· Disclaimer:

- 1) Please follow the marks deduction scheme for each questions. Any unnecessary arguments will deduct further negative marking.
- (2) For any doubt in Q-1,3 talk to Arghya. Q-2,4 talk to Sayan.

· Marking scheme:

Question-1: (a) and (b) Incorrect answers with detailed steps will award Zoro marks. No partial marking.

1. a The state equation:

$$\begin{bmatrix} x_t \\ x_{t-1} \end{bmatrix} = \begin{bmatrix} 0 & \phi \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_{t-1} \\ x_{t-2} \end{bmatrix} + \begin{bmatrix} w_t \\ 0 \end{bmatrix}$$

The observed equation:

$$Y_{t} = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} X_{t} \\ X_{t-1} \end{bmatrix} + V_{t}$$

(b)
$$\sigma_6^2 = \frac{\sigma_w^2}{1-\phi^2}$$
, $\sigma_1^2 = \frac{\sigma_w^2}{1-\phi^2}$

a dy is MA(1) process with

$$8 \text{ TYL}(h) = \begin{cases} -\sigma_w^2 + 2\sigma_v^2, & h = 0\\ -\sigma_v^2, & h = \pm 1 \end{cases}$$
 Otherwise

Tero morks will be given if the autocornelation function is missing.

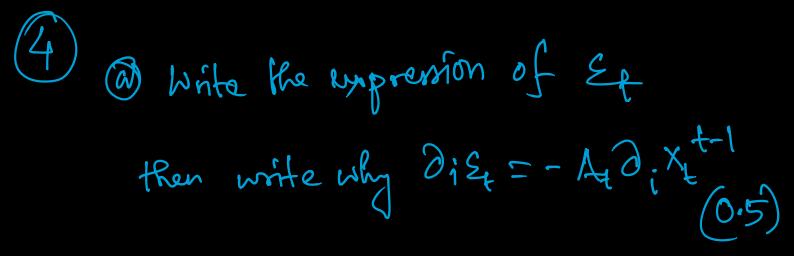
(ii) Reporting summary of coefficients from Arima (Vlog-varue, order = c(0,0,1)) object

Estimate SE ϕ . value 0.0341 0.050 0.050 0.050 0.0013 0.0044 0.7782 $\hat{\sigma}^2 = 0.2355$ (must)

[1 marks for early $+\hat{\sigma}^2$ 0.5 marks for coeffets]

· Reporting only ma (1) coeff (-0.771) will award (0.25) marks.

- (ii) Residual analysis (1 marks)
- · ACF plot for nesiduals [[lag-1] significance (0.5 marks)
- · Lijung-Box test statistic: p-value = 0.015 <0.05 (Rejected at 5% level of significance, Ho: no auto correlation is rejected at 5% 1.0.5)
- , QQ plot / density blot for normality assumption (0.5)
- Plots with no explanation (-0.75) @]
- (2) Find cov (&, &,) by applaining each term without skipping any remarkable step. Marks detucted if written in just 1-2 line.
 - (a) show that $cov(\varepsilon_s, \varepsilon_t) = 0$ for $s \neq t$
 - (b) show that $G_{\text{ov}}\left(\underline{s},\underline{\epsilon}_{\text{t}}\right) = P_{\text{t}}^{t-1} + \sigma_{\text{v}}^{2}$ for s=t



(b) Start with correct expression of x_t^{t-1} $x_t^{t-1} = \cancel{D} x_{t-1}^{t-2} + K_{t-1} \mathcal{E}_{t-1}$ (0.5)

from Shumway, stoffer eg. 6.100-6.107

© Zt = At Pt At + R

Explain why difforemtiation only with Pt

(0.5)

(d) Use appression of K_{t} as mentioned shumovary 9 stoffer $K_{t} = \overline{D} P_{t}^{t+1} A_{t}' \Sigma_{t}^{+} (0.5)$

(2) Use the given apprention of Pt and enduperplaning each 3 terms (1)

Note:

- 1) I Mark deducted if submitted with wrong file name.
- 2) Partial masker deducted if there is broad step jump.