2 TIME-SERIES ANALYSIS

1. Which of the following is NOT a requirement for a series to be covariance stationary? The:

(A) expected value of the time series is constant over time.

(B) time series must have a positive trend.

(C) covariance of the time series with itself (lead or lag) must be constant.

Yolanda Seerveld is an analyst studying the growth of sales of a new restaurant chain called Very Vegan. The increase in the public's awareness of healthful eating habits has had a very positive effect on Very Vegan's business. Seerveld has gathered quarterly data for the restaurant's sales for the past three years. Over the twelve periods, sales grew from $17.2 million in the first quarter to $106.3 million in the last quarter. Because Very Vegan has experienced growth of more than 500% over the three years, the Seerveld suspects an exponential growth model may be more appropriate than a simple linear trend model. However, she begins by estimating the simple linear trend model:

$(sales)_t = \alpha + \beta \times (Trend)_t + E_t$

Where the Trend is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

Regression Statistics	
Multiple R	0.952640
R^2	0.907523
Adjusted R^2	0.898275
Standard Error	8.135514
Observations	12
1st order autocorrelation coefficient of the residuals: -0.075	

ANOVA		
	df	SS
Regression	1	6495.203
Residual	10	661.8659
Total	11	7157.069

	Coefficients	Standard Error
Intercept	10.0015	5.0071
Trend	6.7400	0.6803

The analyst then estimates the following model:

$(\text{natural logarithm of sales})_t = \alpha + \beta \times (\text{Trend})_t + \varepsilon_t$

Regression Statistics	
Multiple R	0.952028
R^2	0.906357
Adjusted R^2	0.896992
Standard Error	0.166686
Observations	12
1st order autocorrelation coefficient of the residuals: -0.348	

ANOVA		
	df	SS
Regression	1	2.6892
Residual	10	0.2778
Total	11	2.9670

	Coefficients	Standard Error
Intercept	2.9803	0.1026
Trend	0.1371	0.0140

Seerveld compares the results based upon the output statistics and conducts two-tailed tests at a 5% level of significance. One concern is the possible problem of autocorrelation, and Seerveld makes an assessment based upon the first-order autocorrelation coefficient of the residuals that is listed in each set of output. Another concern is the stationarity of the data. Finally, the analyst composes a forecast based on each equation for the quarter following the end of the sample.

2. Using the log-linear trend model, the forecast of sales for Very Vegan for the first out-of-sample period is:
   (A) $109.4 million
   (B) $117.0 million
   (C) $121.2 million

3. Which of the following statements regarding seasonality is least accurate?
   (A) A time series that is first differenced can be adjusted for seasonality by incorporating the first-differenced value for the previous year's corresponding period.
   (B) Not correcting for seasonality when, in fact, seasonality exists in the time series results in a violation of an assumption of linear regression.
   (C) The presence of seasonality makes it impossible to forecast using a time-series model.

4. Consider the estimated model $x_t = -6.0 + 1.1x_{t-1} + 0.3x_{t-2} + \varepsilon_t$ that is estimated over 50 periods. The value of the time series for the 49th observation is 20 and the value of the time series for the 50th observation is 22. What is the forecast for the 52nd observation?
   (A) 42
   (B) 24.2
   (C) 27.22.

5. The regression results from fitting an AR(1) model to the first-differences in enrollment growth rates at a large university includes a Durbin-Watson statistic of 1.58. The number of quarterly observations in the time series is 60. At 5% significance, the critical values for the Durbin-Watson statistic are d_l = 1.55 and d_u = 1.62. Which of the following is the most accurate interpretation of the DW statistic for the model?
   (A) Since $d_l < DW < d_u$, the results of the DW test are inconclusive.
   (B) Since $DW > d_l$, the null hypothesis of no serial correlation is rejected.
   (C) The Durbin-Watson statistic cannot be used with AR(1) models.

6. Alexis Popov, CFA, is analyzing monthly data. Popov has estimated the model $x_t = b_0 + b_1 \times x_{t-1} + b_2 \times x_{t-2} + e_t$. The researcher finds that the residuals have a significant ARCH process. The best solution to this is to:
   (A) re-estimate the model with generalized least squares.
   (B) re-estimate the model using a seasonal lag.
   (C) re-estimate the model using only an AR(1) specification.

7. Are either of the slope coefficients statistically significant?
   (A) The simple trend regression is not, but the log-linear trend regression is.
   (B) Yes, both are significant.
   (C) The simple trend regression is, but not the log-linear trend regression.

8. Alexis Popov, CFA, wants to estimate how sales have grown from one quarter to the next on average. The most direct way for Popov to estimate this would be:
   (A) an AR(1) model.
   (B) an AR(1) model with a seasonal lag.

(C) a linear trend model.

9 With respect to the possible problems of autocorrelation and nonstationarity, using the log-linear transformation appears to have:

(A) not improved the results for either possible problems.

(B) improved the results for nonstationarity but not autocorrelation.

(C) improved the results for autocorrelation but not nonstationarity.

10. Using the simple linear trend model, the forecast of sales for Very Vegan for the first out-of-sample period is:

(A) $97.6 million.

(B) $113.0 million.

(C) $123.0 million.

11. Trend models can be useful tools in the evaluation of a time series of data. However, there are limitations to their usage. Trend models are not appropriate when which of the following violations of the linear regression assumptions is present?

(A) Model misspecification.

(B) Serial correlation.

(C) Heteroskedasticity.

12. Consider the estimated model $x_t = -6.0 + 1.1x_{t-1} + 0.3x_{t-2} + \varepsilon_t$ that is estimated over 50 periods. The value of the time series for the 49th observation is 20 and the value of the time series for the 50th observation is 22. What is the forecast for the 51st observation?

(A) 30.2.

(B) 24.2.

(C) 23

13. Modeling the trend in a time series of a variable that grows at a constant rate with continuous compounding is best done with:

(A) a log-linear transformation of the time series.

(B) simple linear regression.

(C) a moving average model.

14. The table below shows the autocorrelations of the lagged residuals for quarterly theater ticket sales that were estimated using the AR(1) model:

$\ln(\text{sales}_t) = b_0 + b_1(\ln \text{sales}_{t-1}) + e_t$ .Assuming the critical t-statistic at 5% significance is 2.0, which of the following is the most likely conclusion about the appropriateness of the model? The time series:

Lagged Autocorrelations of the Log of Quarterly Theater Ticket Sales			
Lag	Autocorrelations	Standard Error	t-Statistic
1	-0.0738	0.1667	-0.44271
2	-0.1047	0.1667	-0.62807
3	-0.0252	0.1667	-0.15117
4	0.5528	0.1667	3.31614

(A) contains ARCH (1) errors.

(B) contains seasonality.

(C) would be more appropriately described with an MA(4) model.

15. Troy Dillard, CFA, has estimated the following equation using quarterly data: $x_t = 93 - 0.5 \times X_{t-1} + 0.1 \times X_{t-4} + e_t$. Given the data in the table below, what is Dillard's best estimate of the first quarter of 2007?

Time	Value
2005: I	62
2005: II	62
2005: III	66
2005: IV	66
2006: I	72
2006: II	70
2006: III	64
2006: IV	66

(A) 66.60.

(B) 66.40.

(C) 67.20.

16. Rhonda Wilson, CFA, is analyzing sales data for the TUV Corp, a current equity holding in her portfolio. She observes that sales for TUV Corp. have grown at a steadily increasing rate over the past ten years due to the successful introduction of some new products. Wilson anticipates that TUV will continue this pattern of success. Which of the following models is most appropriate in her analysis of sales for TUV Corp?

(A) A log-linear trend model, because the data series exhibits a predictable, exponential growth trend.

(B) A log-linear trend model, because the data series can be graphed using a straight, upward-sloping line.

(C) A linear trend model, because the data series is equally distributed above and below the line and the mean is constant.

17. After discussing the above matter with a colleague, Cranwell finally decides to use an autoregressive model of order one i.e. AR(1) for the above data. Below is a summary of the findings of the model:

b_0	0.4563
b_1	0.6874
Standard error	0.3745
R-squared	0.7548
Durbin Watson	1.23
F	12.63
Observations	180

Calculate the mean reverting level of the series.

(A) 1.26.

(B) 1.46.

(C) 1.66.

18. Cranwell is aware that the Dickey Fuller test can be used to discover whether a model has a unit root. He is also aware that the test would use a revised set of critical t-values. What would it mean to Bert to reject the null of the Dickey Fuller test (H_0: g = 0) ?

(A) There is no unit root.

(B) There is a unit root and the model cannot be used in its current form.

(C) There is a unit root but the model can be used if covariance-stationary.

19. Cranwell would also like to test for serial correlation in his AR(1) model. To do this, Cranwell should:

(A) use the provided Durbin Watson statistic and compare it to a critical value.

(B) use a t-test on the residual autocorrelations over several lags.

(C) determine if the series has a finite and constant covariance between leading and lagged terms of itself.

20. When using the root mean squared error (RMSE) criterion to evaluate the predictive power of the model, which of the following is the most appropriate statement?

(A) Use the model with the highest RMSE calculated using the in-sample data.

(B) Use the model with the lowest RMSE calculated using the out-of-sample data.

(C) Use the model with the lowest RMSE calculated using the in-sample data.

21. Which of the following statements regarding a mean reverting time series is least accurate?

(A) If the current value of the time series is above the mean reverting level, the prediction is that the time series will decrease.

(B) If the current value of the time series is above the mean reverting level, the prediction is that the time series will increase.

(C) If the time-series variable is x, then $x_t = b_0 + b_1 x_{t-1}$

22. The procedure for determining the structure of an autoregressive model is:

(A) estimate an autoregressive model (for example, an AR(1) model), calculate the autocorrelations for the model's residuals, test whether the autocorrelations are different from zero, and add an AR lag for each significant autocorrelation.

(B) estimate an autoregressive model (e.g., an AR(1) model), calculate the autocorrelations for the model's residuals, test whether the autocorrelations are different from zero, and revise the model if there are significant autocorrelations.

(C) test autocorrelations of the residuals for a simple trend model, and specify the number of significant lags.

23. A time series that has a unit root can be transformed into a time series without a unit root through:

(A) mean reversion.

(B) first differencing.

(C) calculating moving average of the residuals.

24. Suppose that the time series designated as Y is mean reverting. If $Y_{t+1} = 0.2 + 0.6\ Y_t$, the best prediction of Y_{t+1} is:

(A) 0.3.

(B) 0.5.

(C) 0.8.

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Winston Collier, CFA, has been asked by his supervisor to develop a model for predicting the warranty expense incurred by Premier Snowplow Manufacturing Company in servicing its plows. Three years ago, major design changes were made on newly manufactured plows in an effort to reduce warranty expense. Premier warrants its snowplows for 4 years or 18,000 miles, whichever comes first. Warranty expense is higher in winter months, but some of Premier's customers defer maintenance issues that are not essential to keeping the machines functioning to spring or summer seasons. The data that Collier will analyze is in the following table (in $ millions):

Quarter	Warranty Expense	Change in Warranty Expense y_t	Lagged Change in Warranty Expense y_{t-1}	Seasonal Lagged Change in Warranty Expense y_{t-4}
2002.1	103			
2002.2	52	–51		
2002.3	32	–20	–51	
2002.4	68	+36	–20	
2003.1	91	+23	+36	

2003.2	44	–47	+23	–51
2003.3	30	–14	–47	–20
2003.4	60	+30	–14	+36
2004.1	77	+17	+30	+23
2004.2	38	–39	+17	–47
2004.3	29	–9	–39	–14
2004.4	53	+24	–9	+30

Winston submits the following results to his supervisor. The first is the estimation of a trend model for the period 2002:1 to 2004:4. The model is below. The standard errors are in parentheses.

$$(\text{Warranty expense})_t = 74.1 - 2.7 * t + e_t$$

(14.37) (1.97)

R-squared = 16.2%

Winston also submits the following results for an autoregressive model on the differences in the expense over the period 2004: to 2004:4. The model is below where "y" represents the change in expense as defined in the table above. The standard errors are in parentheses.

$$y_t = -0.7 - 0.07 * y_{t-1} + 0.83 * y_{t-4} + e_t$$

(0.643) (0.0222) (0.0186)

R-squared = 99.98%

After receiving the output, Collier's supervisor asks him to compute moving averages of the sales data.

25. Collier's supervisors would probably not want to use the results from the trend model for all of the following reasons EXCEPT:

(A) the model is a linear trend model and log-linear models are always superior.

(B) the slope coefficient is not significant.

(C) it does not give insights into the underlying dynamics of the movement of the dependent variable.

26. For this question only, assume that Winston also ran an AR(1) model with the following results:

$$y_t = -0.9 - 0.23 * y_{t-1} + e_t$$

R-squared = 78.3%

(0.823) (0.0222)

The mean reverting level of this model is closed to:

(A) 1.16

(B) –0.73

(C) 0.77

27. Based on the autoregressive model, expected warranty expense in the first quarter of 2005 will be closest to:
    (A) $51 million.
    (B) $60 million.
    (C) $65 million.

28. Based on the results, is there a seasonality component in the data?
    (A) Yes, because the coefficient on y_{t-4} is large compared to its standard error.
    (B) Yes, because the coefficient on y_t is small compared to its standard error.
    (C) No, because the slope coefficients in the autoregressive model have opposite signs.

29. Which of the following statements regarding unit roots in a time series is least accurate?
    (A) A time series that is a random walk has a unit root.
    (B) A time series with a unit root is not covariance stationary.
    (C) Even if a time series has a unit root, the predictions from the estimated model are valid.

30. Suppose you estimate the following model of residuals from an autoregressive model:
    $\varepsilon_t^2 = 0.25 + 0.6\varepsilon^2_{t-2} + \mu_t$, where $\varepsilon = \hat{\varepsilon}$
    If the residual at time t is 0.9, the forecasted variance for time t+1 is:
    (A) 0.736.
    (B) 0.790.
    (C) 0.850.

31. Suppose that the following time-series model is found to have a unit root:
    $\text{Sales}_t = b_0 + b_1 \text{Sales}_{t-1} + \varepsilon_t$
    What is the specification of the model if first differences are used?
    (A) $\text{Sales}_t = b_0 + b_1 \text{Sales}_{t-1} + b_2 \text{Sales}_{t-2} + \varepsilon_t$
    (B) $\text{Sales}_t = b_1 \text{Sales}_{t-1} + \varepsilon_t$
    (C) $(\text{Sales}_t - \text{Sales}_{t-1}) = b_0 + b_1 (\text{Sales}_{t-1} - \text{Sales}_{t-2}) + \varepsilon_t$

32. Dianne Hart, CFA, is considering the purchase of an equity position in Book World, Inc, a leading seller of books in the United States. Hart has obtained monthly sales data for the past seven years, and has plotted the data points on a graph. Hart notices that the revenues are growing at approximately 4.5% per year. Which of the following statements regarding Hart's analysis of the data time series of Book World's sales is most accurate? Hart should utilize a:
    (A) mean-reverting model to analyze the data because the time series pattern is covariance stationary.

(B) log-linear model to analyze the data because it is likely to exhibit a compound growth trend.

(C) linear model to analyze the data because the mean appears to be constant.

33. The model $x_t = b_0 + b_1 x_{t-1} + b_2 x_{t-2} + b_3 x_{t-12} + \varepsilon_t$ is an autoregressive model of type:

(A) AR(2).

(B) AR(1).

(C) AR(12).

34. The data below yields the following AR(1) specification: $x_t = 0.9 - 0.55x_{t-1} + E_t$ and the indicated fitted values and residuals.

Time	xt	fitted values	residuals
1	1	–	–
2	–1	0.35	–1.35
3	2	1.45	0.55
4	–1	–0.2	–0.8
5	0	1.45	–1.45
6	2	0.9	1.1
7	0	–0.2	0.2
8	1	0.9	0.1
9	2	0.35	1.65

The following sets of data are ordered from earliest to latest. To test for ARCH, the researcher should regress:

(A) (-1.35, 0.55, -0.8, -1.45, 1.1, 0.2, 0.1, 1.65) on (0.35, 1.45, -0.2, 1.45, 0.9, -0.2, 0.9, 0.35)

(B) (1.8225, 0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01) on (0.3025, 0.64, 2.1025, 1.21, 0.04, 0.01, 2.7225)

(C) (1, 4, 1, 0, 4, 0, 1, 4) on (1, 1, 4, 1, 0, 4, 0, 1)

35. The main reason why financial and time series intrinsically exhibit some form of nonstationarity is that:

(A) most financial and time series have a natural tendency to revert toward their means.

(B) most financial and economic relationships are dynamic and the estimated regression coefficients can vary greatly between periods.

(C) serial correlation, a contributing factor to nonstationarity, is always present to a certain degree in most financial and time series.

36. David Brice, CFA, has tried to use an AR(1) model to predict a given exchange rate. Brice has concluded the exchange rate follows a random walk without a drift. The current value of the exchange rate is 2.2. Under these conditions, which of the following would be least likely?

(A) The residuals of the forecasting model are autocorrelated.
(B) The forecast for next period is 2.2.
(C) The process is not covariance stationary.

Diem Le is analyzing the financial statements of McDowell Manufacturing. He has modeled the time series of McDowell's gross margin over the last 16 years. The output is shown below. Assume 5% significance level for all statistical tests.

Autoregressive Model Gross Margin - McDowell Manufacturing Quarterly Data: 1st Quarter 1985 to 4th Quarter 2000 Regression Statistics	
R-squared	0.767
Standard error of forecast	0.049
Observations	64
Durbin-Watson	1.923 (not statistically significant)

	Coefficient	Standard Error	t-statistic
Constant	0.155	0.052	?????
Lag 1	0.240	0.031	?????
Lag 4	0.168	0.038	?????

Autocorrelation of Residuals			
Lag	Autocorrelation	Standard Error	t-statistic
1	0.015	0.129	?????
2	–0.101	0.129	?????
3	–0.007	0.129	?????
4.	0.095	0.129	?????

Partial List of Recent Observations	
Quarter	Observation
4th Quarter 2002	0.250
1st Quarter 2003	0.260
2nd Quarter 2003	0.220
3rd Quarter 2003	0.200
4th Quarter 2003	0.240

Abbrevited Table of the Student's t-distribution (One-Tailed Probabilities)

df	p = 0.10	p = 0.05	p = 0.025	p = 0.01	p = 0.005
50	1.299	1.676	2.009	2.403	2.678
60	1.296	1.671	2.000	2.390	2.660
70	1.294	1.667	1.994	2.381	2.648

37. Le can conclude that the model is:
    (A) properly specified because the Durbin-Watson statistic is not significant.
    (B) properly specified because there is no evidence of autocorrelation in the residuals.
    (C) not properly specified because there is evidence of autocorrelation in the residuals and the Durbin-Watson statistic is not significant.

38. What is the forecast for the gross margin in the first quarter of 2004?
    (A) 0.246.
    (B) 0.250.
    (C) 0.256.

39. With respect to heteroskedasticity in the model, we can definitively say:
    (A) nothing.
    (B) an ARCH process exists because the autocorrelation coefficients of the residuals have different signs.
    (C) heteroskedasticity is not a problem because the DW statistic is not significant.

40. Supposing the time series is actually a random walk, which of the following approaches would be appropriate prior to using an autoregressive model?
    (A) First differencing the time series.
    (B) ARCH.
    (C) Convert the time series by taking a natural log of the series.

41. Frank Batchelder and Miriam Yenkin are analysts for Bishop Econometrics. Batchelder and Yenkin are discussing the models they use to forecast changes in China's GDP and how they can compare the forecasting accuracy of each model. Batchelder states, "The root mean squared error (RMSE) criterion is typically used to evaluate the in-sample forecast accuracy of autoregressive models." Yenkin replies, "If we use the RMSE criterion, the model with the largest RMSE is the one we should judge as the most accurate."
    With regard to their statements about using the RMSE criterion:
    (A) Batchelder is correct; Yenkin is incorrect.
    (B) Batchelder is incorrect; Yenkin is correct.
    (C) Batchelder is incorrect; Yenkin is incorrect.

Bill Johnson, CFA, has prepared data concerning revenues from sales of winter clothing made by Polar Corporation. This data is presented (in $ millions) in the following table:

		Change In Sales	Lagged Change In Sales	Seasonal Lagged Change In Sales
Quarter	Sales	Y	Y + (–1)	Y + (–4)
2013.1	182			
2013.2	74	–108		
2013.3	78	4	–108	
2013.4	242	164	4	
2014.1	194	–48	164	
2014.2	79	–115	– 48	–108
2014.3	90	11	–115	4
2014.4	260	170	11	w

42. The preceding table will be used by Johnson to forecast values using:
(A) an autoregressive model with a seasonal lag.
(B) a serially correlated model with a seasonal lag.
(C) a log-linear trend model with a seasonal lag.

43. The value that Johnson should enter in the table in place of "w" is:
(A) –115.
(B) 164.
(C) –48.

44. Imagine that Johnson prepares a change-in-sales regression analysis model with seasonality, which includes the following:

	Coefficients
Intercept	–6.032
Lag 1	0.017
Lag 4	0.983

Based on the model, expected sales in the first quarter of 2015 will be closest to:
(A) 210.
(B) 155.
(C) 190.

45. Johnson's model was most likely designed to incorporates correction for:
(A) cointegration in the time series.
(B) nonstationarity in time series data.

(C) heteroskedasticity of model residuals.

46. To test for covariance-stationarity in the data, Johnson would most likely use a:

(A) Durbin-Watson test.

(B) Dickey-Fuller test.

(C) t-test.

47. The presence of conditional heteroskedasticity of residuals in Johnson's model is would most likely to lead to:

(A) invalid standard errors of regression coefficients and invalid statistical tests.

(B) invalid standard errors of regression coefficients, but statistical tests will still be valid.

(C) invalid estimates of regression coefficients, but the standard errors will still be valid.

48. One choice a researcher can use to test for nonstationarity is to use a:

(A) Dickey-Fuller test, which uses a modified X^2 statistic.

(B) Dickey-Fuller test, which uses a modified t-statistic.

(C) Breusch-Pagan test, which uses a modified t-statistic.

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49. Consider the following estimated model:

$$(\text{Sales}_t - \text{Sales}_{t-1}) = 100 - 1.5(\text{Sales}_{t-1} - \text{Sales}_{t-2}) + 1.2(\text{Sales}_{t-4} - \text{Sales}_{t-5}) \quad t = 1,2,..T$$

and Sales for the periods 1999.1 through 2000.2:

t	Period	Sales
T	2000.2	$1,000
T-1	2000.1	$900
T-2	1999.4	$1,200
T-3	1999.3	$1,400
T-4	1999.2	$1,000
T-5	1999.1	$800

The forecasted Sales amount for 2000.3 is closest to:

(A) $730.00

(B) $1,430.00

(C) $1,730.00

50. Barry Phillips, CFA, is analyzing quarterly data. He has estimated an AR(1) relationship $\left(x_t = b_0 + b_1 \times x_{t-1} + e_t\right)$ and wants to test for seasonality. To do this he would want to see if which of the following statistics is significantly different from zero?

(A) Correlation (e_t, e_{t-4})

(B) Correlation (e_t, e_{t-5})

(C) Correlation (e_t, e_{t-1})

51. Consider the estimated AR(2) model, $x_t = 2.5 + 3.0\,x_{t-1} + 1.5\,x_{t-2} + \varepsilon_t \; t = 1, 2, \ldots 50$.

Making a prediction for values of x for $1 \leq t \leq 50$ is referred to as:

(A) requires more information to answer the question.

(B) an in-sample forecast.

(C) an out-of-sample forecast.

52. Consider the following estimated model.

$$\left(\text{Sales}_t - \text{Sales}_{t-1}\right) = 30 + 1.5\left(\text{Sales}_{t-1} - \text{Sales}_{t-2}\right) + 1.2\left(\text{Sales}_{t-4} - \text{Sales}_{t-5}\right) t = 1, 2 \ldots T$$

and Sales for the periods 1999.1 through 2000.2:

t	Period	Sales
T	2000.2	$2,000
T-1	2000.1	$1,800
T-2	1999.4	$1,500
T-3	1999.3	$1,400
T-4	1999.2	$1,900
T-5	1999.1	$1,700

The forecasted Sales amount for 2000.3 is closest to:

(A) $1,730.00

(B) $2,625.00

(C) $2,270.00

53. David Brice, CFA, has used an AR(1) model to forecast the next period's interest rate to be 0.08. The AR(1) has a positive slope coefficient. If the interest rate is a mean reverting process with an unconditional mean, a.k.a., mean reverting level, equal to 0.09, then which of the following could be his forecast for two periods ahead?

(A) 0.081.

(B) 0.072.

(C) 0.113.

54. Troy Dillard, CFA, has estimated the following equation using semiannual data: $x_t = 44 + 0.1 \text{ x } X_{t-1} - 0.25 \text{ x } X_{t-2} - 0.15 \text{ x } X_{t-3} + e_t$. Given the data in the table below, what is Dillard's best forecast of the second half of 2007?

Time	Value
2003: I	31
2003: II	31
2004: I	33
2004: II	33
2005: I	36
2005: II	35
2006: I	32
2006: II	33

(A) 34.36.

(B) 34.05.

(C) 33.74.

55. Barry Phillips, CFA, has the following time series observations from earliest to latest: (5, 6, 5, 7, 6, 6, 8, 8, 9, 11). Phillips transforms the series so that he will estimate an autoregressive process on the following data (1, -1, 2, -1, 0, 2, 0, 1, 2). The transformation Phillips employed is called:

(A) moving average.

(B) beta drift.

(C) first differencing.

56. The regression results from fitting an AR(1) to a monthly time series are presented below. What is the mean-reverting level for the model?

Model: $\Delta Exp_t = b_0 + b_1 \Delta Exp_{t-1} + \varepsilon_t$				
	Coefficients	Standard Error	t-Statistic	p-value
Intercept	1.3304	0.0089	112.2849	< 0.0001
Lag-1	0.1817	0.0061	30.0125	< 0.0001

(A) 7.3220.

(B) 0.6151.

(C) 1.6258.

57. Which of the following statements regarding covariance stationarity is CORRECT?

(A) A time series may be both covariance stationary and heteroskedastic.

(B) The estimation results of an AR model involving a time series that is not covariance stationary are meaningless.

(C) A time series that is covariance stationary may have residuals whose mean changes over time.

58. A time series x that is a random walk with a drift is best described as:

(A) $x_t = x_{t-1} + \varepsilon_t$.

(B) $x_t = b_0 + b_i x_{t-1} + \varepsilon_t$.

(C) $x_t = b_0 + b_1 x_{t-1}$.

59. Which of the following is least likely a consequence of a model containing ARCH(1) errors? The:

(A) regression parameters will be incorrect.

(B) model's specification can be corrected by adding an additional lag variable.

(C) variance of the errors can be predicted.

60. Which of the following is a seasonally adjusted model?

(A) $Sales_t = b_0 + b_1 Sales_{t-1} + b_2 Sales_{t-2} + \varepsilon_t$.

(B) $(Sales_t - Sales_{t-1}) = b_0 + b_1 (Sales_{t-1} - Sales_{t-2}) + b_2 (Sales_{t-4} - Sales_{t-5}) + \varepsilon_t$.

(C) $Sales_t = b_1 Sales_{t-1} + \varepsilon_t$.

61. Barry Phillips, CFA, has estimated an AR(1) relationship ($x_t = b_0 + b_1 \times x_{t-1} + e_t$) and got the following result: $x_{t+1} = 0.5 + 1.0x_t + e_t$. Phillips should:

(A) first difference the data because $b_1 = 1$.

(B) not first difference the data because $b_0 = 0.5 < 1$.

(C) not first difference the data because $b_1 - b_0 = 1.0 - 0.5 = 0.5 < 1$.

62. The table below includes the first eight residual autocorrelations from fitting the first differenced time series of the absenteeism rates (ABS) at a manufacturing firm with the model

$$\Delta ABS_t = b_0 + b_1 \Delta ABS_{t-1} + \varepsilon_t$$

Based on the results in the table, which of the following statements most accurately describes the appropriateness of the specification of the model,

$\Delta ABS_t = b_0 + b_1 \Delta ABS_{t-1} + \varepsilon_1$?

Lagged Autocorrelations of the Residuals of the First Differences in Absenteeism Rates			
Lag	**Autocorrelation**	**Standard Error**	**t-Statistic**
1	-0.0738	0.1667	-0.44271
2	-0.1047	0.1667	-0.62807
3	-0.0252	0.1667	-0.15117
4	-0.0157	0.1667	-0.09418
5	-0.1262	0.1667	-0.75705
6	0.0768	0.1667	0.46071
7	0.0038	0.1667	0.02280
8	-0.0188	0.166	-0.11278

(A) The negative values for the autocorrelations indicate that the model does not fit the time series.

(B) The low values for the t-satistics indicate that the model fits the time series.

(C) The Durbin-Watson statistic is needed to determine the presence of significant correlation of the residuals.

63. Alexis Popov, CFA, has estimated the following specification: $x_t = b_0 + b_1 \times x_{t-1} + e_t$. Which of the following would most likely lead Popov to want to change the model's specification?

(A) Correlation (e_t, e_{t-1}) is not significantly different from zero.

(B) $b_0 < 0$.

C) Correlation (e_t, e_{t-2}) is significantly different from zero.

64. William Zox, an analyst for Opal Mountain Capital Management, uses two different models to forecast changes in the inflation rate in the United Kingdom. Both models were constructed using U.K. inflation data from 1988-2002. In order to compare the forecasting accuracy of the models, Zox collected actual U.K. inflation data from 2004-2005, and compared the actual data to what each model predicted. The first model is an AR(1) model that was found to have an average squared error of 10.429 over the 12 month period. The second model is an AR(2) model that was found to have an average squared error of 11.642 over the 12 month period. Zox then computed the root mean squared error for each model to use as a basis of comparison. Based on the results of his analysis, which model should Zox conclude is the most accurate?

(A) Model 2 because it has an RMSE of 3.41.

(B) Model 1 because it has an RMSE of 3.23.

(C) Model 1 because it has an RMSE of 5.21.

Bert Smithers, CFA, is a sell-side analyst who has been asked to look at the luxury car sector. He has hypothesized that sales of luxury cars have grown at a constant rate over the past 15 years.

Exhibit 1

b_0	0.4563
b_1	0.6874
Standard error	0.3745
R-squared	0.7548
Durbin-Watson	1.23
F	12.63
Observations	15
20X1 sales ($bn)	1.05

65. If his assumption about a constant is correct, which of the following models is most appropriate for modeling these data?

(A) $\ln(\text{LuxCarSales}) = b_0 + b_1(t) + e_t$.

(B) LuxCarSales = $b_0 + b_1(t) + e_t$.

(C) LuxCarSalest = $b_0 + b_1$LuxCarSales$_{(t-1)} + e_t$.

66. After discussing the above matter with a colleague, Bert finally decides to use an annual autoregressive model of Order One [i.e., AR(1)]. Using the data in Exhibit 1, calculate the mean reverting level of the series.

(A) 1.66.

(B) 1.26.

(C) 1.46.

67. Bert is aware that the Dickey Fuller test can be used to discover whether a model has a unit root. He is also aware that the test would use a revised set of critical t-values. What would it mean to Bert to reject the null of the Dickey Fuller test (H_o: g = 0)?

(A) There is a unit root and the model cannot be used in its current form.

(B) There is no unit root.

(C) There is a unit root but the model can be used if covariance-stationary.

68. Bert would also like to test for serial correlation in his AR(1) model. How could this be done?

(A) use a t-test on the residual autocorrelations over several lags.

(B) determine if the series has a finite and constant covariance between leading and lagged terms of itself.

(C) use the provided Durbin-Watson statistic and compare it to a critical value.

69. When using the root mean squared error (RMSE) criterion to evaluate the predictive power of the model, which of the following is the most appropriate statement?

(A) Use the model with the highest RMSE calculated using the in-sample data.

(B) Use the model with the lowest RMSE calculated using the in-sample data.

(C) Use the model with the lowest RMSE calculated using the out-of-sample data.

70. Bert would like to use his AR(1) model to forecast future sales of luxury automobiles. What is the annualized growth rate between today and 20X3?

(A) 12%

(B) 11%

(C) 10%

71. A monthly time series of changes in maintenance expenses (ΔExp) for an equipment rental company was fit to an AR(1) model over 100 months. The results of the regression and the first twelve lagged residual autocorrelations are shown in the tables below. Based on the information in these tables, does the model appear to be appropriately specified? (Assume a 5% level of significance.)

Regression Results for Maintenance Expense Changes
Model: $DExp_t = b_0 + b_1 DExp_{t-1} + e_t$

	Coefficients	Standard Error	t-Statistic	p-value
Intercept	1.3304	0.0089	112.2849	< 0.0001
Lag-1	0.1817	0.0061	30.0125	< 0.0001

Lagged Autocorrelations for Maintenance Expense Changes					
Lag	Autocorrelation	t-Statistic	Lag	Autocorrelation	t-Statistic
1	-0.239	-2.39	7	-0.018	-0.18
2	-0.278	-2.78	8	-0.033	-0.33
3	-0.045	-0.45	9	0.261	2.61
4	-0.033	-0.33	10	0.060	-0.60
5	-0.180	-1.80	11	0.212	2.12
6	-0.110	-1.10	12	0.022	0.22

(A) No, because several of the residual autocorrelations are significant.

(B) Yes, because the intercept and the lag coefficient are significant.

(C) Yes, because most of the residual autocorrelations are negative.

72. Which of the following statements regarding time series analysis is least accurate?

(A) We cannot use an AR(1) model on a time series that consists of a random walk.

(B) If a time series is a random walk, first differencing will result in covariance stationarity.

(C) An autoregressive model with two lags is equivalent to a moving-average model with two lags.

73. Which of the following statements regarding the instability of time-series models is most accurate?

Models estimated with:

(A) shorter time series are usually more stable than those with longer time series.

(B) a greater number of independent variables are usually more stable than those with a smaller number.

(C) longer time series are usually more stable than those with shorter time series.

Albert Morris, CFA, is evaluating the results of an estimation of the number of wireless phone minutes used on a quarterly basis within the territory of Car-tel International, Inc. Some of the information is presented below (in billions of minutes):

Wireless Phone Minutes $(WPM)_t = b_0 + b_1 WPM_{t-1} + \varepsilon_t$

ANOVA	Degree of Freedom	Sum of Squares	Mean Square

Regression	1	7,212.641	7,212.641
Error	26	3,102.410	119.324
Total	27	10,315.051	

Coefficients	Coefficient	Standard Error of the Coefficient
Intercept	–8.0237	2.9023
WPM_{t-1}	1.0926	0.0673

The variance of the residuals from one time period within the time series is not dependent on the variance of the residuals in another time period.

Morris also models the monthly revenue of Car-tel using data over 96 monthly observations. The model is shown below:

Sales (CAD$ millions) = $b_0 + b_1 \text{Sales}_{t-1} + \varepsilon_t$

Coefficients	Coefficient	Standard Error of the Coefficient
Intercept	43.2	12.32
$Sales_{t-1}$	0.8867	0.4122

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74. The value for WPM this period is 544 billion. Using the results of the model, the forecast Wireless Phone Minutes three periods in the future is:
    (A) 691.30.
    (B) 586.35.
    (C) 683.18.

75. The WPM model was specified as a(n):
    (A) Moving Average (MA) Model.
    (B) Autoregressive (AR) Model.
    (C) Autoregressive (AR) Model with a seasonal lag.

76. The mean reverting level of monthly sales is closest to:
    (A) 381.29 million.
    (B) 8.83 million.
    (C) 43.2 million.

77. Morris concludes that the current price of Car-tel stock is consistent with single stage constant growth model (with g = 3%). Based on this information, the sales model is most likely:
    (A) Incorrectly specified and first differencing the data would be an appropriate remedy.

(B) Correctly specified.

(C) Incorrectly specified and first differencing the natural log of the data would be an appropriate remedy.

78. Which of the following statements regarding an out-of-sample forecast is least accurate?

(A) Forecasting is not possible for autoregressive models with more than two lags.

(B) There is more error associated with out-of-sample forecasts, as compared to in-sample forecasts.

(C) Out-of-sample forecasts are of more importance than in-sample forecasts to the analyst using an estimated time-series model.

79. Suppose you estimate the following model of residuals from an autoregressive model.

$\varepsilon_t^2 = 0.4 + 0.80\varepsilon_{t-1}^{\ 2} + \mu_t$, where $\varepsilon = \hat{\varepsilon}$

If the residual at time t is 2.0, the forecasted variance for time t+1 is:

(A) 2.0.

(B) 3.6.

(C) 3.2.

80. David Wellington, CFA, has estimated the following log-linear trend model:

$LN(x_t) = b_0 + b_1 t + \varepsilon_t$ Using six years of quarterly observations, 2001:1 to 2006:1V, Wellington gets the following estimated equation: LN(xt) = 1.4 + 0.02t. The first out-of-sample forecast of x_t for 2007:l is closest to:

(A) 6.69.

(B) 1.88.

(C) 4.14.

81. Given an AR(1) process represented by $x_{t+1} = b_0 + b_1 \times x_t + e_t$, the process would not be a random walk if:

(A) $E(e_t) = 0$.

(B) the long run mean is $b_0 / (1 - b_1)$.

(C) $b_1 = 1$.

Clara Holmes, CFA, is attempting to model the importation of an herbal tea into the United States which last year was $54 million. She gathers 24 years of annual data, which is in millions of inflation-adjusted dollars.

She computes the following equation:

$(\text{Tea Imports})_t = 3.8836 + 0.9288 \times (\text{Tea Imports})_{t-1} + e_t$

t-statistics	(0.9328)	(9.0025)

$R^2 = 0.7942$

Adj. $R^2 = 0.7844$

SE = 3.0892

N = 23

Holmes and her colleague, John Briars, CFA, discuss the implication of the model and how they might improve it. Holmes is fairly satisfied with the results because, as she says "the model explains 78.44 percent of the variation in the dependent variable." Briars says the model actually explains more than that.

Briars and Holmes decide to ask their company's statistician about the consequences of serial correlation. Based on what Briars and Holmes tell the statistician, the statistician informs them that serial correlation will only affect the standard errors and the coefficients are still unbiased. The statistician suggests that they employ the Hansen method, which corrects the standard errors for both serial correlation and heteroskedasticity.

Given the information from the statistician, Briars and Holmes decide to use the estimated coefficients to make some inferences. Holmes says the results do not look good for the future of tea imports because the coefficient on $(\text{Tea Import})_{t-1}$ is less than one. This means the process is mean reverting. Using the coefficients in the output, says Holmes, "we know that whenever tea imports are higher than 41.810, the next year they will tend to fall. Whenever the tea imports are less than 41.810, then they will tend to rise in the following year." Briars agrees with the general assertion that the results suggest that imports will not grow in the long run and tend to revert to a long-run mean, but he says the actual long-run mean is 54.545. Briars then computes the forecast of imports three years into the future.

82. With respect to the statement that the company's statistician made concerning the consequences of serial correlation, assuming the company's statistician is competent, we would most likely deduce that Holmes and Briars did not tell the statistician:

(A) the sample size.

(B) the model's specification.

(C) the value of the Durbin-Watson statistic.

83. The statistician's statement concerning the benefits of the Hansen method is:

(A) correct, because the Hansen method adjusts for problems associated with both serial correlation and heteroskedasticity.

(B) not correct, because the Hansen method only adjusts for problems associated with serial correlation but not heteroskedasticity.

(C) not correct, because the Hansen method only adjusts for problems associated with heteroskedasticity but not serial correlation.

84. Using the model's results, Briar's forecast for three years into the future is:
(A) $47.151 million.
(B) $54.543 million.
(C) $54.108 million.

85. With respect to the comments of Holmes and Briars concerning the mean reversion of the import data, the long-run mean value that:
(A) Briars computes is correct.
(B) Briars computes is not correct, and his conclusion is probably not accurate.
(C) Briars computes is not correct, but his conclusion is probably accurate.

86. To qualify as a covariance stationary process, which of the following does not have to be true?
(A) Covariance(x_t, x_{t-2}) = Covariance(x_t, x_{t+2}).
(B) Covariance(x_t, x_{t-1}) = Covariance(x_t, x_{t-2}).
(C) $E[x_t] = E[x_{t+1}]$

87. An analyst modeled the time series of annual earnings per share in the specialty department store industry as an AR(3) process. Upon examination of the residuals from this model, she found that there is a significant autocorrelation for the residuals of this model. This indicates that she needs to:
(A) alter the model to an ARCH model.
(B) revise the model to include at least another lag of the dependent variable.
(C) switch models to a moving average model.

88. An analyst wants to model quarterly sales data using an autoregressive model. She has found that an AR(1) model with a seasonal lag has significant slope coefficients. She also finds that when a second and third seasonal lag are added to the model, all slope coefficients are significant too.
Based on this, the best model to use would most likely be an:
(A) ARCH(1).
(B) AR(1) model with no seasonal lags.
(C) AR(1) model with 3 seasonal lags.

89. The table below shows the autocorrelations of the lagged residuals for the first differences of the natural logarithm of quarterly motorcycle sales that were fit to the AR(1) model: $(\ln sales_t - \ln sales_{t-1}) = b_0 + b_1(\ln sales_{t-1} - \ln sales_{t-2}) + \varepsilon_t$. The critical t-statistic at 5%

significance is 2.0, which means that there is significant autocorrelation for the lag-4 residual, indicating the presence of seasonality. Assuming the time series is covariance stationary, which of the following models is most likely to CORRECT for this apparent seasonality?

Lagged Autocorrelations of First Differences in the Log of Motorcycle Sales			
Lag	Autocorrelation	Standard Error	t-Statistic
1	-0.0738	0.1667	-0.44271
2	-0.1047	0.1667	-0.62807
3	-0.0252	0.1667	-0.15117
4	0.5528	0.1667	3.31614

(A) $\ln sales_t = b_0 + b_1(\ln sales_{t-1}) - b_2(\ln sales_{t-4}) + \varepsilon_t$.

(B) $(\ln sales_t - \ln sales_{t-4}) = b_0 + b_1(\ln sales_{t-1} - \ln sales_{t-2}) + \varepsilon_t$.

(C) $(\ln sale_t - \ln sales_{t-1}) = b_0 + b_1 (\ln sales_{t-1} - \ln sales_{t-2}) + b_2 (\ln sales_{t-4} - \ln sales_{t-5}) + \varepsilon_t$.

90. The primary concern when deciding upon a time series sample period is which of the following factors?

(A) Current underlying economic and market conditions.

(B) The length of the sample time period.

(C) The total number of observations.

91. In the time series model: $y_t = b_0 + b_1 t + \varepsilon_t$, t = 1,2,...,T, the:

(A) disturbance term is mean-reverting.

(B) change in the dependent variable per time period is b_1.

(C) disturbance terms are autocorrelated.

92. The model $x_t = b_0 + b_1 x_{t-1} + b_2 x_{t-2} + b_3 x_{t-3} + b_4 x_{t-4} + \varepsilon_t$ is:

(A) an autoregressive conditional heteroskedastic model, ARCH.

(B) a moving average model, MA(4).

(C) an autoregressive model, AR(4).

93. An AR(1) autoregressive time series model:

(A) can be used to test for a unit root, which exists if the slope coefficient is less than one.

(B) can be used to test for a unit root, which exists if the slope coefficient equals one.

(C) cannot be used to test for a unit root.

Housing industry analyst Elaine Smith has been assigned the task of forecasting housing foreclosures. Specifically, Smith is asked to forecast the percentage of outstanding mortgages that will be foreclosed upon in the coming quarter. Smith decides to employ multiple linear regression and time series analysis.

Besides constructing a forecast for the foreclosure percentage, Smith wants to address the following two questions:

Research Question 1:	Is the foreclosure percentage significantly affected by short-term interest rates?
Research Question 1:	Is the foreclosure percentage significantly affected by government intervention policies?

Smith contends that adjustable rate mortgages often are used by higher risk borrowers and that their homes are at higher risk of foreclosure. Therefore, Smith decides to use short-term interest rates as one of the independent variables to test Research Question 1.

To measure the effects of government intervention in Research Question 2, Smith uses a dummy variable that equals 1 whenever the Federal government intervened with a fiscal policy stimulus package that exceeded 2% of the annual Gross Domestic Product. Smith sets the dummy variable equal to 1 for four quarters starting with the quarter in which the policy is enacted and extending through the following 3 quarters. Otherwise, the dummy variable equals zero.

Smith uses quarterly data over the past 5 years to derive her regression. Smith's regression equation is provided in Exhibit 1:

Exhibit 1: Foreclosure Share Regression Equation

$\text{foreclosure share} = b_0 + b_1(\Delta\text{INT}) + b_2(\text{STIM}) + b_3(\text{CRISIS}) + \varepsilon$	
Where:	
Foreclosure share	= the percentage of all outstanding mortgages foreclosed upon during the quarter
ΔINT	= the quarterly change in the 1-year Treasury bill rate (e.g., ΔINT = 2 for a two percentage point increase in interest rates)
STIM	= 1 for quarters in which a Federal fiscal stimulus package was in place
CRISIS	= 1 for quarters in which the median house price is one standard deviation below its 5-year moving average

The results of Smith's regression are provided in Exhibit 2:

Exhibit 2: Foreclosure Share Regression Results

Variable	Coefficient	t-statistic
Intercept	3.00	2.40
ΔINT	1.00	2.22

STIM	-2.50	-2.10
CRISIS	4.00	2.35

The ANOVA results from Smith's regression are provided in Exhibit 3:

Exhibit 3: Foreclosure Share Regression Equation ANOVA Table

Source	Degrees of Freedom	Sum of Squares	Mean Sum of Squares
Regression	3	15	5.0000
Error	16	5	0.3125
Total	19	20	

Smith expresses the following concerns about the test statistics derived in her regression:

Concern 1:	If my regression errors exhibit conditional heteroskedasticity, my t-statistics will be underestimated.
Concern 2:	If my independent variables are correlated with each other, my F-statistic will be overestimated.

Before completing her analysis, Smith runs a regression of the changes in foreclosure share on its lagged value. The following regression results and autocorrelations were derived using quarterly data over the past 5 years (Exhibit 4 and Exhibit 5, respectively):

Exhibit 4. Lagged Regression Results

Δ foreclosure share$_t$ = 0.05 + 0.25 (Δforeclosure share$_{t-1}$)

Exhibit 5. Autocorrelation Analysis

Lag	Autocorrelation	t-statistic
1	0.05	0.22
2	-0.35	-1.53
3	0.25	1.09
4	0.10	0.44

Exhibit 6 provides critical values for the Student's t-Distribution

Area in Both Tails Combined				
Degrees of Freedom	**20%**	**10%**	**5%**	**1%**
16	1.337	1.746	2.120	2.921

17	1.333	1.740	2.110	2.898
18	1.330	1.734	2.101	2.878
19	1.328	1.729	2.093	2.861
20	1.325	1.725	2.086	2.845

94. The most appropriate interpretation from the foreclosure share regression equation model is:
   (A) Multiple-R of the model is 0.75.
   (B) Multiple-R of the model is 0.87.
   (C) Variable STIM explains 37.5% of the variation in foreclosure share.

95. The test mentioned by Jessica is known as the:
   (A) Breusch-Pagan, which is a one-tailed test
   (B) Durbin-Watson, which is a two-tailed test
   (C) Breusch-Pagan, which is a two-tailed test

96. The standard error of estimate for Smith's regression is closest to:
   (A) 0.53
   (B) 0.16
   (C) 0.56

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97. Are Jessica and her son Jonathan, correct in terms of the method used to correct for heteroskedasticity and the likely effects?
   (A) Neither is correct
   (B) One is correct
   (C) Both are correct

98 Based on her regression results in Exhibit 2, using a 5% level of significance, Smith should conclude that:
   (A) stimulus packages have significant effects on foreclosure percentages, but housing crises do not have significant effects on foreclosure percentages.
   (B) both stimulus packages and housing crises have significant effects on foreclosure percentages.
   (C) stimulus packages do not have significant effects on foreclosure percentages, but housing crises do have significant effects on foreclosure percentages.

99. What can be said of the overall explanatory power of the model at the 5% significance?
   (A) There is no value to calendar trading.
   (B) There is value to calendar trading.
   (C) The coefficient of determination for the above regression is significantly higher than the standard error of the estimate, and therefore there is value to calendar trading.

100. The most recent change in foreclosure share was +1 percent. Smith decides to base her analysis on the data and methods provided in Exhibit 4 and Exhibit 5, and determines that the two-step ahead forecast for the change in foreclosure share (in percent) is 0.125, and that the mean reverting value for the change in foreclosure share (in percent) is 0.071. Is Smith correct?
   (A) Smith is correct on both the forecast and the mean reverting level.
   (B) Smith is correct on the two-step ahead forecast for change in foreclosure share only.
   (C) Smith is correct on the mean-reverting level for forecast of change in foreclosure share only.

101. What is most likely represented by the intercept of the regression?
   (A) The intercept is not a driver of returns, only the independent variables.
   (B) The return on a particular trading day.
   (C) The drift of a random walk.

102. Assume for this question that Smith finds that the foreclosure share series has a unit root. Under these conditions, she can most reliably regress foreclosure share against the change in interest rates (ΔINT) if:
   (A) ΔINT has unit root and is not cointegrated with foreclosure share.
   (B) ΔINT does not have unit root.
   (C) ΔINT has unit root and is cointegrated with foreclosure share.

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Vikas Rathod, an enrolled candidate for the CFA Level II examination, has decided to perform a calendar test to examine whether there is any abnormal return associated with investments and disinvestments made in blue-chip stocks on particular days of the week. As a proxy for blue-chips, he has decided to use the S&P 500 index. The analysis will involve the use of dummy variables and is based on the past 780 trading days. Here are selected findings of his study:

RSS	0.0039
SSE	0.9534
SST	0.9573
R-squared	0.004
SEE	0.035

Jessica Jones, CFA, a friend of Rathod, overhears that he is interested in regression analysis and warns him that whenever heteroskedasticity is present in multiple regression this could undermine the regression results. She mentions that one easy way to spot conditional heteroskedasticity is through a scatter plot, but she adds that there is a more formal test. Unfortunately, she can't quite remember its name. Jessica believes that heteroskedasticity can be rectified using White-corrected standard errors. Her son Jonathan who has also taken part in the discussion, hears this comment and argues that White correction would typically reduce the number of Type I errors in financial data?

103. Assuming the a_1 term of an ARCH(1) model is significant, the following can be forecast:
   (A) A significant a1 implies that the ARCH framework cannot be used.
   (B) The variance of the error term.
   (C) The square of the error term.

104. How many dummy variables should Rathod use?
   (A) Six
   (B) Four
   (C) Five

105. Is Smith correct or incorrect regarding Concerns 1 and 2?
   (A) Correct on both Concerns.
   (B) Incorrect on both Concerns.
   (C) Only correct on one concern and incorrect on the other.

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