PRACTICAL – 15

Submitted By: Ridam Singhal(5040)

AIM: To find the variance of the random component using "Variate Difference" method.

EXPERIMENT:

Find the variance of the random component in the following series by 'Variate Difference' Method:

3106	4118	2124	994	872	568	687	78	788	968
498	1105	1135	1104	886	1100	1107	887	775	886
1001	1125	778	886	1102	1115	1135	1104	1096	1110
788	968	498	1100	1107					

THEORY:

VARIATE DIFFERENCE METHOD:

1. We first have to find the values of Δyt, $\Delta^2 yt$, $\Delta^3 yt$ … for the given values of t and yt.
2. Then compute: V1 $=\frac{\mu_2'(\Delta yt)}{C_1^2}$, V2 $=\frac{\mu_2'(\Delta^2 yt)}{C_2^4}$
3. If, let us say, V1 and V2 do not differ significantly than either of them can be regarded as an estimate of V. Otherwise, calculate V3, V4, … till two successive estimates of V are homogeneous.

Significance of $(V_k - V_{k+1})$**.** Homogeneity of two successive estimates of V cannot be tested by Variance Ratio Test (F-test) since the consecutive terms are not independent. *O*. Andersen obtained the standard error of $(V_k - V_{k+1})$ and found that for large samples,

$$R_k = \frac{V_k - V_{k+1}}{V_k} \cdot H_{kN} \sim N(0, 1) \qquad \ldots(2{\cdot}67)$$

where V_k and V_{k+1} are consecutive estimates of V from the kth and $(k + 1)$th differences of y_t and H_{kN} ; a function of k and N (the total number of observations in the given time series), corresponds to the variance of the ratio and has been tabulated in the book "*Variate Difference Method*" by **G. Titner**. Thus if $|R_k| > 1{\cdot}96$, the difference is significant (otherwise not) at 5% level of significance.

CALCULATIONS:

Table 15.1

t	yt	Δyt	Δ^2yt	Δ^3yt	Δ^4yt	Δ^5yt	Δ^6yt
1	3106						
		1012					
2	4118		-3006				
		-1994		3870			
3	2124		864		-3726		
		-1130		144		2392	
4	994		1008		-1334		737
		-122		-1190		3129	
5	872		-182		1795		-6680
		-304		605		-3551	
6	568		423		-1756		8505
		119		-1151		4954	
7	687		-728		3198		-12048
		-609		2047		-7094	
8	78		1319		-3896		12719
		710		-1849		5625	
9	788		-530		1729		-5507
		180		-120		118	
10	968		-650		1847		-5346
		-470		1727		-5228	
11	498		1077		-3381		10779
		607		-1654		5551	
12	1105		-577		2170		-8363
		30		516		-2812	
13	1135		-61		-642		4199
		-31		-126		1387	
14	1104		-187		745		-3390
		-218		619		-2003	
15	886		432		-1258		3880
		214		-639		1877	
16	1100		-207		619		-2141
		7		-20		-264	
17	1107		-227		355		-311
		-220		335		-575	
18	887		108		-220		461
		-112		115		-114	
19	775		223		-334		672
		111		-219		558	
20	886		4		224		-1267

		115		5		-709	
21	1001		9		-485		2600
		124		-480		1891	
22	1125		-471		1406		-4570
		-347		926		-2679	
23	778		455		-1273		3988
		108		-347		1309	
24	886		108		36		-824
		216		-311		485	
25	1102		-203		521		-1274
		13		210		-789	
26	1115		7		-268		1189
		20		-58		400	
27	1135		-51		132		-607
		-31		74		-207	
28	1104		23		-75		-75
		-8		-1		-282	
29	1096		22		-357		1835
		14		-358		1553	
30	1110		-336		1196		-4739
		-322		838		-3186	
31	788		502		-1990		8050
		180		-1152		4864	
32	968		-650		2874		-11127
		-470		1722		-6263	
33	498		1072		-3389		
		602		-1667			
34	1100		-595				
		7					
35	1107						
SUM=		-1999	-1005	2411	-5537	337	-8655

Table 15.2

	$(\Delta yt)^2$	$(\Delta^2 yt)^2$	$(\Delta^3 yt)^2$	$(\Delta^4 yt)^2$	$(\Delta^5 yt)^2$	$(\Delta^6 yt)^2$
	1024144					
		9036036				
	3976036		14976900			
		746496		13883076		
	1276900		20736		5721664	
		1016064		1779556		543169
	14884		1416100		9790641	

	33124		3222025		44622400
92416		366025		12609601	
	178929		3083536		72335025
14161		1324801		24542116	
	529984		10227204		145154304
370881		4190209		50324836	
	1739761		15178816		161772961
504100		3418801		31640625	
	280900		2989441		30327049
32400		14400		13924	
	422500		3411409		28579716
220900		2982529		27331984	
	1159929		11431161		116186841
368449		2735716		30813601	
	332929		4708900		69939769
900		266256		7907344	
	3721		412164		17631601
961		15876		1923769	
	34969		555025		11492100
47524		383161		4012009	
	186624		1582564		15054400
45796		408321		3523129	
	42849		383161		4583881
49		400		69696	
	51529		126025		96721
48400		112225		330625	
	11664		48400		212521
12544		13225		12996	
	49729		111556		451584
12321		47961		311364	
	16		50176		1605289
13225		25		502681	
	81		235225		6760000
15376		230400		3575881	
	221841		1976836		20884900
120409		857476		7177041	
	207025		1620529		15904144
11664		120409		1713481	
	11664		1296		678976
46656		96721		235225	
	41209		271441		1623076
169		44100		622521	
	49		71824		1413721

	400		3364		160000	
		2601		17424		368449
	961		5476		42849	
		529		5625		5625
	64		1		79524	
		484		127449		3367225
	196		128164		2411809	
		112896		1430416		22458121
	103684		702244		10150596	
		252004		3960100		64802500
	32400		1327104		23658496	
		422500		8259876		123810129
	220900		2965284		39225169	
		1149184		11485321		
	362404		2778889			
		354025				
	49					
SUM=	8992323	18633845	41953299	102647557	300435197	982666197

Table 15.3

$\mu'_2(\Delta yt)$	$\mu'_2(\Delta^2 yt)$	$\mu'_2(\Delta^3 yt)$	$\mu'_2(\Delta^4 yt)$	$\mu'_2(\Delta^5 yt)$	$\mu'_2(\Delta^6 yt)$
264480.088	564661.970	1311040.594	3311211.516	10014506.567	33885041.276

Table 15.4

V1	V2	V3	V4	V5	V6
132240.044	94110.328	65552.030	47303.022	39740.105	36672.123

Table 15.5

H(1,35)	H(2,35)	H(3,35)	H(4,35)	H(5,35)
11.216	14.667	17.005	18.574	19.586

Table 15.6

R1	R2	R3	R4	R5
3.234	4.451	4.734	2.970	1.512

RESULT:

We have:
$|R_1| = 3.234$, $|R_2| = 4.451$, $|R_3| = 4.734$, $|R_4| = 2.970$, $|R_5| = 1.512$

Now,

- As $|R_1| > 1.96$, therefore difference between V_1 and V2 is significant.
- As $|R_2| > 1.96$, therefore difference between V_2 and V_3 is significant.
- As $|R_3| > 1.96$, therefore difference between V_3 and V_4 is significant.
- As $|R_4| > 1.96$, therefore difference between V_4 and V_5 is significant.
- As $|R_5| < 1.96$, therefore difference between V_5 and V_6 is not significant

CONCLUSION:

As the difference between V5 and V6 is insignificant, hence we can say that any of the two can be taken as the variance of the random component.

Therefore,

Variance of the random component = 39740.105
OR
Variance of the random component = 36672.123