1. From the following data calculate the four-year moving average and determine the trend values. Also find the short term fluctuations.

Year :	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
value	50.0	36.5	43.0	44.5	38.9	38.1	32.6	41.7	41.1	33.8

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Year	value y	4 year moving total	2 period moving total	4 year centred moving average y_i	Short term fluctuation $y - y_i$
1958	50.0				
1959	36.5	174	336.9	42.11	$43.0 - 42.11 = 0.89$
1960	43.0	162.9	327.4	40.93	$44.5 - 40.93 = 3.57$
1961	44.5	164.5	318.6	39.83	$38.9 - 39.83 = -0.93$
1962	38.9	154.1	305.4	38.18	$38.1 - 38.18 = -0.08$
1963	38.1	151.3	304.8	38.10	$32.6 - 38.10 = -5.50$
1964	32.6	153.5	302.7	37.84	$41.7 - 37.84 = 3.86$
1965	41.7	149.2	—	—	
1966	41.1	—	—	—	
1967	33.8				

2. For the following series of observations, verify that 4 years centred moving average is equivalent to a 5 year weighted moving average with weights 1, 2, 2, 2 and 1 respectively.

Year	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Sales ('000 Rs)	2	6	1	5	3	7	2	6	4	8	3.

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Year	Sales	4 year moving total	2 period moving total	4 year centred moving average
1969	2			
1970	6	14	29	3.625
1971	1	15	31	3.875
1972	5	16	33	4.125
1973	3	17	35	4.375
1974	7	18	37	4.625
1975	2	19	39	4.875
1976	6	20	41	5.125
1977	4	21		
1978	8	-		
1979	3	-		

5 year weighted moving average with weights

year	sales	5 year weighted total	5 year weighted moving average
1969	2	$2+2(6+1+5)+3=29$	$\frac{29}{1+2+2+2+1}=\frac{29}{8}=3.625$
1970	6	$6+2(1+5+3)+7=31$	$\frac{31}{1+2+2+2+1}=\frac{31}{8}=3.875$
1971	1	$1+2(5+3+7)+2=33$	4.125
1972	5	$5+2(3+7+2)+6=35$	4.375
1973	3	$3+2(7+2+6)+4=37$	4.625
1974	7	$7+2(2+6+4)+8=39$	4.875
1975	2	$2+2(6+4+8)+3=41$	5.125
1976	6		
1977	4		
1978	8		
1979	3		

3. Calculate the seasonal indices from the following data using the average method

Year	I st Quarter	II Quarter	III Quarter	IV Quarter
1974	72	68	80	70
1975	76	70	82	74
1976	74	66	84	80
1977	76	74	84	78
1978	78	74	86	82

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Year	I Qua	II Qua	III Qua	IV Qua
1974	72	68	80	70
1975	76	70	82	74
1976	74	66	84	80
1977	76	74	84	78
1978	78	74	86	82
Total	376	352	416	384
Average	$\frac{376}{5} = 75.2$	70.4	83.2	76.8

General average

$$= \frac{75.2 + 70.4 + 83.2 + 76.8}{4}$$

$$= \frac{305.6}{4}$$

$$= 76.4$$

Seasonal Index for the I Qua = $\frac{\text{Aver of I Qua}}{\text{General Aver}} * 100$

$= \frac{75.2}{76.4} * 100 = 98.43$

Seasonal Index for the II Qua = $\frac{\text{Aver of II Qua}}{\text{General Aver}} * 100$

$= \frac{70.4}{76.4} * 100 = 92.15$

S. I ~~of~~ for III Qua $= \frac{83.2}{76.4} * 100 = 108.9$

S. I for IV Qua $= \frac{76.8}{76.4} * 100 = 100.52$ //

4. Use the method of monthly averages to find the monthly indices for the following data of production of a commodity for the years 1979, 1980 & 1981.

Month	Production (in lakhs of tons)		
	1979	1980	1981
Jan	12	15	16
Feb	11	14	15
Mar	10	13	14
Apr	14	16	16
May	15	16	15
Jun	15	15	17

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July	16	17	16
Aug	13	12	13
Sep	11	13	10
Oct	10	12	10
NOV	12	13	11
Dec	15	14	15

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Month	1979	1980	1981	Monthly total	Monthly Average	Seasonal Index
Jan	12	15	16	43	14.33	
Feb	11	14	15	40	13.33	
Mar	10	13	14	37	12.33	
Apr	14	16	16	46	15.33	
May	15	16	15	46	15.33	
June	15	15	17	47	15.33	
July	16	17	16	49	16.33	
Aug	13	12	13	38	12.67	
Sep	11	13	10	34	11.33	
Oct	10	12	10	32	10.67	
Nov	12	13	11	36	12.00	
Dec	15	14	15	44		

General Average = 13.64

$$\text{S.I for Jan} = \frac{\text{Aver for Jan}}{\text{General Aver}} * 100 = \frac{14.33}{13.64} * 100 = 105.06$$

$$\text{S.I for Feb} = \frac{\text{Aver for Feb}}{\text{General Aver}} * 100 = \frac{13.33}{13.64} * 100 = 97.73$$

Sol

Month	1979	1980	1981	Monthly total	Monthly Average	Seasonal Index
Jan	12	15	16	43	14.33	105.06
Feb	11	14	15	40	13.33	97.73
Mar	10	13	14	37	12.33	90.4
Apr	14	16	16	46	15.33	112.39
May	15	16	15	46	15.33	112.39
June	15	15	17	47	15.33	112.39
July	16	17	16	49	16.33	119.72
Aug	13	12	13	38	12.67	92.89
Sep	11	13	10	34	11.33	83.06
Oct	10	12	10	32	10.67	78.23
Nov	12	13	11	36	12.00	87.98
Dec	15	14	15	44	14.67	107.55

5. Calculate seasonal indices by the ratio to moving average method from the following data

Wheat Prices (in Rs/quintal)

Quar/year	1972	1973	1974	1975
I	75	86	90	100
II	60	65	72	78
III	54	63	66	72
IV	59	80	85	93

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Year	Quarter	wheat price (Y)	4-Quar moving total	Sum of 2 Qua moving total	4 Qua centred total (T)	Ratio to moving aver (in %.) Y/T *100
1972	I	75				
	II	60	248			
	III	54	259	507	63.375	54/63.375 *100 = 85.21
	IV	59	264	523	65.375	59/65.375 *100 = 90.25
1973	I	86	273	537	67.125	128.12
	II	65	294	567	70.875	91.71
	III	63	298	592	74	85.14
	IV	80				

1974	I	90	305	603	75·375	106·14
	II	72	308	613	76·625	117·46
	III	66	313	621	77·625	92·75
	IV	85	323	636	79·5	83·02
1975	I	100	329	652	81·5	104·29
	II	78	335	664	83·0	120·48
	III	72	343	678	84·75	92·04
	IV	93				

Calculation of Seasonal Indices

Year / Qua	Ratio to moving average			
	I	II	III	IV
1972	-	-	85.21	90.25
1973	128.12	91.71	85.14	106.14
1974	117.46	92.75	83.02	104.29
1975	120.48	92.04	-	-
Total	366.06	276.5	253.37	300.68
Aver	122.02	92.17	84.46	100.23

General average =

$$\frac{122.02 + 92.17 + 84.46 + 100.23}{4}$$

$$= 99.72$$

S.I for I Qua $= \frac{\text{Ave for I Qua}}{\text{Grne Aver}} * 100 = \frac{122.02}{99.72} * 100$

$= 122.36$

S.I for II Qua $= \frac{92.17}{99.72} * 100 = 92.43$

S.I for III Qua $= \frac{84.46}{99.72} * 100 = 84.70$

S.I for IV Qua $= \frac{100.23}{99.72} * 100 = 100.51$

NOTE: The difference between General average and the Quarterly average gives the Seasonal variations. //