03

2025

04 Thursday

Week 14 / Day (093-272)

Time Series (Practice Questions)

1) Day (t)	Temperature (y)	$(x_t - \bar{x})$	$(x_{t-1} - \bar{x})$	$(x_{t+1} - \bar{x})$
1	22	-4.93		
2	23	-3.93	-4.93	
3	23	-3.93	-3.93	-4.93
4	24	-2.93	-3.93	-3.93
5	23	-3.93	-2.93	-3.93
6	25	-1.93	-3.93	-2.93
7	26	-0.93	-1.93	-3.93
8	28	1.07	-0.93	-1.93
9	~~30~~ 28	1.07	1.07	-0.93
10	~~31~~ 30	3.07	1.07	1.07
11	~~30~~ 31	4.07	3.07	1.07
12	30	3.07	4.07	3.07
13	30	3.07	3.07	4.07
14	31	4.07	3.07	3.07
15	30	3.07	4.07	3.07

April 2025

Wk	M	T	W	T	F	S	S
14		1	2	3	4	5	6
15	7	8	9	10	11	12	13
16	14	15	16	17	18	19	20
17	21	22	23	24	25	26	27
18	28	29	30				

Mean = 26.93
= 27 (approx)

$(x_{t-2} - \bar{x})$ Variance *

$$\gamma_0 = \frac{1}{n} \Sigma (x_t - \bar{x})^2$$

$$= \frac{1}{15} [\quad] = 10.46$$

-4.93
-3.93
-3.93
-2.93
-3.93
-1.93
-0.93
1.07
1.07
3.07
4.07
3.07
3.07

Autocovariance coefficient at lag k = 1

$$\gamma_1 = \frac{1}{n} \Sigma (x_t - \bar{x})(x_{t-1} - \bar{x})$$

130.0686

$$= \frac{130.0686}{15}$$

$$= 8.671$$

∴ (AC1) Autocorrelation $= \frac{\gamma_1}{\gamma_0}$

$$= \frac{8.671}{10.46}$$

~~0.83~~ = 0.8289
= 0.83

05

04 Saturday

Week 14 / Day (095-270)

2025

104.0637

~~$x_t - \bar{x}$~~
~~$t-2$~~

Autocovariance coefficient at lag $k=2$

$$\gamma_2 = \frac{1}{n} \sum (x_{t-0} - \bar{x})(x_{t-2} - \bar{x})$$

$$= \frac{117.5737}{15} \quad \frac{104.0637}{15}$$

$$= 7.8382 \quad = 6.93758$$

Autocorrelation (Ac2):-

$$\frac{\gamma_2}{\gamma_0}$$

$$= \frac{6.93758}{10.46}$$

06 Sunday

$$= 0.66$$

Autovariance coefficient at lag $k=3$.

$$\gamma_3 = \frac{1}{n} \sum (x_t - \bar{x})(x_{t-3} - \bar{x})$$

$$= \frac{74.1288}{15} = 4.94192$$

April 2025

Wk	M	T	W	T	F	S	S
14		1	2	3	4	5	6
15	7	8	9	10	11	12	13
16	14	15	16	17	18	19	20
17	21	22	23	24	25	26	27
18	28	29	30				

Notes

2025

2025

07

Week 15 / Day (097-268)

Monday / 04

	$(x_{t-3} - \bar{x})$	$(x_t - \bar{x})$	$(x_{t-4} - \bar{x})$
1	–	-4.93	–
2	–	-3.93	–
3	–	-3.93	–
4	-4.93	-2.93	–
5	-3.93	-3.93	-4.93
6	-3.93	-1.93	-3.93
7	-2.93	-0.93	-3.93
8	-3.93	1.07	-2.93
9	-1.93	1.07	-3.93
10	-0.93	3.07	-1.93
11	1.07	4.07	-0.93
12	1.07	3.07	1.07
13	3.07	3.07	1.07
14	4.07	4.07	3.07
15	3.07	3.07	4.07

.063

2

k=3.

✓Notes

✓Notes

May

Wk	M	T	W	T	F
18				1	2
19	5	6	7	8	9
20	12	13	14	15	16
21	19	20	21	22	23
22	26	27	28	29	30

08 2025

04 Tuesday Week 15 / Day (098-267)

Auto correlation (AC3) $= \frac{\gamma_3}{\gamma_0}$

$= \frac{4.94192}{10.46}$

$= 0.47$

Autovariance coefficient at lag $k=4$

$\gamma_4 = \frac{1}{n} \sum (x_t - \bar{x})(x_{t-4} - \bar{x})$

$= \frac{45.1239}{15}$

$= 3.00826$

$AC4 = \frac{\gamma_4}{\gamma_0}$

$= \frac{3.00826}{10.46} = 0.2875$

April 2025

Wk	M	T	W	T	F	S	S
14		1	2	3	4	5	6
15	7	8	9	10	11	12	13
16	14	15	16	17	18	19	20
17	21	22	23	24	25	26	27
18	28	29	30				

Notes

2025

09

Week 15 / Day (099-266) / Wednesday / 04

(1)

	MA	AR	ARMA
Acf	Cuts off at k=q	decay	decay
PACF	decay	Cut off at k=p	decay.

(2)

day	Temp.	$(x_t - \bar{x})$	$(x_{t-1} - \bar{x})$	$(x_{t-2} - \bar{x})$	$(x_{t-3} - \bar{x})$	$(x_{t-4} - \bar{x})$
1	27	-2	—	—	—	—
2	29	0	-2	—	—	—
3	31	2	0	-2	—	—
4	27	-2	2	0	-2	—
5	28	-1	-2	2	0	-2
6	30	1	-1	-2	2	0
7	32	3	1	-1	-2	2
8	29	0	3	1	-1	-2
9	28	-1	0	3	1	-1
10	30	1	-1	0	3	1
11	30	1	1	-1	0	3
12	26	-3	1	1	-1	0
13	30	1	-3	1	1	-1
14	31	2	1	-3	1	1
15	27	-2	2	1	-3	1

Notes

MAY

JUNE

May 2025

Wk	M	T	W	T	F	S	S
18				1	2	3	4
19	5	6	7	8	9	10	11
20	12	13	14	15	16	17	18
21	19	20	21	22	23	24	25
22	26	27	28	29	30	31	

10

2025

04 Thursday

Week 15 / Day (100-265)

Mean = 29

Variance $\gamma_0 = \frac{1}{n}\sum(x_t - \bar{x})^2$

$= \frac{43}{15}$

~~2.866~~ 2.933

~~Autocovari~~ covariance coefficient — γ_1

$= \frac{1}{n}\sum(x_t - \bar{x})(x_{t-1} - \bar{x})$

$= \frac{-8}{15} = -0.533$

AC1 = ~~-0.8~~ ~~-0.186~~ -0.1817

~~Autoco~~ $\gamma_2 = \frac{1}{n}\sum(x_t - \bar{x})(x_{t-2} - \bar{x})$

$= \frac{-25}{15} = -1.667$

April 2025

Wk	M	T	W	T	F	S	S
14		1	2	3	4	5	6
15	7	8	9	10	11	12	13
16	14	15	16	17	18	19	20
17	21	22	23	24	25	26	27
		29	30				

✓Notes

$AC2 = \frac{-1.667}{2.933}$

$= -0.5682$

$\gamma_3 = \frac{1}{n} \sum (x_t - \bar{x})(x_{t-3} - \bar{x})$

$= \frac{14}{15}$

$= 0.933$

$AC3 = \frac{0.933}{2.933} = 0.318$

$\gamma_4 = \frac{1}{n} \sum (x_t - \bar{x})(x_{t-4} - \bar{x})$

$= \frac{12}{15}$

$= 0.8$

$AC4 = \frac{0.8}{2.933} = 0.2727$

PACF

$\rho_0 = 1$

$\phi_{11} = \rho_1 = -0.18$

$$\phi_{22} = \frac{\begin{vmatrix} 1 & \rho_1 \\ \rho_1 & \rho_2 \end{vmatrix}}{\begin{vmatrix} 1 & \rho_1 \\ \rho_1 & 1 \end{vmatrix}}$$

$= -0.5682$

$= -0.5682$

$$= \frac{\begin{vmatrix} 1 & -0.18 \\ -0.18 & -0.568 \end{vmatrix}}{\begin{vmatrix} 1 & -0.18 \\ -0.18 & 1 \end{vmatrix}}$$

13 Sunday

$= \frac{-0.6004}{0.9676}$

$= -0.6205$

$$\phi_{33} = \frac{\begin{vmatrix} 1 & -0.18 & -0.18 \\ -0.18 & 1 & -0.568 \\ -0.568 & -0.18 & 0.318 \end{vmatrix}}{\begin{vmatrix} 1 & -0.18 & -0.568 \\ -0.18 & 1 & 0.318 \\ -0.568 & -0.18 & 1 \end{vmatrix}}$$

$$= \frac{0.21576 - 0.06837552 - 0.108072}{1.05724 + 0.00012232 - 0.3410272}$$

$$= 0.03931248$$

$$= 0.0548$$

So, we can conclude, ACF cuts off and ACF decay, so AR model is Suitable