TIME SERIES ANALYSIS

PRACTICAL – 4

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AIM: To compute monthly seasonal indices by ratio seasonal method.

PRACTICAL:

The data given in the following table shows the monthly production of wool (in .000 tons) by state industries from Jan 2001 to Dec. 2005. Compute the monthly seasonal indices by ratio to trend method.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2001	156.75	133.65	108.90	85.80	87.45	95.70	107.25	89.10	135.30	148.50	161.70	184.80
2002	185.31	172.53	138.45	142.71	74.55	83.07	48.99	123.54	157.62	208.74	215.13	238.56
2003	306.90	284.58	273.42	217.62	181.35	189.72	181.35	161.82	189.72	212.04	357.12	376.65
2004	305.76	274.56	180.96	168.48	124.80	184.08	234.00	168.48	212.16	271.44	377.52	411.84
2005	349.87	324.42	311.70	248.09	206.74	216.28	206.74	184.47	216.28	241.73	407.12	429.38

THEORY:

RATIO TO TREND METHOD

1. Based on Multiple models of Time Series.
2. We assume that seasonal variation for any given month is constant factor of trend.

STEPS:

1. Calculate the trend values for various time durations (Quarterly/Monthly) using Least Square method and fitting the appropriate mathematical curve.
2. Express all the original data as the percentage of trend on the basis of the following formula. (Original Data/Trend Value)*100.
3. Calculate the seasonal variation indices.

For a Parabolic Curve:

Normal Equations:

- $\Sigma yt=na+b\Sigma x+c\Sigma x^2$
- $\Sigma xyt=a\Sigma x+b\Sigma x^2+c\Sigma x^3$
- $\Sigma x^2yt=a\Sigma x^2+b\Sigma x^3+c\Sigma x^4$

CALCULATIONS:

Table 4.1

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL	AVERAGE	X	trend values
2001	156.75	133.65	108.9	85.8	87.45	95.7	107.25	89.1	135.3	148.5	161.7	184.8	1494.9	124.575	-2	116.9231429
2002	185.31	172.53	138.45	142.71	74.55	83.07	48.99	123.54	157.62	208.74	215.13	238.56	1789.2	149.1	-1	173.0294286
2003	306.9	284.58	273.42	217.62	181.35	189.72	181.72	161.82	189.72	212.04	357.12	376.65	2932.66	244.388333	0	218.5128571
2004	305.76	274.56	180.96	168.48	124.8	184.08	234	168.48	212.16	271.44	377.52	411.84	2914.08	242.84	1	253.3734286
2005	349.87	324.42	311.7	248.09	206.74	216.74	206.74	184.47	216.28	241.73	407.12	429.38	3343.28	278.606667	2	277.6111429

As

$\Sigma Y(t) = na + b\Sigma X + c\Sigma X^2$

$\Sigma XY(t) = a\Sigma X + b\Sigma X^2 + c\Sigma X^3$

$\Sigma X^2Y = a\Sigma X^2 + b\Sigma X^3 + c\Sigma X^4$

Therefore,

a	b	c
218.5129	40.172	-5.31143

We get,

avg yearly increment=	40.172
monthly increment=	3.347667

Table 4.2

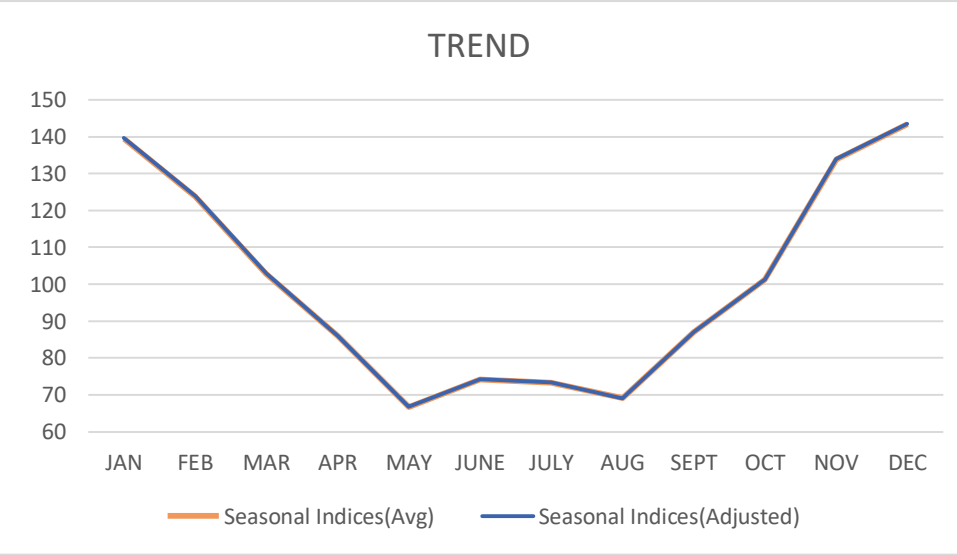
						MONTHLY TREND VALUES						
YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
2001	98.51098	101.8586	105.2063	108.554	111.9016	115.2493	118.597	121.9446	125.2923	128.64	131.9876	135.3353
2002	154.6173	157.9649	161.3126	164.6603	168.0079	171.3556	174.7033	178.0509	181.3986	184.7463	188.0939	191.4416
2003	200.1007	203.4484	206.796	210.1437	213.4914	216.839	220.1867	223.5344	226.882	230.2297	233.5774	236.925
2004	234.9613	238.3089	241.6566	245.0043	248.3519	251.6996	255.0473	258.3949	261.7426	265.0903	268.4379	271.7856
2005	259.199	262.5466	265.8943	269.242	272.5896	275.9373	279.285	282.6326	285.9803	289.328	292.6756	296.0233

Table 4.3

						TREND ELIMINATED VALUES						
YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
2001	159.1193	131.2113	103.5109	79.03902	78.14899	83.03737	90.43232	73.06594	107.9875	115.4385	122.5115	136.5497
2002	119.8508	109.2204	85.82715	86.66936	44.37291	48.47814	28.04183	69.38464	86.89152	112.9874	114.3737	124.6124
2003	153.3728	139.8782	132.2172	103.5577	84.94489	87.49348	82.52997	72.39156	83.62055	92.09933	152.8915	158.9743
2004	130.1321	115.2118	74.88312	68.76615	50.25127	73.1348	91.7477	65.20252	81.05673	102.3953	140.6359	151.5312
2005	134.9812	123.5666	117.227	92.14388	75.84294	78.54683	74.02475	65.26847	75.62758	83.54878	139.1028	145.0494
Seasonal Indices(Avg)	**139.4912**	**123.8177**	**102.7331**	**86.03523**	**66.7122**	**74.13812**	**73.35531**	**69.06263**	**87.03677**	**101.2939**	**133.9031**	**143.3434**
Seasonal Indices(Adjusted)	139.5985	123.9129	102.8121	86.10137	66.76349	74.19512	73.41171	69.11572	87.10369	101.3717	134.006	143.4536

sum(Seasonal Average Indices)=	1200.9226
k=	0.9992317

Graph 4.1



RESULT:

- Sum of seasonal indices is observed to be 1200.9226. We obtain the value of k by diving 1200 by the sum of average seasonal indices.
- Adjusted seasonal indices are obtained by multiplying the average seasonal indices by the correlation factor k.
- Graph for average and adjusted indices has been plotted in Graph 4.1.

CONCLUSION:

- The positive value of monthly increment (3.347667) indicates that there is an increasing trend.

- Average production of wool for years 2001-2005 is maximum in the month of January. After that, it gradually decreases from February to August and then starts increasing from September. It achieves a maximum in December.
- For year 2001, maximum production is observed in the month of January, whereas for years 2002- 2005, maximum production month is December.