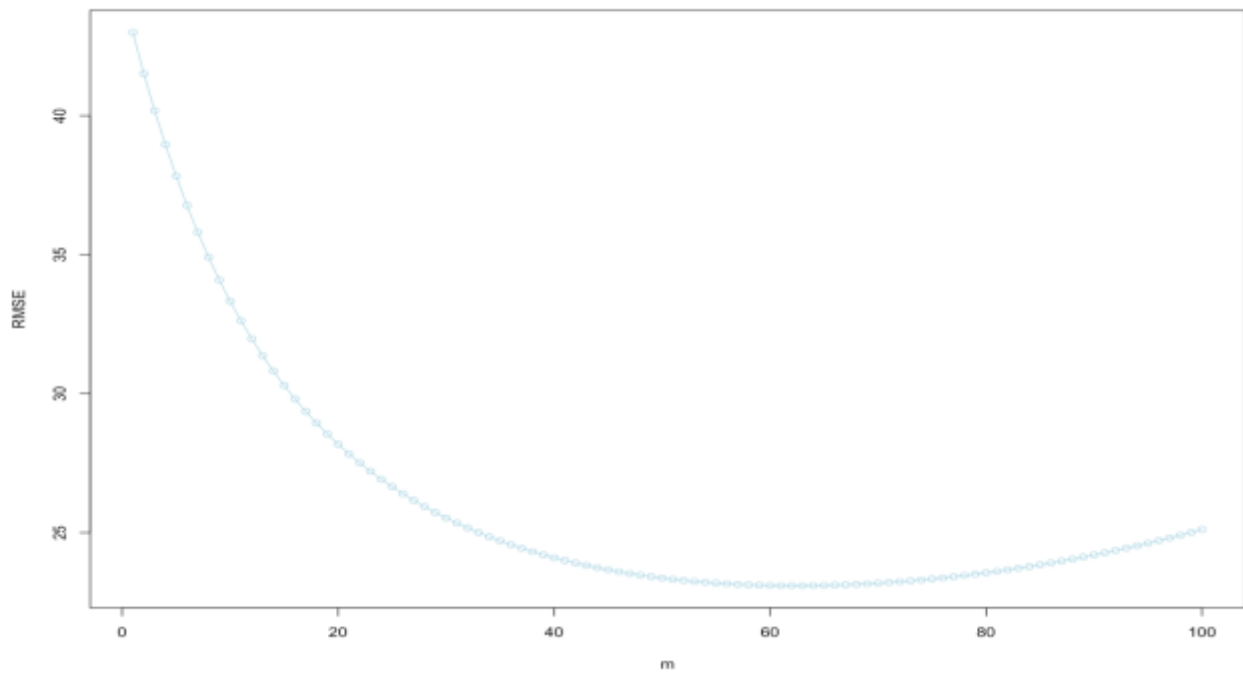RMSE value for Exponential Smoothing Model at **alpha= 0.45: 23.6637841321677**

Training Data vs Fitted Data for Exponential Smoothing Model at Alpha = 0.45
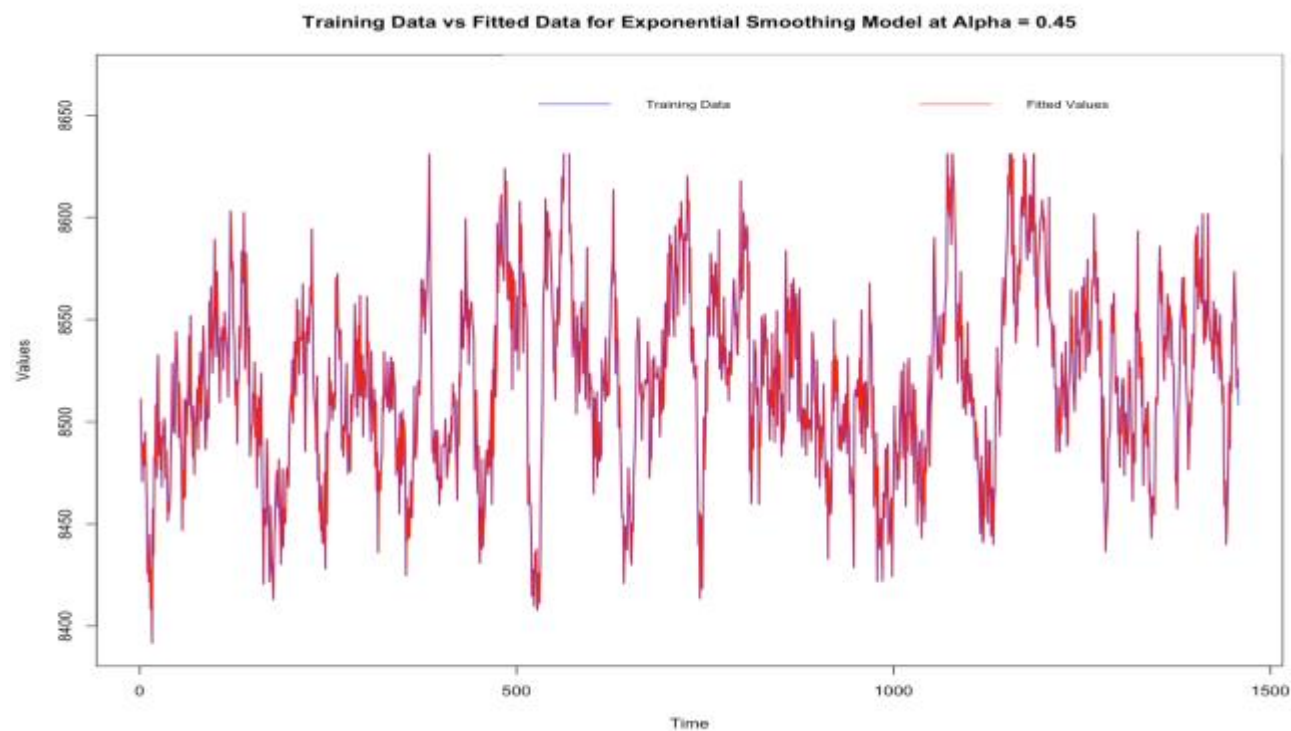
2.2

Alpha	RMSE	Alpha	RMSE	Alpha	RMSE
0.01	42.99576	0.35	24.7051	0.68	23.14239
0.02	41.51075	0.36	24.568	0.69	23.1614
0.03	40.18578	0.37	24.4392	0.70	23.18332
0.04	38.96413	0.38	24.31829	0.71	23.20813
0.05	37.82915	0.39	24.20487	0.72	23.23578
0.06	36.77735	0.40	24.09861	0.73	23.26625
0.07	35.80594	0.41	23.99916	0.74	23.2995
0.08	34.91052	0.42	23.90623	0.75	23.33552
0.09	34.08553	0.43	23.81953	0.76	23.37428
0.10	33.32494	0.44	23.73879	0.77	23.41575
0.11	32.62283	0.45	23.66378	0.78	23.45994
0.12	31.97362	0.46	23.59427	0.79	23.50682
0.13	31.37223	0.47	23.53004	0.80	23.55637
0.14	30.81413	0.48	23.47089	0.81	23.6086
0.15	30.29529	0.49	23.41664	0.82	23.6635
0.16	29.81214	0.50	23.36711	0.83	23.72106
0.17	29.36154	0.51	23.32215	0.84	23.78128
0.18	28.94071	0.52	23.28161	0.85	23.84416
0.19	28.54721	0.53	23.24534	0.86	23.90972
0.20	28.17883	0.54	23.21321	0.87	23.97795
0.21	27.83364	0.55	23.18511	0.88	24.04886
0.22	27.5099	0.56	23.16091	0.89	24.12246
0.23	27.20603	0.57	23.14051	0.90	24.19878
0.24	26.92062	0.58	23.1238	0.91	24.27781
0.25	26.6524	0.59	23.1107	0.92	24.35959
0.26	26.40021	0.60	23.10112	0.93	24.44413
0.27	26.163	0.61	23.09498	0.94	24.53146
0.28	25.93981	**0.62**	**23.09219**	0.95	24.6216
0.29	25.72977	0.63	23.09269	0.96	24.71458
0.30	25.53207	0.64	23.09642	0.97	24.81043
0.31	25.34598	0.65	23.10331	0.98	24.90918
0.32	25.17084	0.66	23.1133	0.99	25.01087
0.33	25.00602	0.67	23.12634	1.0	25.11553
34	24.85094				

Lowest value of RMSE is: 23.09219 at Alpha = 0.62.

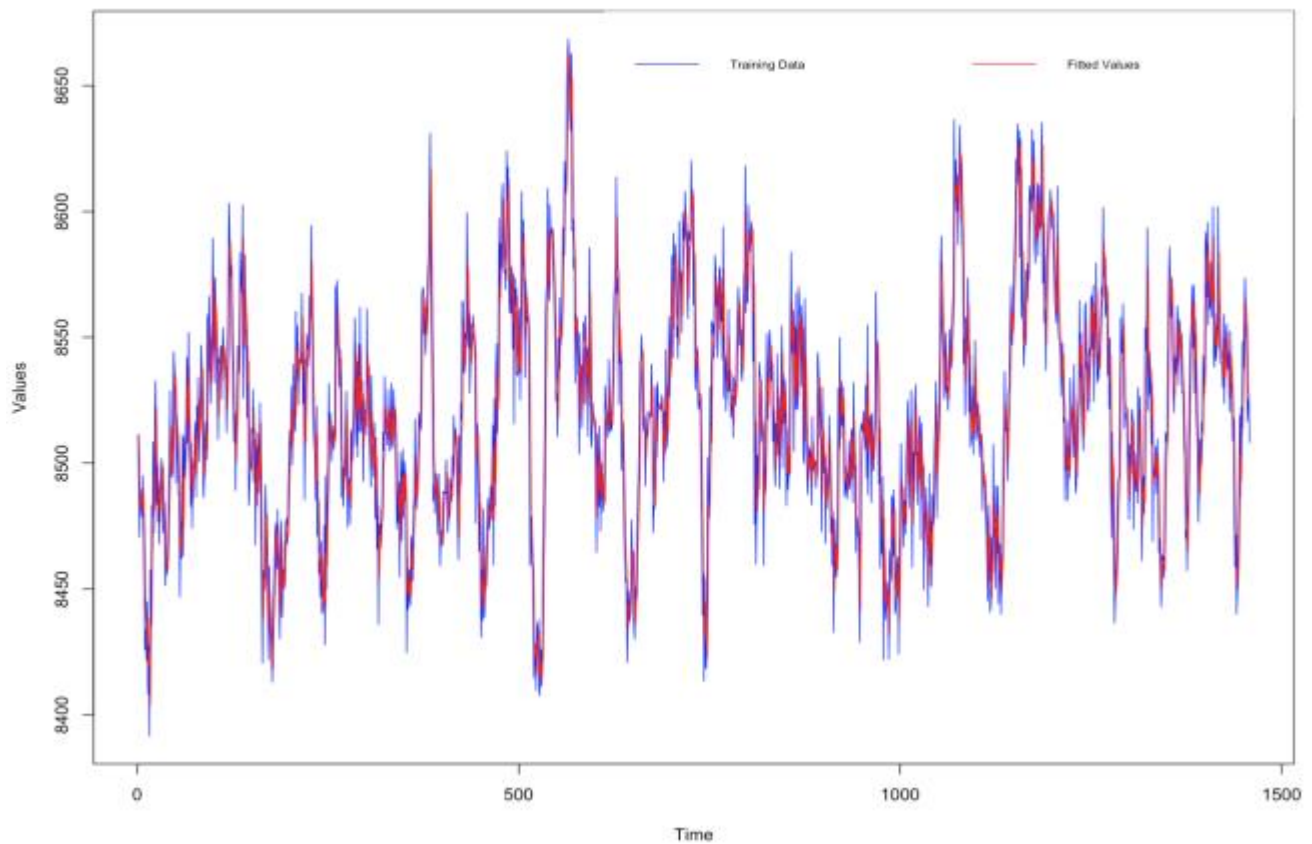Given below is the graph to show the RMSE plot versus Alpha values as written in above table:

RMSE values for Exponential Smoothing Model

2.3

Alpha selected for the Exponential Smoothing Model **= 0.62**

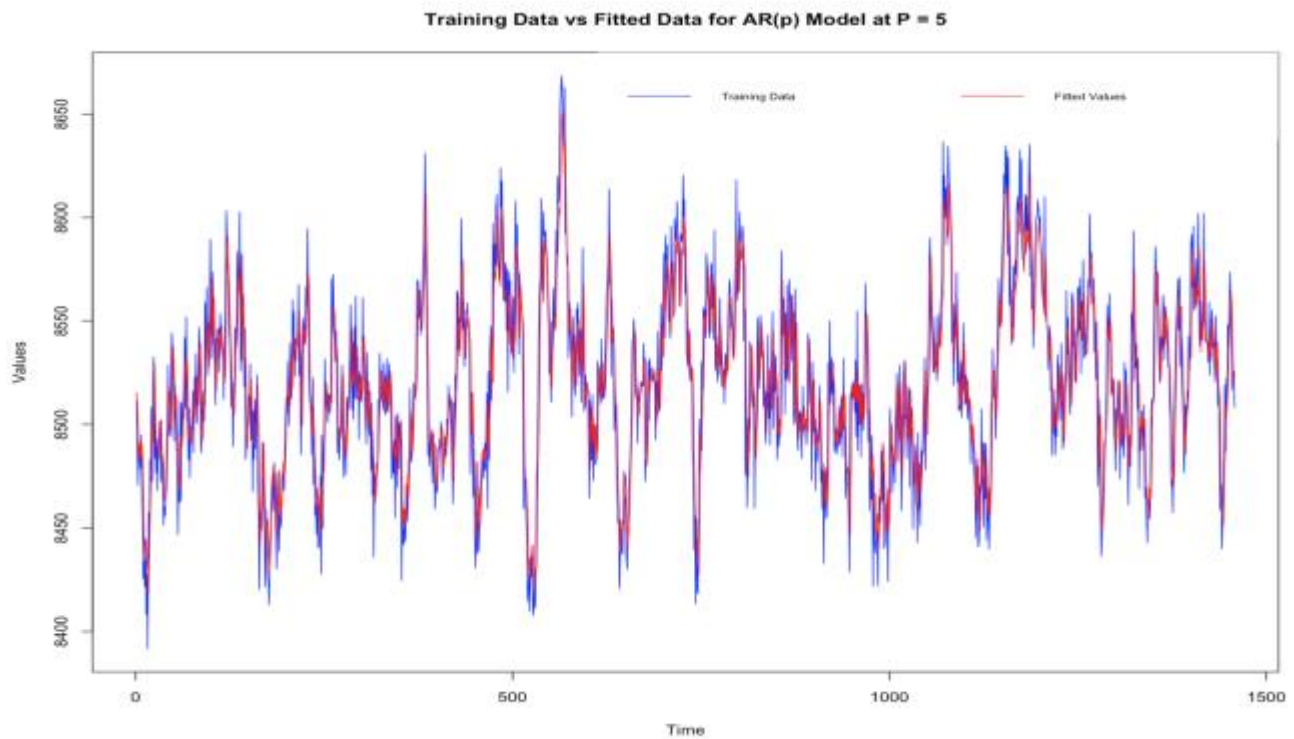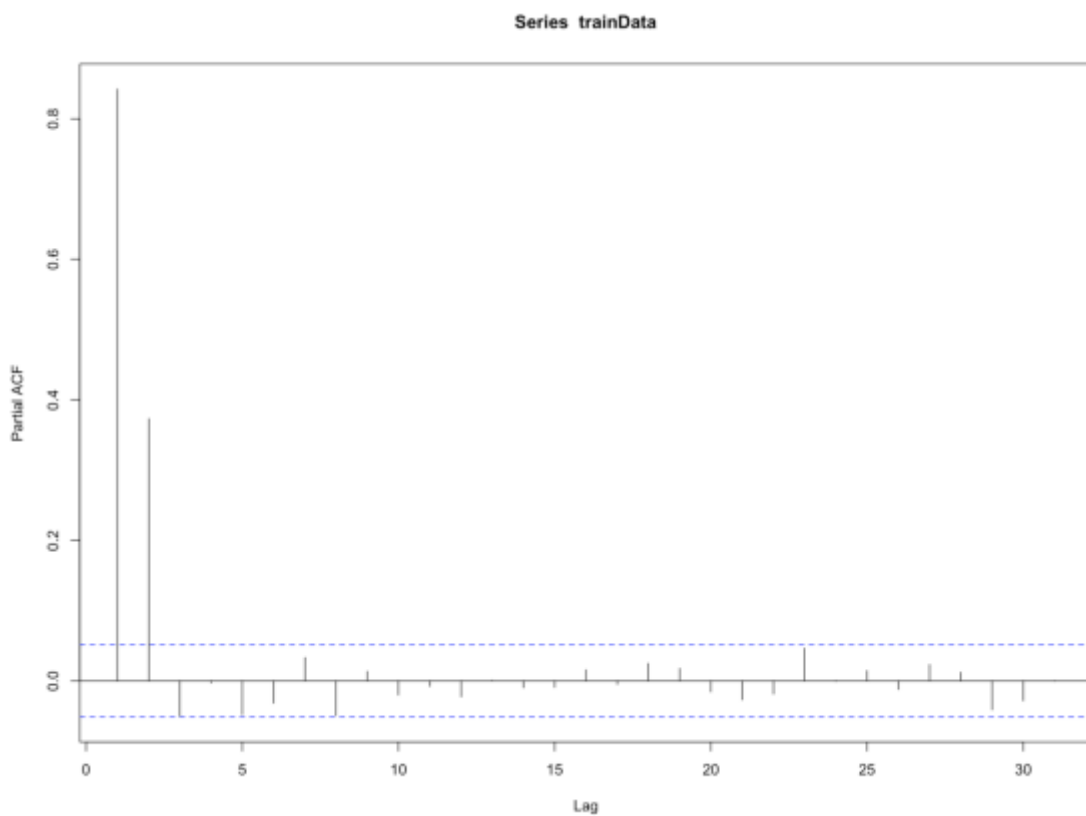### Training Data vs Fitted Data for Exponential Smoothing Model at Alpha = 0.62

| Training Data | Fitted Values |

Part 3

3.1

Applying AR(p) model for p = 5.

"RMSE value for AR(p) model at p = 5: 22.3326573420611"

Training Data vs Fitted Data for AR(p) Model at P = 5

3.2

Series trainData

On observing PACF, there is sharp decline from P = 2 to P = 3. Hence, best value for P should be 2.

3.3

For P =2, we have got the following results:

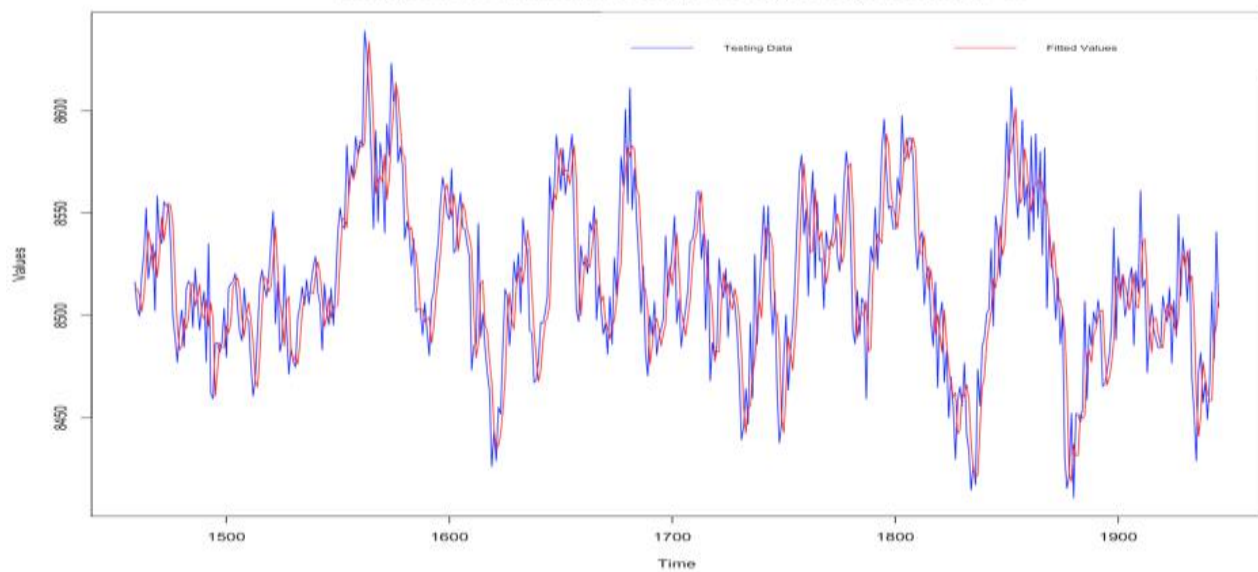**"RMSE value for AR(p) model at p = 2: 22.3611701949522"**

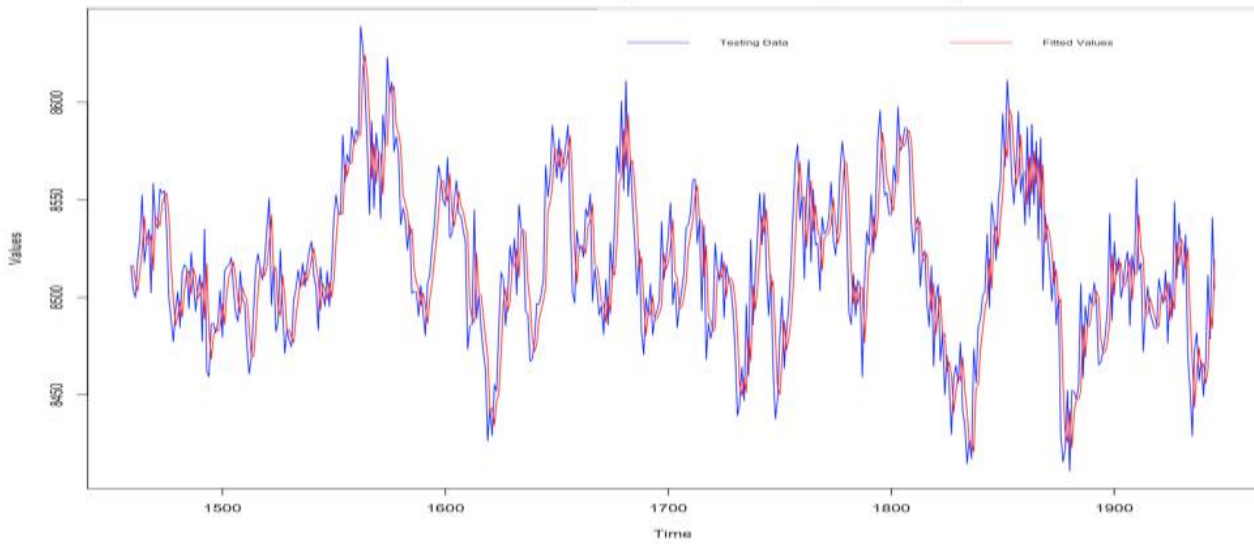Training Data vs Fitted Data for AR(p) Model at P = 2
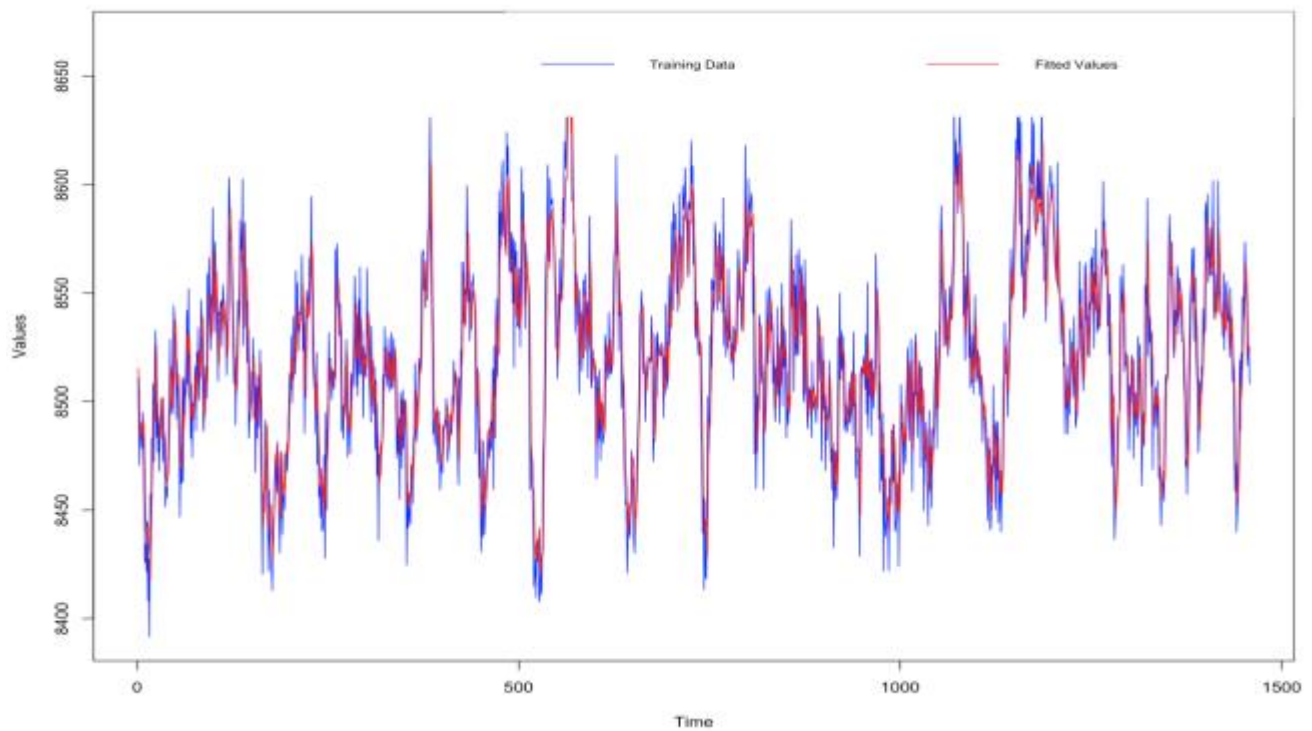
Part 4

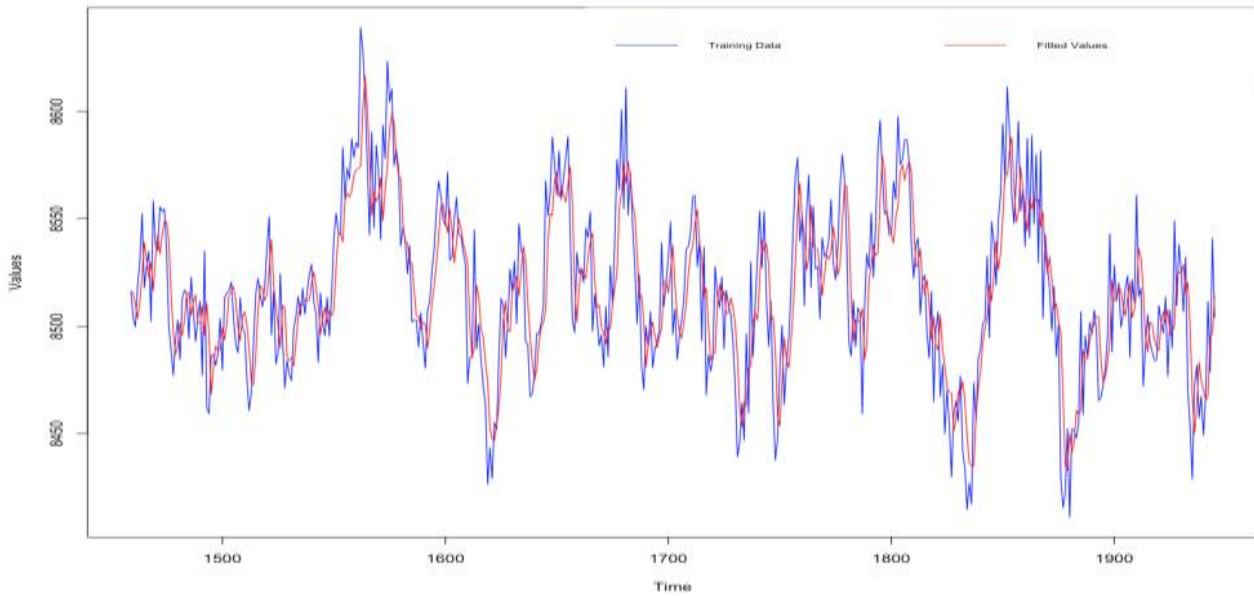Comparison of the three models on Test Data is as follows:

Testing Data vs Fitted Data for Simple Moving Average Model at M = 2

Testing Data vs Fitted Data for Exponential Smoothing Model at Alpha = 0.62

Training Data vs Fitted Data for AR(p) Model at P = 2

MODEL	RMSE
"Simple Moving Average"	"23.8662613711004"
"Exponential Smoothing"	"24.2961871095798"
"AR(p) Model"	**"23.2375480361294"**

On observing the RMSE values, AR(p) Model is better than the rest of the models with RMSE = 23.2.