TEST #1

STA 4853 **Name:**____________________________________

March 2, 2022

Please read the following directions.
DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO

Directions

- This exam is **closed book** and **closed notes**.
- There are **35** multiple choice questions.
- Circle the **single best** answer for each multiple choice question. Your choice should be made clearly.
- Always **circle the correct response**. (Sometimes the question has an empty blank or a box, but this is **NOT** where the answer goes.)
- There is no penalty for guessing.
- The exam has **11** pages.
- Each question is worth equal credit (except Problem 13, which gets a double weight so that the highest possible raw score is 36).

Problem 1. Suppose we fit a regression model to data. If the regression assumptions are valid, the plot of the residuals versus the fitted values (also called predicted values) will ________.

a) often be used to detect cases with unusual covariate values

b) be useful whenever the data are time ordered

c) be centered about zero with no bend

d) follow roughly a straight line with positive slope

e) be useful in detecting serial correlation

f) have a two standard error band with increasing width

Problem 2. If $\{z_t\}$ is an MA(**4**) process then $z_{t-\mathbf{2}}$ depends on the random shocks ________

a) $\{a_{t-2}, a_{t-3}, a_{t-4}\}$ **b)** $\{a_{t+4}, a_{t+3}, \ldots, a_{t-2}\}$ **c)** $\{a_{t+4}, a_{t+3}, a_{t+2}\}$

d) $\{a_{t+2}, a_{t+1}, \ldots, a_{t-4}\}$ **e)** $\{a_{t-2}, a_{t-3}, \ldots, a_{t-6}\}$ **f)** $\{a_t, a_{t-1}, \ldots, a_{t-6}\}$

Problem 3. Suppose the SAS output for some parameter gives an estimate of 0.23978, a standard error of 0.09915, a t-value of 2.42, and a p-value of 0.0156. Which of the following is true?

a) When the true value of the parameter is zero, the probability of getting a value of $|t|$ equal to 2.42 is 0.0156 or larger.

b) When the true value of the parameter is 0.23978, the probability of getting a value of $|t|$ which is 2.42 or larger is approximately 0.0156.

c) When the true value of the parameter is 0.23978, the probability of getting a value of $|t|$ equal to 2.42 is 0.0156 or larger.

d) When the true value of the parameter is zero, the probability of getting an estimate greater than 0.23978 is approximately 0.0156.

e) When the true value of the parameter is zero, the probability of getting an estimate equal to 0.23978 is 0.0156 or larger.

f) When the true value of the parameter is zero, the probability of getting a value of $|t|$ which is 2.42 or larger is approximately 0.0156.

Problem 4. If Y and Z are independent random variables, then $E(YZ) =$ ________.

a) $EY + EZ$ **b)** 0 **c)** $\text{Var}(Y) + \text{Var}(Z)$ **d)** $\text{Cov}(Y, Z)$

e) $E(\widetilde{Y}\widetilde{Z})$ **f)** $E(a_s a_t)$ **g)** $E(z_s a_t)$ **h)** $(EY)(EZ)$

Problem 5. The ACF plot produced by PROC ARIMA has a band marked at two standard errors. For a ________ process, after lag 3 we expect all (or nearly all) of the values r_k to lie within this band, most of them being well inside the band.

a) ARMA(1,3) **b)** ARMA(3,1) **c)** ARMA(3,3) **d)** MA(3) **e)** AR(3)

Problem 6. An ARMA(1,2) model has been fitted to a time series of length 100 using METHOD=ML. In the SAS output, immediately after the table labeled **Maximum Likelihood Estimation** there is another table which is given below. In this table, the value 2.819585 which is labeled **Std Error Estimate** is ________

a) $\hat{\sigma}_z$ **b)** $\hat{\sigma}_a$ **c)** $\hat{\sigma}_a^2$ **d)** $\hat{\sigma}_z^2$
e) $\text{SE}(\hat{\theta}_1)$ **f)** $\text{SE}(\hat{\theta}_2)$ **g)** $\text{SE}(\hat{\phi}_1)$ **h)** $\text{SE}(\hat{C})$

Constant Estimate	4.037071
Variance Estimate	7.950057
Std Error Estimate	2.819585
AIC	495.7337
SBC	506.1544
Number of Residuals	100

Problem 7. In a regression of a response variable Y on two covariates X_1, X_2 with a sample of size n, the estimates $\hat{\beta}_0$, $\hat{\beta}_1$, $\hat{\beta}_2$ are the values of β_0, β_1, β_2 which minimize ________.

a) $\sum_{i=1}^{n} (Y_i - \beta_0 - \beta_1 X_{1,i} - \beta_2 X_{2,i})$ **b)** $\sum_{i=1}^{n} (Y_i + \beta_0 + \beta_1 X_{1,i} + \beta_2 X_{2,i})$

c) $\sum_{i=1}^{n} (Y_i + \beta_0 + \beta_1 X_{1,i} + \beta_2 X_{2,i})^2$ **d)** $\sum_{i=1}^{n} (Y_i - \beta_0 - \beta_1 X_{1,i} - \beta_2 X_{2,i})^2$

e) $\sum_{i=1}^{n} |Y_i - \beta_0 - \beta_1 X_{1,i} - \beta_2 X_{2,i}|$ **f)** $\sum_{i=1}^{n} |Y_i + \beta_0 + \beta_1 X_{1,i} + \beta_2 X_{2,i}|$

Problem 8. In PROC ARIMA the statement

ESTIMATE P=(1,4) Q=(2,3) ;

will fit which of the following models?

a) $z_t = C + \phi_2 z_{t-2} + \phi_3 z_{t-3} + a_t - \theta_1 a_{t-1} - \theta_4 a_{t-4}$
b) $z_t = C + \phi_1 z_{t-1} + \phi_4 z_{t-4} + a_t - \theta_2 a_{t-2} - \theta_3 a_{t-3}$
c) $z_t = C + \phi_1 z_{t-1} + \phi_3 z_{t-3} + a_t - \theta_2 a_{t-2} - \theta_4 a_{t-4}$
d) $z_t = C + \phi_2 z_{t-2} + \phi_4 z_{t-4} + a_t - \theta_2 a_{t-1} - \theta_4 a_{t-3}$
e) $z_t = C + \phi_2 z_{t-2} + \phi_3 z_{t-3} - \theta_1 a_{t-1} - \theta_4 a_{t-4}$
f) $z_t = C + \phi_1 z_{t-1} + \phi_4 z_{t-4} - \theta_2 a_{t-2} - \theta_3 a_{t-3}$
g) $z_t = C + \phi_1 z_{t-1} + \phi_3 z_{t-3} - \theta_2 a_{t-2} - \theta_4 a_{t-4}$
h) $z_t = C + \phi_2 z_{t-2} + \phi_4 z_{t-4} - \theta_2 a_{t-1} - \theta_4 a_{t-3}$

Problem 9. For an AR(p) model, the CLS method estimates parameters by those values _________.

a) which minimize $\sum_{t=1}^{n} \left(z_t + C + \phi_1 z_{t-1} + \cdots + \phi_p z_{t-p}\right)$ where $z_t = 0$ for $t < 1$.

b) which maximize the likelihood of the observed data $z_1, \ldots, z_n$ assuming the shocks a_t are independent $N(0, \sigma_a^2)$.

c) which minimize the likelihood of the observed data $z_1, \ldots, z_n$ assuming the shocks a_t are independent $N(0, \sigma_a^2)$.

d) which minimize the likelihood of the observed data $z_1, \ldots, z_n$ without assuming the shocks a_t are normally distributed.

e) which minimize $\sum_{t=1}^{n} \left|z_t + C + \phi_1 z_{t-1} + \cdots + \phi_p z_{t-p}\right|$ where $z_t = 0$ for $t < 1$.

f) which minimize $\sum_{t=1}^{n} \left(\tilde{z}_t - \phi_1 \tilde{z}_{t-1} - \cdots - \phi_p \tilde{z}_{t-p}\right)^2$ where $\tilde{z}_t = 0$ for $t < 1$.

Problem 10. Suppose you have a very long time series $z_1, z_2, \ldots, z_n$ which is generated from an AR(**2**) process, and you create the lagged variables z_{t-1}, z_{t-2}, z_{t-3}, and z_{t-4} (that is, you create z lagged by 1, z lagged by 2, etc. which are more briefly written as `zlag1`, `zlag2`, `zlag3`, `zlag4`). If you fit the regression of z_t on z_{t-1}, z_{t-2}, z_{t-3}, z_{t-4} (i.e., the regression of `z` on the variables `zlag1`, `zlag2`, `zlag3`, `zlag4`), then the regression coefficients for z_{t-3} and z_{t-4} will _________.

a) both be positive

b) both be negative

c) be positive and negative, respectively

d) be negative and positive, respectively

e) be positive and zero, respectively

f) both be very close to zero

Problem 11. An AR(1) process is _________.

a) stationary if $\phi_1 < 1$, and non-stationary if $\phi_1 \geq 1$

b) stationary if $\phi_1 \leq 1$, and non-stationary if $\phi_1 > 1$

c) stationary if $\phi_1 > 1$, and non-stationary if $\phi_1 \leq 1$

d) stationary if $\phi_1 \geq 1$, and non-stationary if $\phi_1 < 1$

e) stationary if $|\phi_1| < 1$, and non-stationary if $|\phi_1| \geq 1$

f) stationary if $|\phi_1| \leq 1$, and non-stationary if $|\phi_1| > 1$

g) stationary if $|\phi_1| > 1$, and non-stationary if $|\phi_1| \leq 1$

h) stationary if $|\phi_1| \geq 1$, and non-stationary if $|\phi_1| < 1$

Problem 12. Let L be the likelihood value, k be the number of estimated parameters, and n be the number of residuals. The AIC is equal to _________.

a) $-2\ln(L) - 2k$ **b)** $-2\ln(L) + 2k$ **c)** $+2\ln(L) - 2k$ **d)** $+2\ln(L) + 2k$

e) $-2\ln(L) - k\ln(n)$ **f)** $-2\ln(L) + k\ln(n)$ **g)** $+2\ln(L) - k\ln(n)$ **h)** $+2\ln(L) + k\ln(n)$

Problem 13. In our class, we assume that ARMA processes are constructed from a sequence of random shocks a_t which are ___(1)___ and have a ___(2)___ distribution with mean ___(3)___ and variance ___(4)___ .

Select the best choice to fill each of the numbered blanks above.

Blank (1): **a)** independent **b)** correlated

Blank (2): **a)** t **b)** chi-square **c)** normal

Blank (3): **a)** 0 **b)** 1 **c)** μ_z

Blank (4): **a)** σ_a^2 **b)** σ_z^2 **c)** 0 **d)** 1

Problem 14. Suppose you are applying a regression model to data and the errors exhibit serial correlation, but the other regression assumptions are valid. Which one of the following items in the regression output might be seriously in error?

a) the leverage and Cook's D values
b) the regression estimates $\widehat{\beta}_i$
c) the residuals and fitted values
d) the standard errors of the $\widehat{\beta}_i$'s
e) the R-Square value
f) the error degrees of freedom

Problem 15. In PROC ARIMA the statement

ESTIMATE P=3 ;

will fit which of the following models?

a) $z_t = C + \phi_1 z_{t-1} + \phi_2 z_{t-2} + \phi_3 z_{t-3} + a_t$
b) $z_t = C + \phi_3 z_{t-3} + a_t$
c) $z_t = C - \theta_1 a_{t+1} - \theta_2 a_{t+2} - \theta_3 a_{t+3} + a_t$
d) $z_t = C - \theta_3 a_{t-3} + a_t$
e) $z_t = C + \phi_1 a_{t-1} + \phi_2 a_{t-2} + \phi_3 a_{t-3} + a_t$
f) $z_t = C + \phi_3 a_{t-3} + a_t$
g) $z_t = C + \phi_1 z_{t+1} + \phi_2 z_{t+2} + \phi_3 z_{t+3} + a_t$
h) $z_t = C - \theta_3 a_{t+3} + a_t$

Problem 16. If you are applying regression to data which ________, you should use the Durbin-Watson test.

a) contains high leverage cases
b) contains outliers
c) is time ordered
d) is **not** normally distributed
e) contains influential cases
f) has many covariates

Problem 17. A random sample of size n individuals is drawn from a population of N individuals. The values of X (height) are measured for these n individuals, and these values are used to compute s_x^2, the sample variance. The sample variance is an estimate of the population variance. The formula for the **population** variance is $\sigma_x^2 =$ ________.

a) $\frac{1}{n}\sum_{i=1}^{n}(X_i - \mu_x)^2$ with $\mu_x = \frac{1}{n}\sum_{i=1}^{n} X_i$ **b)** $\frac{1}{N}\sum_{i=1}^{N}|X_i - \mu_x|$ with $\mu_x = \frac{1}{N}\sum_{i=1}^{N} X_i$

c) $\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2$ with $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$ **d)** $\frac{1}{N}\sum_{i=1}^{N}(X_i - \mu_x)^2$ with $\mu_x = \frac{1}{N}\sum_{i=1}^{N} X_i$

e) $\frac{1}{n-1}\sum_{i=1}^{n}|X_i - \overline{X}|$ with $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$ **f)** $\frac{1}{n}\sum_{i=1}^{n}|X_i - \mu_x|$ with $\mu_x = \frac{1}{n}\sum_{i=1}^{n} X_i$

Problem 18. Let $\rho_1, \rho_2, \rho_3, \ldots$ and $\phi_{11}, \phi_{22}, \phi_{33}, \ldots$ be the ACF and PACF, respectively, of a stationary ARMA process. The value of ϕ_{44} may be expressed as a function of ________.

a) $\widehat{\phi}_{44}$ **b)** ρ_4 **c)** $\phi_{11}, \phi_{22}, \phi_{33}$ **d)** $\rho_1, \rho_2, \rho_3, \rho_4$
e) $\widehat{\phi}_{11}, \widehat{\phi}_{22}, \widehat{\phi}_{33}$ **f)** $\widehat{\rho}_1, \widehat{\rho}_2, \widehat{\rho}_3, \widehat{\rho}_4$ **g)** $\widehat{\rho}_4$ **h)** ρ_4, ρ_5, ρ_6

Problem 19. In a regression model, let $\widehat{\beta}_i$ be the parameter estimate, t_i be the t-value, and $\mathrm{SE}(\widehat{\beta}_i)$ be the standard error corresponding to the covariate X_i. If ________, we may decide to drop X_i from the regression model.

a) $|t_i|$ is large **b)** $|t_i|$ is small **c)** t_i is large and positive
d) t_i is large and negative **e)** t_i is negative **f)** t_i is positive
g) $|\mathrm{SE}(\widehat{\beta}_i)|$ is small **h)** $|\mathrm{SE}(\widehat{\beta}_i)|$ is large **i)** $\mathrm{SE}(\widehat{\beta}_i)$ is large and positive
j) $\mathrm{SE}(\widehat{\beta}_i)$ is large and negative **k)** $\mathrm{SE}(\widehat{\beta}_i)$ is negative **l)** $\mathrm{SE}(\widehat{\beta}_i)$ is positive

Problem 20. Which of the following is another way to write an MA(3) process?

a) $\widetilde{z}_t = \psi_1 z_{t-1} + \psi_2 z_{t-2} + \psi_3 z_{t-3}$ **b)** $\widetilde{z}_t = C + \psi_1 a_{t+1} + \psi_2 a_{t+2} + \psi_3 a_{t+3}$
c) $\widetilde{z}_t = C + \psi_1 a_{t-1} + \psi_2 a_{t-2} + \psi_3 a_{t-3}$ **d)** $\widetilde{z}_t = C + \psi_1 a_{t+1} + \psi_2 a_{t+2} + \psi_3 a_{t+3}$
e) $\widetilde{z}_t = a_t + \psi_1 \widetilde{z}_{t-1} + \psi_2 \widetilde{z}_{t-2} + \psi_3 \widetilde{z}_{t-3}$ **f)** $\widetilde{z}_t = \psi_0 a_t + \psi_1 a_{t-1} + \psi_2 a_{t-2} + \psi_3 a_{t-3}$
g) $\widetilde{z}_t = \psi_0 a_t + \psi_1 a_{t+1} + \psi_2 a_{t+2} + \psi_3 a_{t+3}$ **h)** $\widetilde{z}_t = \psi_1 a_{t-1} + \psi_2 a_{t-2} + \psi_3 a_{t-3}$

Problem 21. A stationary AR(1) process $\{z_t\}$ has variance equal to $\mathrm{Var}(z_t) =$ ________.

a) $\frac{C}{1-\phi_1}$ **b)** $\frac{C^2}{1-\phi_1^2}$ **c)** $\frac{C}{1-\phi_1^2}$ **d)** $\frac{\sigma_a^2}{1-\phi_1}$ **e)** $\frac{\sigma_a}{1-\phi_1}$ **f)** $\frac{\sigma_a^2}{1-\phi_1^2}$

Problem 22. If $\{z_t\}$ is an MA(6) process, then $\text{Cov}(z_t, z_{t-4}) =$ _________.

a) $\sigma_z^2(\psi_0\psi_4 + \psi_1\psi_5 + \psi_2\psi_6)$ **b**) $\sigma_z^2(\psi_1\psi_5 + \psi_2\psi_6)$

c) $\sigma_a^2(\psi_0\psi_6 + \psi_1\psi_7 + \psi_2\psi_8 + \psi_3\psi_9)$ **d**) $\sigma_z^2(\psi_0\psi_6 + \psi_1\psi_7 + \psi_2\psi_8 + \psi_3\psi_9)$

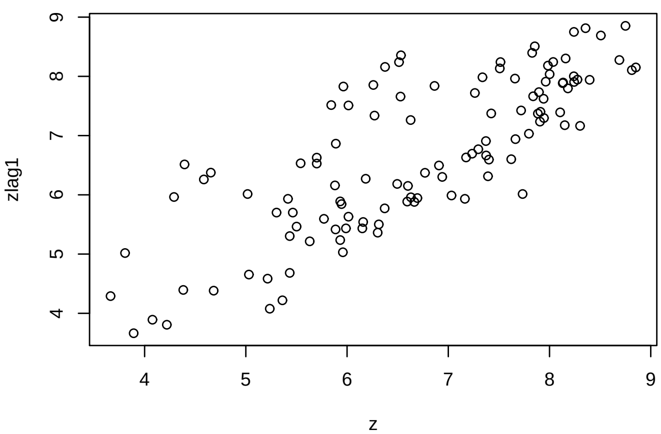
e) $\sigma_a^2(\psi_1\psi_7 + \psi_2\psi_8 + \psi_3\psi_9 + \psi_4\psi_{10})$ **f**) $\sigma_z^2(\psi_1\psi_7 + \psi_2\psi_8 + \psi_3\psi_9 + \psi_4\psi_{10})$

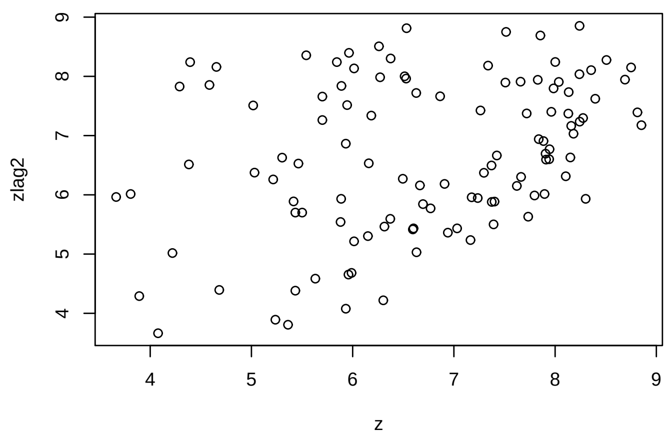
g) $\sigma_a^2(\psi_1\psi_5 + \psi_2\psi_6)$ **h**) $\sigma_a^2(\psi_0\psi_4 + \psi_1\psi_5 + \psi_2\psi_6)$

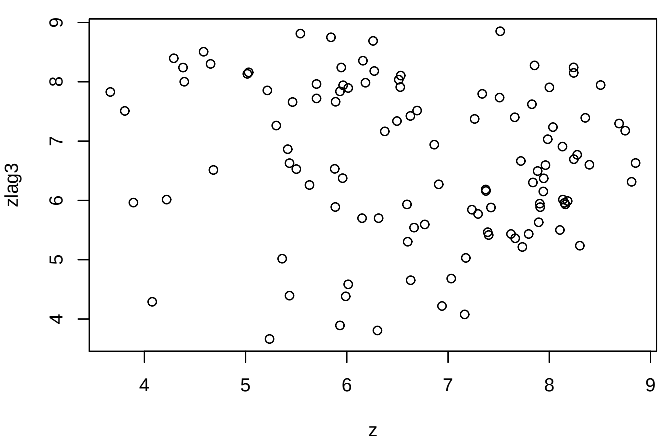
Problem 23. For a time series z_t, the graphs below are scatterplots of z_{t-1} versus z_t (top left), z_{t-2} versus z_t (top right), z_{t-3} versus z_t (bottom left), and z_{t-4} versus z_t (bottom right). Based on these plots, the values of r_1, r_2, r_3, r_4 are approximately equal to _________.

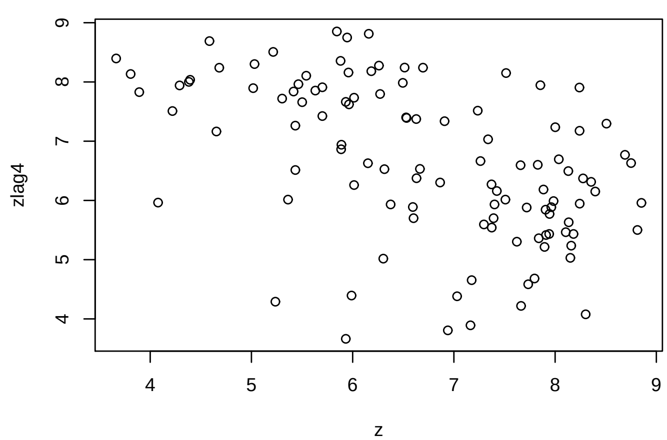
a) 5, 5, 5, 5 **b**) .95, .3, −.1, −.9 **c**) −.8, −.3, .1, .5

d) .8, .3, −.1, −.5 **e**) .8, −.7, −.1, −.2 **f**) 6.7, 6.7, 6.7, 6.7









Problem 24. If a process $z_1, z_2, z_3, \ldots$ is ________.

a) second order stationary, then the ACF might change over time
b) strictly stationary, then the ACF might change over time
c) strictly stationary, then it will also be second order stationary
d) second order stationary, then it will also be strictly stationary
e) second order stationary, then it can**NOT** be weakly stationary
f) weakly stationary, then it can**NOT** be second order stationary

Problem 25. By repeated substitution, the process $z_t = \phi_1 z_{t-1} + a_t$ with $|\phi_1| < 1$ can be re-written as ________.

a) $z_t = a_t + \sum_{i=1}^{\infty} \phi_1 a_{t-i}$ **b)** $z_t = a_t + \sum_{i=1}^{\infty} \phi_1 z_{t-i}$

c) $z_t = a_t + \phi_1 z_{t-1} + \phi_1^2 a_{t-2}$ **d)** $z_t = a_t + \phi_1 z_{t-1} + \phi_1^2 a_{t-2} + \phi_1^3 a_{t-3}$

e) $z_t = a_t - \phi_1 z_{t-1} - \phi_1^2 a_{t-2}$ **f)** $z_t = a_t - \phi_1 z_{t-1} - \phi_1^2 a_{t-2} - \phi_1^3 a_{t-3}$

g) $z_t = a_t + \sum_{i=1}^{\infty} \phi_1^i a_{t-i}$ **h)** $z_t = a_t + \sum_{i=1}^{\infty} \phi_1^i z_{t-i}$

Problem 26. In our usual notation, an ARMA(p,q) process is defined by ________.

a) $z_t = C + \phi_1 a_{t+1} + \cdots + \phi_p a_{t+p} + a_t - \theta_1 z_{t+1} - \cdots - \theta_q z_{t+q}$
b) $z_t = C - \phi_1 z_{t+1} - \cdots - \phi_p z_{t+p} + a_t + \theta_1 a_{t+1} + \cdots + \theta_q a_{t+q}$
c) $z_t = C - \phi_1 a_{t+1} - \cdots - \phi_p a_{t+p} + a_t + \theta_1 z_{t+1} + \cdots + \theta_q z_{t+q}$
d) $z_t = C + \phi_1 z_{t+1} + \cdots + \phi_p z_{t+p} + a_t - \theta_1 a_{t+1} - \cdots - \theta_q a_{t+q}$
e) $z_t = C + \phi_1 a_{t-1} + \cdots + \phi_p a_{t-p} + a_t - \theta_1 z_{t-1} - \cdots - \theta_q z_{t-q}$
f) $z_t = C - \phi_1 z_{t-1} - \cdots - \phi_p z_{t-p} + a_t + \theta_1 a_{t-1} + \cdots + \theta_q a_{t-q}$
g) $z_t = C - \phi_1 a_{t-1} - \cdots - \phi_p a_{t-p} + a_t + \theta_1 z_{t-1} + \cdots + \theta_q z_{t-q}$
h) $z_t = C + \phi_1 z_{t-1} + \cdots + \phi_p z_{t-p} + a_t - \theta_1 a_{t-1} - \cdots - \theta_q a_{t-q}$

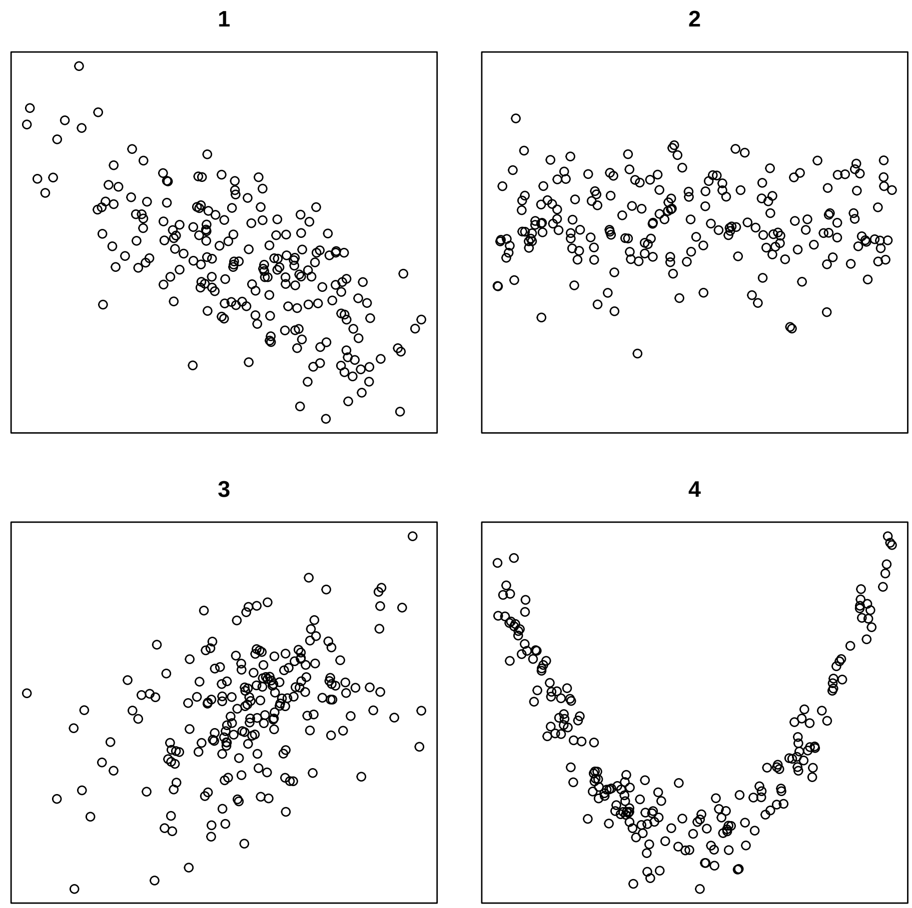
Problem 27. Suppose $\{a_t\}$ is a sequence of random shocks. What is the value of

$$E\left[(2a_2 + 3a_3 + 4a_4)(3a_1 + 4a_2)\right] \ ?$$

a) $63\sigma_z^2$ **b)** $16\sigma_z^2$ **c)** $8\sigma_z^2$ **d)** $18\sigma_z^2$ **e)** 0
f) $63\sigma_a^2$ **g)** $16\sigma_a^2$ **h)** $8\sigma_a^2$ **i)** $18\sigma_a^2$ **j)** 1

Problem 28. The four scatter plots given below depict four samples of size 200. In two of these plots, the sample correlation between X and Y is exactly zero. Which two plots are these?

a) 1, 2 **b**) 1, 3 **c**) 1, 4 **d**) 2, 3 **e**) 2, 4 **f**) 3, 4



Problem 29. Suppose $\{z_t\}$ is a stationary ARMA process generated using the sequence of random shocks $\{a_t\}$. The expression

$$E\,[\,(5\tilde{z}_{t-1} + a_t)\,\tilde{z}_{t-3}\,]$$

can be shown to be equal to _________.

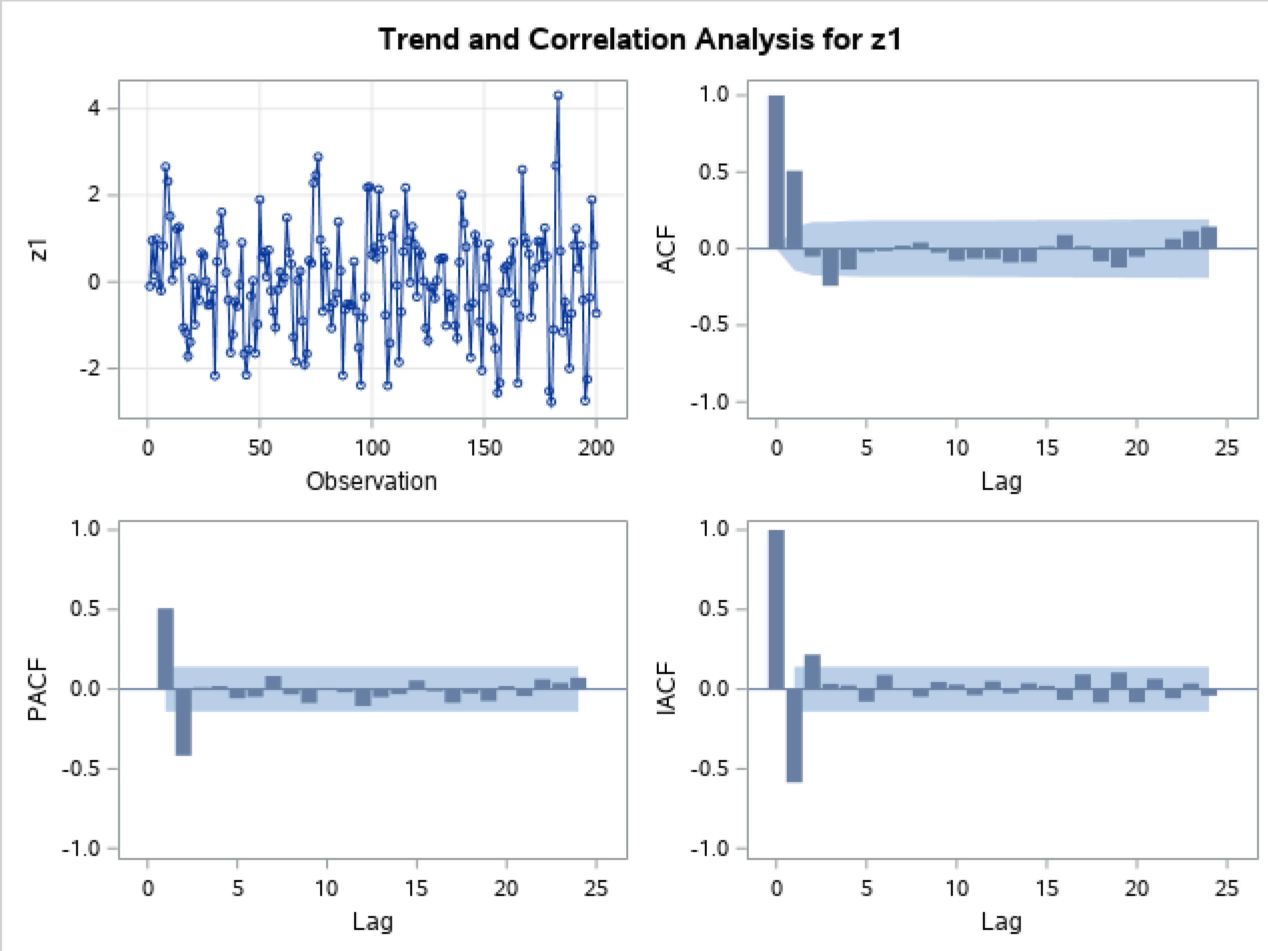
a) $5\rho_2 + \sigma_a^2$ **b**) $5\rho_2 + \sigma_z^2$ **c**) $5\rho_2$ **d**) $25\rho_2$ **e**) $25\rho_2^2$

f) $5\gamma_2 + \sigma_a^2$ **g**) $5\gamma_2 + \sigma_z^2$ **h**) $5\gamma_2$ **i**) $25\gamma_2$ **j**) $25\gamma_2^2$

Problem 30. The SAS output on the next page gives the usual output produced by the IDENTIFY statement in PROC ARIMA for a series `z1` of length 200. Based on this output, a reasonable model for this series is _________

a) MA(4) **b**) MA(3) **c**) MA(2) **d**) AR(2) **e**) AR(1)

f) AR(3) **g**) ARMA(2,3) **h**) ARMA(2,2) **i**) ARMA(1,3) **j**) ARMA(1,1)



Problem 31. Suppose a random sample of n individuals has values of X and Y given by $(X_1, Y_1), (X_2, Y_2,), \ldots, (X_n, Y_n)$. If the sample correlation r between X and Y is **exactly** equal to 1, then the n points $(X_1, Y_1), (X_2, Y_2), \ldots, (X_n, Y_n)$ __________.

a) lie in a band of constant width centered about zero.

b) lie in a band of constant width centered about one.

c) lie exactly on a line with positive slope

d) lie exactly on a line with slope equal to one

e) are very close to a line with slope exactly equal to one

f) are very close to a line with positive slope

g) are very close to the regression line $Y = \beta_0 + \beta_1 X + \varepsilon$

Problem 32. The log of the Lynx time series exhibits oscillations of a somewhat periodic nature. Which of the following time series models (with an appropriate choice of parameter values) is also capable of exhibiting somewhat periodic oscillatory behavior?

a) random shocks **b)** MA(1) **c)** AR(1) **d)** MA(2) **e)** AR(2)

Problem 33. SAS PROC ARIMA was used to fit an AR(1) and an MA(3) model to a time series. The two tables given below are extracted from the output produced by the ESTIMATE statement for these two models. The left table was produced when fitting the AR(1) model; the right table was produced when fitting the MA(3) model.

Suppose you relied on the AIC or SBC to choose between these two models. Which of the following statements is true?

a) AIC selects MA(3); SBC selects AR(1)
b) AIC selects AR(1); SBC selects MA(3)
c) Both AIC and SBC select AR(1)
d) Both AIC and SBC select MA(3)
e) Both AIC and SBC reject the null hypothesis
f) Neither AIC or SBC reject the null hypothesis

Output from fitting AR(1) model

Constant Estimate	4.586857
Variance Estimate	27.1341
Std Error Estimate	5.20904
AIC	1230.079
SBC	1236.676
Number of Residuals	200

Output from fitting MA(3) model

Constant Estimate	10.13516
Variance Estimate	26.55393
Std Error Estimate	5.153051
AIC	1227.85
SBC	1241.043
Number of Residuals	200

Problem 34. For estimating the parameters of an ARMA process, if the shocks a_t are independent and approximately normally distributed with mean zero and constant variance, the preferred method of estimation is _________.

a) the default **b**) AIC **c**) SBC **d**) OLS **e**) CLS **f**) ULS **g**) ML

Problem 35. The process $z_t = 10 + a_t + .8a_{t-1} - .5a_{t-2}$ has coefficient values _________.

a) $\phi_1 = .8, \phi_2 = -.5$
b) $\phi_1 = .8, \phi_2 = .5$
c) $\theta_1 = -.8, \theta_2 = -.5$
d) $\theta_1 = -.8, \theta_2 = .5$
e) $\theta_1 = .8, \theta_2 = -.5$
f) $\theta_1 = .8, \theta_2 = .5$
g) $\phi_1 = -.8, \phi_2 = -.5$
h) $\phi_1 = -.8, \phi_2 = .5$