TIME SERIES ANALYSIS
PRACTICAL – 9

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AIM: To carry out de-seasonalization of the data using ratio to moving average method, and estimate the values using multiplicative model.

EXPERIMENT:

The following data gives monthly sale from 2001 to 2004 of a certain commodity.

2001	Jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	Dec
Sale (Tons)	95	81	66	52	35	58	65	54	82	90	98	112
2002	Jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	Dec
Sale (Tons)	87	81	65	67	53	39	23	58	74	98	101	112
2003	Jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	Dec
Sale (Tons)	110	102	98	78	65	68	75	58	68	76	128	135
2004	Jan	feb	mar	apr	may	jun	jul	aug	sep	oct	Nov	Dec
Sale (Tons)	98	88	58	54	40	59	65	54	68	87	121	132

(i) Estimate monthly sale for the year 2005, by using multiplicative model.

(ii) Draw a graph after de-seasonalisation of data with estimated sales. And comments on graph.

THEORY:

RATIO TO MOVING AVERAGE

This method involves the following steps:

1. This method is based on calculating moving averages by considering n = 12 for monthly data, and n = 4 for quarterly data.
2. For monthly data first calculate the successive averages for the groups of size 12 and then take a 2-point moving average of these averages.
3. Convert the data series as the percentages of the 2-point moving average values i.e. ((given data)/(2-point moving average)*100).
4. These percentages would now represent seasonal variations along with random components.
5. The random component is eliminated by averaging these monthly percentages.
6. Adjusted seasonal indices are computed to make the sum of the indices 1200 or 400 by multiplying them throughout by a correction factor k.

DESEASONALISATION OF DATA

Elimination of seasonal effects from the given values is termed as de-seasonalization of the data. It helps us adjust the given time series for seasonal variations, thus leaving us with trend component, cyclic and irregular movements.
In multiplicative model, de-seasonalized data is obtained by dividing the given values by corresponding indices of seasonal variation.

$$\frac{y}{S} = \frac{TCSI}{S} = TCSI$$

Where,
y = value of time series
S = seasonal component
C = cyclic component
I = irregular component

CALCULATION: (An Excel sheet has also been attached for reference).

Table 9.1

YEAR	MONTH	SALES	12 POINT MOVING AVG.	CENTRED MOVING AVG.	RATIO TO MOVING AVG.
2001	JAN	95			
2001	FEB	81			
2001	MAR	66			
2001	APR	52			
2001	MAY	35			
2001	JUN	58			
			74.00		
2001	JUL	65		73.67	0.882352941
			73.33		
2001	AUG	54		73.33	0.736363636
			73.33		
2001	SEP	82		73.29	1.11881751
			73.25		
2001	OCT	90		73.88	1.218274112
			74.50		
2001	NOV	98		75.25	1.302325581
			76.00		
2001	DEC	112		75.21	1.489196676
			74.42		

2002	JAN	87		72.67	1.197247706
			70.92		
2002	FEB	81		71.08	1.13950762
			71.25		
2002	MAR	65		70.92	0.916568743
			70.58		
2002	APR	67		70.92	0.944770858
			71.25		
2002	MAY	53		71.38	0.742556918
			71.50		
2002	JUN	39		71.50	0.545454545
			71.50		
2002	JUL	23		72.46	0.317423807
			73.42		
2002	AUG	58		74.29	0.780706674
			75.17		
2002	SEP	74		76.54	0.966793685
			77.92		
2002	OCT	98		78.38	1.250398724
			78.83		
2002	NOV	101		79.33	1.273109244
			79.83		
2002	DEC	112		81.04	1.382005141
			82.25		
2003	JAN	110		84.42	1.303060217
			86.58		
2003	FEB	102		86.58	1.178055823
			86.58		
2003	MAR	98		86.33	1.135135135
			86.08		
2003	APR	78		85.17	0.915851272
			84.25		
2003	MAY	65		85.38	0.761346999
			86.50		
2003	JUN	68		87.46	0.777513101
			88.42		
2003	JUL	75		87.92	0.853080569
			87.42		
2003	AUG	58		86.83	0.667946257
			86.25		
2003	SEP	68		84.58	0.803940887
			82.92		
2003	OCT	76		81.92	0.927772126
			80.92		

2003	NOV	128		79.88	1.602503912
			78.83		
2003	DEC	135		78.46	1.720658524
			78.08		
2004	JAN	98		77.67	1.261802575
			77.25		
2004	FEB	88		77.08	1.141621622
			76.92		
2004	MAR	58		76.92	0.754062839
			76.92		
2004	APR	54		77.38	0.697899838
			77.83		
2004	MAY	40		77.54	0.515851693
			77.25		
2004	JUN	59		77.13	0.764991896
			77.00		
2004	JUL	65			
2004	AUG	54			
2004	SEP	68			
2004	OCT	87			
2004	NOV	121			
2004	DEC	132			

Table 9.2

MONTH	YEAR				SEASONAL INDICES	ADJUSTED SEASONAL INDICES
	2001	2002	2003	2004		
JAN		1.19724771	1.30306022	1.26180258	1.254036833	1.25449091
FEB		1.13950762	1.17805582	1.14162162	1.153061688	1.153479203
MAR		0.91656874	1.13513514	0.75406284	0.935255572	0.935594221
APR		0.94477086	0.91585127	0.69789984	0.852840656	0.853149463
MAY		0.74255692	0.761347	0.51585169	0.67325187	0.673495649
JUN		0.54545455	0.7775131	0.7649919	0.695986514	0.696238526
JUL	0.88235294	0.31742381	0.85308057		0.684285772	0.684533547
AUG	0.73636364	0.78070667	0.66794626		0.728338856	0.728602582
SEP	1.11881751	0.96679369	0.80394089		0.963184027	0.963532789
OCT	1.21827411	1.25039872	0.92777213		1.132148321	1.132558262
NOV	1.30232558	1.27310924	1.60250391		1.392646246	1.393150512
DEC	1.48919668	1.38200514	1.72065852		1.530620114	1.531174339
SUM=					11.99565647	12

Correction Factor(k)=	1.000362092

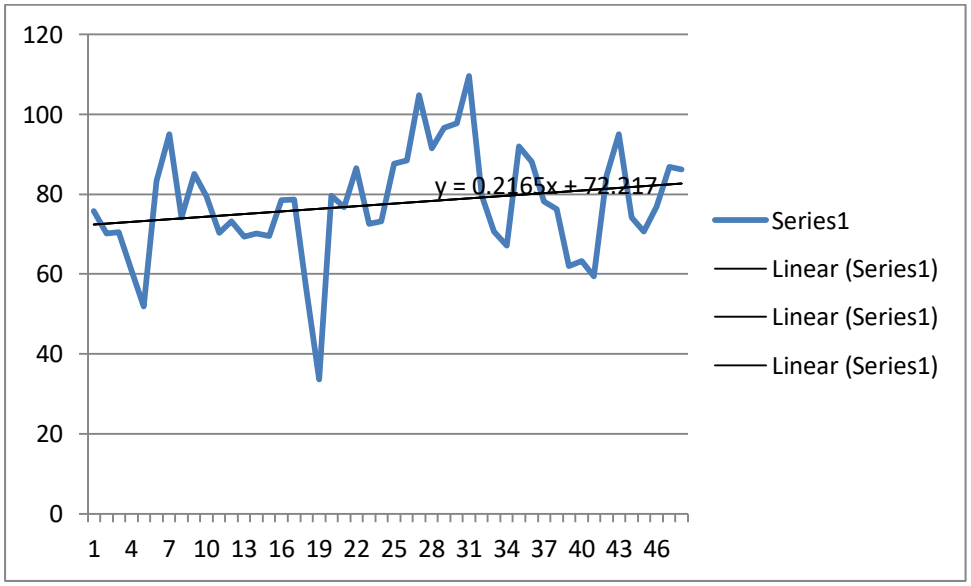
Table 9.3

INDEX NOS.	YEAR	MONTH	SALES (y)	SEASONAL FACTOR	DESEASONALISED DATA	EXPECTED VALUES
1	2001	JAN	95	1.25449091	75.72793017	90.8671673
2	2001	FEB	81	1.153479203	70.22233241	83.80026407
3	2001	MAR	66	0.935594221	70.54340284	68.17347628
4	2001	APR	52	0.853149463	60.95063323	62.35072219
5	2001	MAY	35	0.673495649	51.96767056	49.3668943
6	2001	JUN	58	0.696238526	83.30478402	51.18467144
7	2001	JUL	65	0.684533547	94.95517104	50.47236973
8	2001	AUG	54	0.728602582	74.114478	53.8794323
9	2001	SEP	82	0.963532789	85.10348685	71.46089103
10	2001	OCT	90	1.132558262	79.46611047	84.24194868
11	2001	NOV	98	1.393150512	70.3441582	103.9269385
12	2001	DEC	112	1.531174339	73.14647141	114.5548082
13	2002	JAN	87	1.25449091	69.35084131	94.12633468
14	2002	FEB	81	1.153479203	70.22233241	86.79700304
15	2002	MAR	65	0.935594221	69.4745634	70.60415007
16	2002	APR	67	0.853149463	78.53254666	64.5672045
17	2002	MAY	53	0.673495649	78.69390114	51.116636
18	2002	JUN	39	0.696238526	56.01528581	52.99349913
19	2002	JUL	23	0.684533547	33.59952206	52.25078788
20	2002	AUG	58	0.728602582	79.60443933	55.77234181
21	2002	SEP	74	0.963532789	76.80070765	73.96414921
22	2002	OCT	98	1.132558262	86.52976473	87.18433504
23	2002	NOV	101	1.393150512	72.4975508	107.5463435
24	2002	DEC	112	1.531174339	73.14647141	118.5327991
25	2003	JAN	110	1.25449091	87.68497178	97.38550207
26	2003	FEB	102	1.153479203	88.4281223	89.79374201
27	2003	MAR	98	0.935594221	104.7462648	73.03482385
28	2003	APR	78	0.853149463	91.42594984	66.7836868
29	2003	MAY	65	0.673495649	96.51138819	52.86637769
30	2003	JUN	68	0.696238526	97.66767782	54.80232682
31	2003	JUL	75	0.684533547	109.5636589	54.02920603
32	2003	AUG	58	0.728602582	79.60443933	57.66525132
33	2003	SEP	68	0.963532789	70.57362324	76.4674074
34	2003	OCT	76	1.132558262	67.10471551	90.12672141
35	2003	NOV	128	1.393150512	91.87808418	111.1657485
36	2003	DEC	135	1.531174339	88.16762178	122.51079
37	2004	JAN	98	1.25449091	78.11933849	100.6446694
38	2004	FEB	88	1.153479203	76.29092904	92.79048098
39	2004	MAR	58	0.935594221	61.99268734	75.46549764
40	2004	APR	54	0.853149463	63.29488835	69.00016911
41	2004	MAY	40	0.673495649	59.3916235	54.61611939
42	2004	JUN	59	0.696238526	84.7410734	56.61115451
43	2004	JUL	65	0.684533547	94.95517104	55.80762419

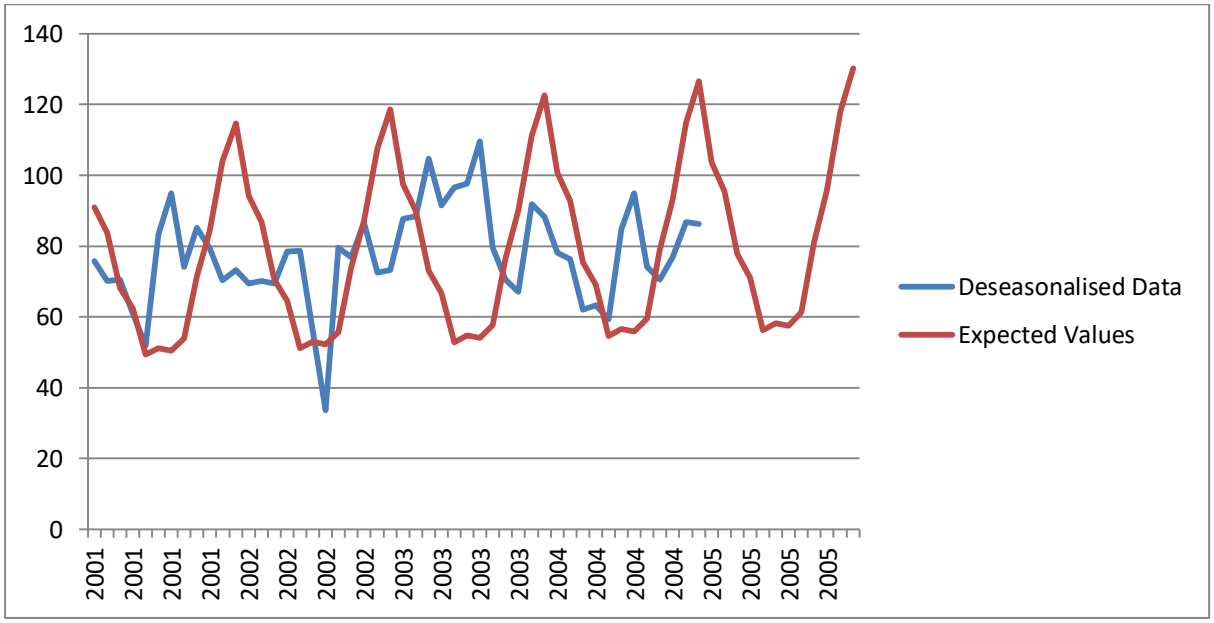
44	2004	AUG	54	0.728602582	74.114478	59.55816082
45	2004	SEP	68	0.963532789	70.57362324	78.97066558
46	2004	OCT	87	1.132558262	76.81724012	93.06910778
47	2004	NOV	121	1.393150512	86.85350145	114.7851535
48	2004	DEC	132	1.531174339	86.2083413	126.488781
49	2005	JAN				103.6322396
50	2005	FEB				95.5374917
51	2005	MAR				77.69361527
52	2005	APR				71.03194455
53	2005	MAY				56.22004928
54	2005	JUN				58.26924656
55	2005	JUL				57.43784083
56	2005	AUG				61.29332787
57	2005	SEP				81.26531892
58	2005	OCT				95.76629528
59	2005	NOV				118.1029415
60	2005	DEC				130.1352727

a=	72.217
b=	0.2165

Graph 9.1



Graph 9.2



RESULT:

- The seasonal and adjusted indices calculated by ratio to moving average method have been shown in Table 9.2.
- The value of correction factor (k) is coming out to be 1.000362092.
- Trend without seasonal effect and estimated sales are computed by de-seasonalization of data.
- Table 9.3 shows de-seasonalized data computed by dividing no. of aircrafts by seasonal factor (adjusted seasonal indices).
- Values of a & b are obtained by plotting the Graph 9.1 for deseasonalized values, and fitting the trend line to obtain its equation, and are shown below Table 9.3
- As a = 72.217 and b = 0.2165, equation for trend values (2005) without seasonal effect is:
  72.217 + (0.2165)*t
- We obtain the estimated values for all the years by multiplying the above equation by the respective seasonal factor (for each month).
- Estimated monthly values for the year 2001-2005 have been computed and summarized along with the de-seasonalized data in Table 9.3.
- Graph 9.2 shows the estimated sales (2001-2005) along with the de-seasonalized sales (2001-2004).

CONCLUSION:

- After de-seasonalization, we can see that the seasonal effect has been removed to an extent.
- Variation in Expected values is more than the variation in Deseasonalised values.