Question 1
L2QM-TBB208-1412
LOS: LOS-6200
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

An analyst estimates the following AR(1) model for the earnings per share of a company:

$$x_t = 0.55 + 0.87x_{t-1} + \varepsilon_t$$

If the company's earnings per share currently stands at $2.55, which of the following values is closest to the two-period-ahead forecast of the model?

- ○ $2.7685.
- ◉ $2.9586.
- ○ Unknown since the values of ε_t and ε_{t+1} need to be observed in order to make the forecast.

Rationale

This Answer is Correct

The one-period-ahead forecast is 0.55 + 0.87(2.55) = 2.7685.

The two-period-ahead forecast is 0.55 + 0.87(2.7685) = 2.9586.

The model forecasts errors to be zero; hence, we do not need to observe their actual values to make a forecast.

Question 2
L2QM-TB0014-1412
LOS: LOS-6220
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

Serena Robins, CFA, is modeling the monthly returns of the FTSE 100 share index as the following AR(1) model:

$$x_t = 0.001 + 0.5x_{t-1} + \varepsilon_t$$

Which of the following values is closest to the mean reverting level of this model?

- ○ 0.001.
- ◉ 0.002.
- ○ 0.5.

Rationale

This Answer is Correct

The mean reverting level of an autoregressive time series is b_0 / (1 − b_1) where b_0 is the intercept term and b_1 is the lag coefficient. In this case, the mean reverting level will be 0.001 / (1 − 0.5) = 0.002.

Question 3

L2R11TB-AC011-1512

LOS: LOS-6190

Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models

Difficulty: medium

When a time series is covariance stationary, it *most likely* means that the covariance of the time series with itself for a fixed number of periods in the past and the future and the expected value of the series are:

- ○ finite.
- ○ constant.
- ◉ constant and finite.

Rationale

❌ **finite.**

The covariance, variance, and mean must all be constant and finite.

Rationale

❌ **constant.**

The covariance, variance, and mean must all be constant and finite.

Rationale

✅ **constant and finite.**

The covariance, variance, and mean must all be constant and finite.

Question 4
L2QM-PQ1108-1410
LOS: LOS-6200
LOS: LOS-6210
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

The following table gives the actual sales and log of sales of Tiara Corp. for the period Q1 2010 to Q4 2010:

Date Quarter: Year	Actual Sales ($ '000)	Log of Sales
1Q 2010	9,268	9.1343
2Q 2010	9,371	9.1454
3Q 2010	8,289	9.0227
4Q 2010	7,650	8.9425

An analyst uses the following regression equation to predict quarterly sales:

$$\Delta \ln\left(\text{Sales}_t\right) = 0.0729 + 0.5289 \Delta \ln\left(\text{Sales}_{t\text{-}1}\right)$$

Based on the information provided, Tiara's forecasted sales for the second-quarter of 2011 are *closest to*:

- ○ 7,887,000
- ○ 7,668,000
- ◉ 8,621,000

Rationale

This Answer is Correct

Date Quarter: Year	Sales ($ '000)	Log of Sales	Actual Values of Changes in the Log of Sales	Forecast Values of Changes in the Log of Sales
1Q: 2010	9,268	9.1343		
2Q: 2010	9,371	9.1454	0.0111	
3Q: 2010	8,289	9.0227	−0.1227	
4Q: 2010	7,650	8.9425	−0.0802	
1Q: 2011	7,887	8.9729		0.0305
2Q: 2011	8,621	9.0619		0.0890

Change in log of sales for Q4 2010= 8.9425 − 9.0227 = −0.0802

$$\begin{aligned}\text{Forecast value of change in the log of sales for Q1 2011} &= 0.0729 + 0.5289\,(-0.0802) \\ &= 0.03048\end{aligned}$$

Log of sales for Q1 2011 = 8.9425 + 0.03048 = 8.97298

$$\begin{aligned}\text{Forecast value of change in the log of sales for Q2 2011} &= 0.0729 + 0.5289\,(0.03048) \\ &= 0.08902\end{aligned}$$

Log of sales for Q2 2011 = 8.97298 + 0.08902 = 9.062

Forecasted sales for Q2 2011 = $e^{9.062}$ = 8,621.38

Question 5
L2R11TB-AC013-1512
LOS: LOS-6220
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium
An autoregressive time series model of order 1 has an intercept of 11 and a lag coefficient of 0.5. The most recent value for the time series is 22. The next value will *most likely*:

- fall rather than rise.
- rise rather than fall.
- rise or fall with equal likelihood.

Rationale

fall rather than rise.

The best way to determine the answer is to calculate the regression mean reverting level, which is:

$$\text{Mean reverting level} = \frac{b_0}{1 - b_1} = \frac{11}{1 - 0.5} = 22$$

Since the previous value was 22, the series is equally likely to fall or rise.

Rationale

rise rather than fall.

The best way to determine the answer is to calculate the regression mean reverting level, which is:

$$\text{Mean reverting level} = \frac{b_0}{1 - b_1} = \frac{11}{1 - 0.5} = 22$$

Since the previous value was 22, the series is equally likely to fall or rise.

Rationale

rise or fall with equal likelihood.

The best way to determine the answer is to calculate the regression mean reverting level, which is:

$$\text{Mean reverting level} = \frac{b_0}{1 - b_1} = \frac{11}{1 - 0.5} = 22$$

Since the previous value was 22, the series is equally likely to fall or rise.

Question 6

L2R11TB-AC020-1512

LOS: LOS-6260

Lesson Reference: Lesson 3: Random Walks and Unit Roots

Difficulty: medium

If a time series has a unit root, it is *most likely* that it:

- ○ is not possible to model it effectively.
- ○ should be modeled using the underlying data.
- ◉ should be modeled using the first differenced data.

Rationale

is not possible to model it effectively.

The underlying data will not be covariance stationary. The first differenced data will have an expected value of zero and is more likely to be covariance stationary.

Rationale

should be modeled using the underlying data.

The underlying data will not be covariance stationary. The first differenced data will have an expected value of zero and is more likely to be covariance stationary.

Rationale

should be modeled using the first differenced data.

The underlying data will not be covariance stationary. The first differenced data will have an expected value of zero and is more likely to be covariance stationary.

Question 7
L2R11TB-AC024-1512
LOS: LOS-6200
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

Details of the autocorrelations for different lags for three time series are as follows.

	Series A	Series B	Series C
Lag 1	0.76	0.64	0.71
Lag 2	0.68	0.53	0.10
Lag 3	0.05	0.41	0.07
Lag 4	0.03	0.35	0.06

The series that is *most likely* a moving average series of order 2 is:

- Series A.
- Series B.
- Series C.

Rationale
Series A.
The autocorrelations are large up to lag 2 and then fall to almost zero, which is what would be expected for a moving average series of order 2.

Rationale
Series B.
The autocorrelations are large up to lag 2 and then fall to almost zero, which is what would be expected for a moving average series of order 2.

Rationale
Series C.
The autocorrelations are large up to lag 2 and then fall to almost zero, which is what would be expected for a moving average series of order 2.

Question 8
L2QM-PQ1116-1410
LOS: LOS-6280
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: medium

The table below shows the autocorrelations of residuals from an AR(1) model designed to fit changes in the net profit margin (NPM) of XYZ Company. The data covers monthly profitability data for three years.

Lag	Autocorrelation
1	−0.0231
2	−0.0221
3	−0.6012
4	0.0957
5	−0.0108
6	−0.0219
7	−0.0015
8	0.0213
9	0.0295
10	−0.0585
11	−0.0348
12	0.4512

The table below shows the output for a regression on changes in NPM for XYZ, where the specifications of regression have been changed:

	Coefficient	Standard Error	t-Stat
Intercept	−0.0009	0.0011	−0.8182
ΔNPM_{t-1}	−0.0581	0.0581	−1.0000
ΔNPM_{t-12}	0.7264	0.0581	12.5026

The change that has been made to the regression model is *most likely*:

- ○ Independent variables for the third and twelfth lags of the dependent variable have been added to the regression.
- ◉ A seasonal lag has been added to the model.
- ○ The form of the independent variable has been changed from ΔNPM to lnΔNPM.

Rationale

This Answer is Correct

Lag	Autocorrelation	Standard Error	t-Stat
1	−0.0231	0.1667	−0.1386
2	−0.0221	0.1667	−0.1326
3	0.4012	0.1667	**2.4072**
4	0.0957	0.1667	0.5742
5	−0.0108	0.1667	−0.0648
6	−0.0219	0.1667	−0.1314
7	−0.0015	0.1667	−0.0090
8	0.0213	0.1667	0.1278

Lag	Autocorrelation	Standard Error	t-Stat
9	0.0295	0.1667	0.1770
10	−0.0585	0.1667	−0.3510
11	−0.0348	0.1667	−0.2088
12	0.4512	0.1667	**2.7072**

The critical *t*-value approximately equals 2.03 (df = 34). The autocorrelations for the third and twelfth lags appear to be different from zero at the 5% level of significance. The analyst has therefore added a seasonal lag (ΔNPM_{t-12}) corresponding to the twelfth lag of the dependent variable. Since this is monthly data, the twelfth lag of the series represents the seasonal lag.

Note that it is not necessary for only the residual autocorrelation corresponding to the seasonal lag to appear significant in a time series suffering from seasonality. In our results, the autocorrelation of the third lag also appears to be statistically significant. However, if the data is suffering from seasonality, adding the seasonal lag usually results in lags for all the residual autocorrelations equaling zero.

Question 9
L2QM-PQ1105-1410
LOS: LOS-6200
LOS: LOS-6210
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

An analyst uses a time-series model to predict Beta Corporation's gross margins. He uses quarterly data from Q1 1991 to Q4 2005. Since he believes that the gross margin in the current period is dependent on the gross margin in the previous period, he starts with an AR(1) model:

Gross $\text{margin}_t = b_0 + b_1$ (Gross margin_{t-1}) $+ \varepsilon_i$

Given below are the regression results:

AR(1) Model Regression Results

Regression Statistics	
R-squared	0.7928
Standard error	0.0464
Observations	60
Durbin-Watson	1.9247

	Coefficient	**Standard Error**	**t-Stat**
Intercept	0.0824	0.0325	2.5354
Lag 1	0.9825	0.0760	12.9276

Autocorrelations of the Residuals from the AR(1) Model

Lag	**Coefficient**
1	0.0824
2	0.0248
3	0.5232
4	0.5632

Which of the following statements regarding the use of the model is *most likely*?

- The model should be used because the regression parameters are significant.
- The model should be used because the R^2 is significantly high.
- The model should not be used because the regression errors are serially correlated.

Rationale

This Answer is Correct

The t-stat of the intercept (2.54) and that of the coefficient on the first lag of the gross margin (12.93) are both greater than the critical t-value (2.0) for a two-tailed test at the 5% significance level with 58 degrees of freedom. This implies that both the intercept and the coefficient on the first lag are highly significant in this regression.

However, the model should still be tested for serial correlation between the residuals. Since this is an AR model, the Durbin-Watson test for serial correlation cannot be used. Therefore, we need to examine the autocorrelations of the error term.

The t-stats for the first four autocorrelations of the residual are calculated in the following table:

Lag	Coefficient	Standard Error[1]	t-Stat
1	0.0824	0.1291	0.6382
2	0.0248	0.1291	0.1920
3	0.5232	0.1291	4.0527
4	0.5632	0.1291	4.3625

[1] Standard error = $1 / n^{0.5} = 1 / 60^{0.5} = 0.1291$.

Since the t-stats for the autocorrelations of the third and fourth lags are greater than the critical t-value (2.0), the autocorrelations for the third and fourth lag are significantly different from zero. Therefore, we can conclude that the model is misspecified due to serial correlation between the residuals.

Question 10
L2R11TB-AC007-1512
LOS: LOS-6170
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium

A time series model is based on a linear trend, $y = b_0 + b_1 t$, using quarterly data. The intercept and the independent coefficient are estimated to be $b_0 = 2.48$ and $b_1 = 1.44$, respectively. If time 1 is March 2010, then the predicted value of y for March 2011 is *closest* to:

- ○ 5.36
- ○ 8.24
- ● 9.68

Rationale

✖ **5.36**

The data is quarterly, and if the March 2010 quarter represents $t = 1$, then the March 2011 quarter is the fifth time period ($t = 5$). The regression is then used to make the estimate:

$$y = 2.48 + 1.44(5) = 9.68$$

Rationale

✖ **8.24**

The data is quarterly, and if the March 2010 quarter represents $t = 1$, then the March 2011 quarter is the fifth time period ($t = 5$). The regression is then used to make the estimate:

$$y = 2.48 + 1.44(5) = 9.68$$

Rationale

✔ **9.68**

The data is quarterly, and if the March 2010 quarter represents $t = 1$, then the March 2011 quarter is the fifth time period ($t = 5$). The regression is then used to make the estimate:

$$y = 2.48 + 1.44(5) = 9.68$$

Question 11
L2QM-TB0012-1412
LOS: LOS-6210
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium
Which of the following statements regarding time series is most accurate?

- ○ The Durbin Watson test for serial correlation is invalid for all types of time series models.
- ◉ The Durbin Watson test for serial correlation is invalid for autoregressive time series models.
- ○ The Durbin Watson test for serial correlation is invalid for log-linear trend models.

Rationale

This Answer is Correct

The Durbin Watson test for serial correlation of residuals is not valid for autoregressive time series models since the independent variable being a lagged value of the independent variable breaches one of the assumptions of the Durbin Watson test. The test can still successfully be applied to trend models.

Question 12
L2QM-TBB209-1412
LOS: LOS-6240
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium
Which of the following data series is *least likely* to give rise to instability in the regression coefficients of an autoregressive time series model?

- ○ Data subject to regime change.
- ◉ Covariance stationary data.
- ○ Data over longer time periods.

Rationale

This Answer is Correct

Instability in the regression coefficients of an autoregressive time series model is caused by changes in the behavior of the underlying data over time, which is more likely to happen when there is a regime change (i.e., a change in the underlying model for fundamental reasons) or when analyzing data over longer time periods.

Question 13
L2R11TB-ITEMSET-AC001-1512
LOS: LOS-6170
LOS: LOS-6180
LOS: LOS-6250
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium

Use the following information to answer the next three questions:

Mark Miller wants to predict future monthly growth rates for an industry, and, as a result, he has constructed a linear trend model in order to estimate the linear trend in inflation. Details of the model are as follows:

Regression Statistics			
R^2		0.09	
Observations		60	
Durbin-Watson		0.12	
	Coefficient	Standard Error	*t*-Statistic
Intercept	5.0268	0.68110	7.38
t(trend)	–0.00543	0.00184	–2.95

Miller notes that the model has statistically significant coefficients and proposes to test the model's performance on out-of-sample data by forecasting the growth rate for periods subsequent to those used to estimate the model.

His colleague, Hani Zakaria, reviews the data and makes the following statement: "The linear trend model that you have used here is inadequate to forecast growth because the Durbin-Watson test indicates that there is serial correlation of the errors."

Miller also decided to try to forecast quarterly sales for the industry using time-series analysis and has created the following autoregressive model of order 1:

$$\text{Sales}_t = 0.021 + 1.008\ \text{Sales}_{t-1} + \varepsilon_t$$

The regression output is as follows:

Regression Statistics			
R^2		0.21	
Observations		48	
Durbin-Watson		1.64	
	Coefficient	Standard Error	*t*-Statistic
Intercept	0.021	0.030	0.7
Lag 1	1.008	0.373	2.7
Autocorrelations of the Residual			
Lag	Autocorrelation	Standard Error	*t*-Statistic
1	0.212	0.144	1.5
2	0.147	0.144	1.0
3	–0.250	0.144	–1.7
4	0.010	0.144	0.1

Miller believes that the data supports the use of the model for the purpose of forecasting industry sales and shows it to Hani Zakaria for confirmation of his analysis. Zakaria reviews the data and tells Miller that it is inappropriate to use the model for a number of misspecifications that include unit root, as evidenced by the lag coefficient.

i.

Using Miller's linear trend model based on monthly data, the forecast growth rate for the first month subsequent to the sampling period is *closest to*:

- (selected) 4.70%.
- 5.02%.
- 5.36%.

Rationale

This Answer is Correct

The model used 60 time periods, so the first month subsequent to the sampling period will be $t = 61$. Using the regression coefficients found in the regression output, the growth rate is calculated as follows:

$$\text{Growth rate}_{t=61} = 5.0268 - 0.00543(61) = 4.70\%$$

Rationale

This Answer is Correct

The model used 60 time periods, so the first month subsequent to the sampling period will be $t = 61$. Using the regression coefficients found in the regression output, the growth rate is calculated as follows:

$$\text{Growth rate}_{t=61} = 5.0268 - 0.00543(61) = 4.70\%$$

Rationale

This Answer is Correct

The model used 60 time periods, so the first month subsequent to the sampling period will be $t = 61$. Using the regression coefficients found in the regression output, the growth rate is calculated as follows:

$$\text{Growth rate}_{t=61} = 5.0268 - 0.00543(61) = 4.70\%$$

ii.

With respect to Zakaria's statement concerning Miller's linear trend model based on monthly data, the statement is *most likely*:

- (selected) correct.
- incorrect because the Durbin-Watson statistic is inconclusive.
- incorrect because it is not possible to use the Durbin-Watson test to identify serial correlation with time series data.

Rationale

This Answer is Incorrect

A Durbin-Watson that approximates 2.0 is indicating no serial correlation. As the Durbin-Watson statistic approaches 0, its minimum possible value, it is indicating a high likelihood of positive serial correlation. When it approaches 4.0, its maximum value, the Durbin-Watson statistic is indicating a high likelihood of negative serial correlation. Given that the regression output shows a Durbin-Watson statistic 0.12, there is a very strong possibility that serial correlation is present. Thus, Zakaria is correct. Remember though that the Durbin-Watson test cannot be used when the independent variable is a lagged value of the dependent variable (e.g., when using an autoregressive model).

Rationale

This Answer is Incorrect

A Durbin-Watson that approximates 2.0 is indicating no serial correlation. As the Durbin-Watson statistic approaches 0, its minimum possible value, it is indicating a high likelihood of positive serial correlation. When it approaches 4.0, its maximum value, the Durbin-Watson statistic is indicating a high likelihood of negative serial correlation. Given that the regression output shows a Durbin-Watson statistic 0.12, there is a very strong possibility that serial correlation is present. Thus, Zakaria is correct. Remember though that the Durbin-Watson test cannot be used when the independent variable is a lagged value of the dependent variable (e.g., when using an autoregressive model).

Rationale

This Answer is Incorrect

A Durbin-Watson that approximates 2.0 is indicating no serial correlation. As the Durbin-Watson statistic approaches 0, its minimum possible value, it is indicating a high likelihood of positive serial correlation. When it approaches 4.0, its maximum value, the Durbin-Watson statistic is indicating a high likelihood of negative serial correlation. Given that the regression output shows a Durbin-Watson statistic 0.12, there is a very strong possibility that serial correlation is present. Thus, Zakaria is correct. Remember though that the Durbin-Watson test cannot be used when the independent variable is a lagged value of the dependent variable (e.g., when using an autoregressive model).

iii.

Zakaria's statement to Miller concerning his model for forecasting quarterly sales is *most likely*:

- (selected) correct.
- incorrect because the Durbin Watson statistic is not significant at the 5% error level.
- incorrect because autocorrelations of the residuals are not significant at the 5% error level.

Rationale

This Answer is Incorrect

The series appears to be a random walk because the intercept does not appear to be significantly different from 0 and the estimated coefficient on the first lag is very close to 1.0. A random walk is not covariance stationary. Therefore, Zakaria is correct in her statement. This means that it is not possible to use the model to make statistical inferences. A more appropriate model might be to first difference the natural logarithm of sales.

Rationale

This Answer is Incorrect

The series appears to be a random walk because the intercept does not appear to be significantly different from 0 and the estimated coefficient on the first lag is very close to 1.0. A random walk is not covariance stationary. Therefore, Zakaria is correct in her statement. This means that it is not possible to use the model to make statistical inferences. A more appropriate model might be to first difference the natural logarithm of sales.

Rationale

This Answer is Incorrect

The series appears to be a random walk because the intercept does not appear to be significantly different from 0 and the estimated coefficient on the first lag is very close to 1.0. A random walk is not covariance stationary. Therefore, Zakaria is correct in her statement. This means that it is not possible to use the model to make statistical inferences. A more appropriate model might be to first difference the natural logarithm of sales.

Question 14
L2QM-TBB207-1412
LOS: LOS-6180
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium
An analyst is using a linear trend model to explain the quarterly sales of a company over time. Which of the following conditions exhibited by the model would *most likely* suggest that the analyst should switch to using a log-linear model?

- (selected) Positive serial correlation.
- Negative serial correlation.
- Multicollinearity.

Rationale

This Answer is Correct

A log-linear trend model should be used when the underlying time series exhibits a constant growth rate over time rather than a constant absolute change in value. In this case, the linear trend model will exhibit positive serial correlation of residuals, since the error term will likely stay negative for protracted periods of time when the exponential growth is below the linear trend, then stay positive for protracted periods of time when the exponential growth is above the linear trend.

Question 15
L2QM-TBX106-1502
LOS: LOS-6280
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: easy
Seasonality in time series models will be evident in:

- ○ High autocorrelation coefficients for the time series values.
- ◉ High autocorrelation coefficients for the residuals of time series model.
- ○ High autocorrelation coefficients for the square of the residuals of time series model.

Rationale

This Answer is Correct

Seasonality will lead to the error term of the model having a positive autocorrelation with the lagged error term for the time where the seasonality is occurring. This will lead to high autocorrelation coefficients for the residuals of the time series of the model.

Question 16
L2QM-PQ1121-1410
LOS: LOS-6300
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: medium
Which of the following tests is *most likely* used to determine whether two time series are cointegrated?

- (selected) Dicky-Fuller test
- Engle-Granger test
- Durbin-Watson test

Rationale

This Answer is Correct

To test whether two time series are cointegrated, we conduct a Dicky-Fuller test using Engle-Granger critical values.

Question 17
L2R11TB-ITEMSET-AC004-1512
LOS: LOS-6210
LOS: LOS-6170
LOS: LOS-6260
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium

Use the following information to answer the next three questions:

Sarah Timms is analyzing annual sales for a company, and she is modeling sales with the use of the following type of AR(1) model:

$$\ln\ Sales_t = b_0 + b_1 \times \ln\ Sales_{t-1} + \varepsilon_t$$

Her regression analysis shows that the intercept and lag coefficients are both statistically significant and the model has a R^2 of 0.4. However, Timms is concerned that the model is not well specified. Therefore, she examines the autocorrelation for the residuals for different lags and finds that none of the autocorrelations are statistically significant. In addition, she conducts a Dickey-Fuller test and concludes that she can reject the null hypothesis for the Dickey-Fuller test.

Timms also wants to analyze the company's quarterly earnings per share (EPS) and has created an AR(1) model of the following form:

$$(\ln\ \mathrm{EPS}_t - \ln\ \mathrm{EPS}_{t-1}) = b_0 + b_1 \times (\ln\ \mathrm{EPS}_{t-1} - \ln\ \mathrm{EPS}_{t-2}) + \varepsilon$$

The regression output is as follows:

Regression Statistics			
R^2		0.79	
Observations		40	
Durbin-Watson		1.93	
	Coefficient	Standard Error	*t*-Statistic
Intercept	0.031	0.010	3.100
Lag 1	0.326	0.110	2.964
Autocorrelations of the Residual			
Lag	Autocorrelation	Standard Error	*t*-Statistic
1	0.237	0.182	1.302
2	0.147	0.182	0.808
3	0.196	0.182	1.077
4	0.038	0.182	0.209

James Langstaff examines the data from the regression output and states that he is concerned that the model is not well specified.

i.
The autoregressive model for the company's sales prepared by Timms is *most likely*:

- (selected) well specified.
- contains a unit root.
- exhibits serial correlation.

Rationale
This Answer is Correct

The coefficients are stated in the write-up as being significant. Furthermore, the write-up indicated that none of the autocorrelations for the residuals are significant. Finally, the Dickey-Fuller test resulted in the null hypothesis (that there is a unit root) being rejected. Overall, there are no indications that the model is not well specified.

Rationale

This Answer is Correct

The coefficients are stated in the write-up as being significant. Furthermore, the write-up indicated that none of the autocorrelations for the residuals are significant. Finally, the Dickey-Fuller test resulted in the null hypothesis (that there is a unit root) being rejected. Overall, there are no indications that the model is not well specified.

Rationale

This Answer is Correct

The coefficients are stated in the write-up as being significant. Furthermore, the write-up indicated that none of the autocorrelations for the residuals are significant. Finally, the Dickey-Fuller test resulted in the null hypothesis (that there is a unit root) being rejected. Overall, there are no indications that the model is not well specified.

ii.

Assume that earnings per share for the company being analyzed were \$1.20 for the first quarter of 2015, \$1.24 for the second quarter of 2015, and \$1.31 for the third quarter of 2015. Based on the EPS model, the earnings per share projected for the final quarter of 2015 will be *closest to*:

- ○ \$1.29
- ○ \$1.35
- ◉ \$1.38

Rationale

This Answer is Incorrect

We use the model and input the last two quarters' EPS in order to find the estimate for the 4th quarter:

$$(\ln EPS_t - \ln EPS_{t-1}) = 0.031 + 0.326(\ln EPS_{t-1} - \ln EPS_{t-2})$$
$$(\ln EPS_t - \ln \$1.31) = 0.031 + 0.326(\ln \$1.31 - \ln \$1.24)$$
$$\ln EPS_t - 0.2700 = 0.031 + 0.326(0.2700 - 0.2151)$$
$$\ln EPS_t = \$1.3756 \approx \$1.38$$

Rationale

This Answer is Incorrect

We use the model and input the last two quarters' EPS in order to find the estimate for the 4th quarter:

$$(\ln EPS_t - \ln EPS_{t-1}) = 0.031 + 0.326(\ln EPS_{t-1} - \ln EPS_{t-2})$$
$$(\ln EPS_t - \ln \$1.31) = 0.031 + 0.326(\ln \$1.31 - \ln \$1.24)$$
$$\ln EPS_t - 0.2700 = 0.031 + 0.326(0.2700 - 0.2151)$$
$$\ln EPS_t = \$1.3756 \approx \$1.38$$

Rationale

This Answer is Incorrect

We use the model and input the last two quarters' EPS in order to find the estimate for the 4th quarter:

$$(\ln EPS_t - \ln EPS_{t-1}) = 0.031 + 0.326(\ln EPS_{t-1} - \ln EPS_{t-2})$$
$$(\ln EPS_t - \ln \$1.31) = 0.031 + 0.326(\ln \$1.31 - \ln \$1.24)$$
$$\ln EPS_t - 0.2700 = 0.031 + 0.326(0.2700 - 0.2151)$$
$$\ln EPS_t = \$1.3756 \approx \$1.38$$

iii.

Using a 5% level of significance, the model for forecasting the company's quarterly earnings per share is *most likely*:

- (selected) well specified.
- not well specified, because it ignores the impact of seasonality.
- not well specified, because there is serial correlation as indicated by the Durbin-Watson statistic.

Rationale

This Answer is Incorrect

The Durbin-Watson statistic is used to test for serial correlation. All of the autocorrelations appear to be insignificant as their *t*-statistics are well below the *t*-critical of approximately 2.0 for a 5% level of significance. Thus, there is no seasonality. Overall, the best choice is that the model is well specified.

Rationale

This Answer is Incorrect

The Durbin-Watson statistic is used to test for serial correlation. All of the autocorrelations appear to be insignificant as their *t*-statistics are well below the *t*-critical of approximately 2.0 for a 5% level of significance. Thus, there is no seasonality. Overall, the best choice is that the model is well specified.

Rationale

This Answer is Incorrect

The Durbin-Watson statistic is used to test for serial correlation. All of the autocorrelations appear to be insignificant as their *t*-statistics are well below the *t*-critical of approximately 2.0 for a 5% level of significance. Thus, there is no seasonality. Overall, the best choice is that the model is well specified.

Question 18

L2R11TB-AC022-1512

LOS: LOS-6290

Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series

Difficulty: medium

If a time series contains autoregressive conditional heteroskedasticity, it is *most likely* that:

- (selected) it is possible to forecast the variance of the errors for future time periods.
- it can be modeled for statistical inference purposes if it is covariance stationary.
- the regression coefficients will not appear to be significant when in fact they are.

Rationale

✓ it is possible to forecast the variance of the errors for future time periods.

The variance of the errors in period $t+1$ can be predicted using the following formula:

$$\hat{\sigma}^2_{t+1} = \hat{a}_0 + \hat{a}_1 \hat{\varepsilon}^2_t$$

Rationale

✗ it can be modeled for statistical inference purposes if it is covariance stationary.

The variance of the errors in period $t+1$ can be predicted using the following formula:

$$\hat{\sigma}^2_{t+1} = \hat{a}_0 + \hat{a}_1 \hat{\varepsilon}^2_t$$

Rationale

✗ the regression coefficients will not appear to be significant when in fact they are.

The variance of the errors in period $t+1$ can be predicted using the following formula:

$$\hat{\sigma}^2_{t+1} = \hat{a}_0 + \hat{a}_1 \hat{\varepsilon}^2_t$$

Question 19
L2QM-PQ1113-1410
LOS: LOS-6190
LOS: LOS-6260
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium
Which of the following is *least likely* a method to determine whether a time series is covariance stationary?

- ○ Looking at a graphical plot of the data.
- ◉ Examining the autocorrelations of the residuals at various lags.
- ○ Conducting the Dicky-Fuller test for unit root.

Rationale

This Answer is Correct

One way of determining whether a time series is covariance stationary is by examining the autocorrelations of the **time series** at various lags. For a stationary time series, either the time-series autocorrelations at all lags do not significantly differ from 0, or the autocorrelations drop off rapidly to 0 as the number of lags becomes large. Note that the residual autocorrelations are used to test for serial correlation in a **log-linear** trend model.

Question 20
L2R11TB-AC009-1512
LOS: LOS-6170
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium
An analyst has constructed a log linear time series model based on monthly sales (in millions of dollars) as follows: $\ln(Sales_t) = b_0 + b_1 t$. Her regression output indicates that $b_0 = 0.02$ and $b_1 = 0.022$. If time 1 is January 2009, the predicted value of sales for December 2010 is *closest to*:

- $0.58 million.
- $1.09 million.
- $1.73 million. (selected)

Rationale

$0.58 million. (incorrect)

The data is monthly and if January 2009 represents $t = 1$, then December 2011 is the 24th time period ($t = 24$). The regression is then used to make the estimate:

$$\begin{aligned} \ln(\text{Sales}_t) &= 0.02 + 0.022(24) = 0.548 \\ \text{Sales}_t &= e^{0.548} = 1.73 \text{ million} \end{aligned}$$

Rationale

$1.09 million. (incorrect)

The data is monthly and if January 2009 represents $t = 1$, then December 2011 is the 24th time period ($t = 24$). The regression is then used to make the estimate:

$$\begin{aligned} \ln(\text{Sales}_t) &= 0.02 + 0.022(24) = 0.548 \\ \text{Sales}_t &= e^{0.548} = 1.73 \text{ million} \end{aligned}$$

Rationale

$1.73 million. (correct)

The data is monthly and if January 2009 represents $t = 1$, then December 2011 is the 24th time period ($t = 24$). The regression is then used to make the estimate:

$$\begin{aligned} \ln(\text{Sales}_t) &= 0.02 + 0.022(24) = 0.548 \\ \text{Sales}_t &= e^{0.548} = 1.73 \text{ million} \end{aligned}$$

Question 21
L2R11TB-AC023-1512
LOS: LOS-6260
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium
Two time series are being analyzed, one as the dependent variable and one as the independent variable in a linear regression. Both time series have a unit root. The relationship between the two variables:

- cannot be analyzed using linear regression.
- can only be analyzed using linear regression if the two series are cointegrated.
- can only be analyzed using linear regression if the two series are not cointegrated.

Rationale
cannot be analyzed using linear regression.
When both the series have a unit root but are cointegrated, the error term in the linear regression of one series against the other will be covariance stationary, meaning that linear regression analysis can be used.

Rationale
can only be analyzed using linear regression if the two series are cointegrated.
When both the series have a unit root but are cointegrated, the error term in the linear regression of one series against the other will be covariance stationary, meaning that linear regression analysis can be used.

Rationale
can only be analyzed using linear regression if the two series are not cointegrated.
When both the series have a unit root but are cointegrated, the error term in the linear regression of one series against the other will be covariance stationary, meaning that linear regression analysis can be used.

Question 22
L2QM-TB0013-1412
LOS: LOS-6190
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium
Which of the following time series is *most likely* to be covariance stationary?

- The quarterly revenues of a growing company.
- The quarterly revenues of a company with high seasonality in sales.
- The monthly returns of the share price of a mature quoted company.

Rationale

This Answer is Correct

A series is covariance stationary if it has a constant mean, constant variance, and constant covariance with lagged values of itself over time. Answer A is unlikely to have a constant mean if the sales are trending upward, while answer B is unlikely to have a constant variance across time if there is high seasonality in the data.

Question 23
L2R11TB-AC016-1512
LOS: LOS-6190
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium
In the period from 1990 to 1999, inflation was relatively stable. From 2000 to 2009, inflation was more volatile as a result of government policy. The most appropriate period for constructing a time series model is *most likely*:

- 1990 to 1999.
- 2000 to 2009.
- 1990 to 2009.

Rationale
1990 to 1999.
If the whole period is used, the series will not be covariance stationary. The shorter, more recent period is preferable.

Rationale
2000 to 2009.
If the whole period is used, the series will not be covariance stationary. The shorter, more recent period is preferable.

Rationale
1990 to 2009.
If the whole period is used, the series will not be covariance stationary. The shorter, more recent period is preferable.

Question 24
L2R11TB-AC018-1512
LOS: LOS-6250
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium
If a time series follows a random walk without drift, it is *most likely* that the intercept for an AR(1) model for the series is:

- (selected) zero and its lag coefficient is one.
- one and its lag coefficient is zero.
- zero and its lag coefficient is zero.

Rationale
✔ **zero and its lag coefficient is one.**
Since the best forecast for a series that follows a random walk without drift at time $t + 1$ is the value at time t, then $x_{t+1} = 0 + 1(x_t)$.

Rationale
✖ **one and its lag coefficient is zero.**
Since the best forecast for a series that follows a random walk without drift at time $t + 1$ is the value at time t, then $x_{t+1} = 0 + 1(x_t)$.

Rationale
✖ **zero and its lag coefficient is zero.**
Since the best forecast for a series that follows a random walk without drift at time $t + 1$ is the value at time t, then $x_{t+1} = 0 + 1(x_t)$.

Question 25

L2QM-TB0016-1412

LOS: LOS-6290

Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series

Difficulty: medium

Which of the following statements regarding autoregressive conditional heteroskedasticity (ARCH) in a time series is most accurate?

- The test for ARCH involves regressing the squared errors of a time series against lagged versions of themselves. Should ARCH exist, its presence can be used to predict the error terms of the model.
- The test for ARCH involves regressing the errors of a time series against lagged versions of themselves. Should ARCH exist, its presence can be used to predict the error terms of the model.
- The test for ARCH involves regressing the squared errors of a time series against lagged versions of themselves. Should ARCH exist, its presence can be used to predict the variance of the error terms of the model.

Rationale

This Answer is Correct

Autoregressive conditional heteroskedasticity (ARCH) is defined as the situation where the variance of the error terms in a model are dependent on the variance of the error term in previous periods. This can be identified by regressing squared residuals with lagged values of themselves since the squared residual represents the variance of the error term. Should ARCH exist in a model, by definition, it can be used to predict the variance of the error term in the model.

Question 26
L2R11TB-AC019-1512
LOS: LOS-6250
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium
If a time series follows a random walk, it is *most likely* that the intercept for an AR(1) model based on the first differenced data is:

- zero and its lag coefficient is one.
- one and its lag coefficient is zero.
- zero and its lag coefficient is zero.

Rationale
zero and its lag coefficient is one.
The first differenced data has an expected value of zero, since it is equal to the error term, which has an expected value of zero.

Rationale
one and its lag coefficient is zero.
The first differenced data has an expected value of zero, since it is equal to the error term, which has an expected value of zero.

Rationale
zero and its lag coefficient is zero.
The first differenced data has an expected value of zero, since it is equal to the error term, which has an expected value of zero.

Question 27
L2R11TB-AC012-1512
LOS: LOS-6210
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

An analyst has constructed an autoregressive time series model of order 1 based on 60 observations. Details of the model are as follows.

Regression Statistics	
R^2	0.68
Observations	60
Durbin-Watson	1.21

	Coefficient	**Standard Error**	***t*-Statistic**
Intercept	0.0721	0.0244	3.0
Lag 1	0.9234	0.2491	3.7

Autocorrelations of the Residual

Lag	**Autocorrelation**	**Standard Error**	***t*-Statistic**
1	0.21	0.129	1.628
2	0.18	0.129	1.395
3	0.11	0.129	0.853
4	0.09	0.129	0.698

If significance testing is conducted at the 5 percent error level, the analyst can *most likely* conclude that the model:

- (selected) is well specified and indicates a significant relationship between the dependent variable and its lagged value.
- cannot be used for the purposes of statistical inference because the autocorrelations indicate positive serial correlation.
- cannot be used for the purposes of statistical inference because the Durbin Watson coefficient indicates positive serial correlation.

Rationale

✔ **is well specified and indicates a significant relationship between the dependent variable and its lagged value.**

The Durbin-Watson test is irrelevant because the independent variable is a lagged value of the dependent variable. Given $n = 60$ and 5 percent significance, the t-critical is approximately 2.0 and we can see that none of the autocorrelations for the residuals are significant. The model itself has a high R^2 and both the coefficients are significant at the 5 percent level of significance.

Rationale

✖ **cannot be used for the purposes of statistical inference because the autocorrelations indicate positive serial correlation.**

The Durbin-Watson test is irrelevant because the independent variable is a lagged value of the dependent variable. Given $n = 60$ and 5 percent significance, the t-critical is approximately 2.0 and we can see that none of the autocorrelations for the residuals are significant. The model itself has a high R^2 and both the coefficients are significant at the 5 percent level of significance.

Rationale

cannot be used for the purposes of statistical inference because the Durbin Watson coefficient indicates positive serial correlation.

The Durbin-Watson test is irrelevant because the independent variable is a lagged value of the dependent variable. Given $n = 60$ and 5 percent significance, the t-critical is approximately 2.0 and we can see that none of the autocorrelations for the residuals are significant. The model itself has a high R^2 and both the coefficients are significant at the 5 percent level of significance.

Question 28
L2QM-PQ1122-1410
LOS: LOS-6300
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: medium

Consider the following statements regarding regressions with more than one time series:

Statement 1: If neither of the time series has a unit root, linear regression cannot be used to test the relationship between the two series.

Statement 2: If both the time series have unit roots, linear regression can only be used if they are cointegrated.

Which of the following is *most likely*?

- ○ Only Statement 1 is correct.
- ◉ Only Statement 2 is correct.
- ○ Both statements are correct.

Rationale

This Answer is Correct

Regarding Statement 1, if neither of the time series has a unit root, linear regression **can** be used to test the relationship between the two series.

Statement 2 is correct.

Question 29
L2R11TB-AC014-1512
LOS: LOS-6200
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium
When the chain rule of forecasting is used to forecast future values, it is *most likely* that the uncertainty of the forecast will:

- decline for values further in the future.
- increase for values further in the future.
- stay constant for values further in the future.

Rationale
decline for values further in the future.
The uncertainty for forecasting a value at $t+2$, for example, has the uncertainty of forecasting the value at $t+1$ and the additional uncertainty when forecasting the value at $t+2$ based on the forecast value at $t+1$.

Rationale
increase for values further in the future.
The uncertainty for forecasting a value at $t+2$, for example, has the uncertainty of forecasting the value at $t+1$ and the additional uncertainty when forecasting the value at $t+2$ based on the forecast value at $t+1$.

Rationale
stay constant for values further in the future.
The uncertainty for forecasting a value at $t+2$, for example, has the uncertainty of forecasting the value at $t+1$ and the additional uncertainty when forecasting the value at $t+2$ based on the forecast value at $t+1$.

Question 30
L2QM-TB0011-1412
LOS: LOS-6170
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium

An analyst hypothesizes that there exists an exponential relationship between a variable y and time t as follows:

$$y_t = e^b a + b_{1t}$$

Which of the following linear regression models will correctly reflect this relationship?

- ○ A linear regression of the natural log of y versus the natural log of time t.
- ◉ A linear regression of the natural log of y versus time t.
- ○ A linear regression of the y versus the natural log of time t.

Rationale

This Answer is Correct

When the natural logarithm is applied to both sides of the relationship, the expression can be expressed as

$$lny_t = b_a + b_1 t$$

Question 31
L2QM-ITEMSET-PQ1119-1411
LOS: LOS-6280
LOS: LOS-6290
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: medium

Use the following information to answer the next two questions:

An analyst develops an AR(1) model to predict monthly inflation using data over the last 10 years. The results of this regression are given below:

AR(1) Model Regression Results

Regression Statistics	
R-squared	0.7521
Standard error	0.981
Observations	120
Durbin-Watson	1.651

	Coefficient	Standard Error	t-Stat
Intercept	0.0954	0.0443	2.1535
Lag 1	0.8324	0.0714	11.6583

Autocorrelations of the Residuals from the AR(1) Model

Lag	Autocorrelation	Standard Error	t-Stat
1	−0.0451	0.0913	−0.4940
2	−0.0418	0.0913	−0.4579
3	0.0412	0.0913	0.4513
4	0.0396	0.0913	0.4338
5	−0.0408	0.0913	−0.4469

ARCH(1) Regression Results for AR(1) Model Residuals

Note that the variables in the regression are expressed as percentages (e.g., 1% = 1).

Regression Statistics	
R-squared	0.0168
Standard error	11.82
Observations	120
Durbin-Watson	1.9214

	Coefficient	Standard Error	t-Stat
Intercept	4.2188	0.789	5.3470
Lag 1	0.1789	0.0701	2.5521

i.
Which of the following is most likely!

- ○ The model is misspecified because the time series is not covariance stationary.
- ○ The model is misspecified because the errors are serially correlated.
- ◉ The model is misspecified because the errors suffer from conditional heteroskedasticity.

Rationale

This Answer is Correct

The ARCH(1) regression results indicate that the coefficient on the previous period's squared residual (a_1) is significantly different from 0. The *t*-stat of 2.5521 is high enough for us to be able to reject the null hypothesis that the errors have no autoregressive conditional heteroskedasticity (H_0: $a_1 = 0$).

We are not provided with adequate information to determine whether the time series is covariance stationary. In order to make that determination we would need any of the following:

- A graph that plots the actual data.
- The autocorrelation of the time series at various lags.
- Regression results for a first-differenced time series.

None of the residual autocorrelations appear to be significantly different from 0, so we can conclude that serial correlation among the error terms is not the problem.

ii.

Based on ARCH(1) results provided in the previous problem, if the error in one period is 2%, the predicted variance of the error in the next period is most likely:

- ○ 4.58%.
- ● 4.93%.
- ○ 4.22%.

Rationale

This Answer is Correct

Predicted variance of error in period $t = 4.2188 + 0.1789(2^2) = 4.93\%$.

Question 32
L2QM-ITEMSET-PQ1106-1411
LOS: LOS-6200
LOS: LOS-6210
LOS: LOS-6220
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models

Use the following information to answer the next 2 questions:

An analyst wants to predict changes in GDP growth rate and estimates the following AR(1) model:

$$\text{Change in GDP growth rate}_t = 0.0517 + 0.2479\ (\text{Change in GDP growth rate}_{t-1})$$

Given that the model is covariance stationary and that there is no serial correlation between the error terms, answer the following questions:

i.
The mean-reverting level is *closest to*:

- ○ 0.0414
- ◉ 0.0687
- ○ 0.2614

Rationale
This Answer is Correct
Mean-reverting level = b_0 / (1 − b_1) = 0.0517 / (1 − 0.2479) = 0.0687

ii.
Given that the change in the GDP growth rate in the current period (t) is 0.05, the prediction of the change in the period following the next period (t+2) is *closest to*:

- ◉ 6.76%
- ○ 6.41%
- ○ 6.28%

Rationale
This Answer is Correct

$$\begin{aligned}\text{One-period ahead predicted change in the unemployment rate} &= 0.0517 + 0.2479\,(0.05)\\ &= 0.064095 \text{ or } 6.4095\,\%\end{aligned}$$

$$\begin{aligned}\text{Two-period ahead predicted change in the unemployment rate} &= 0.0517 + 0.2479\,(0.064095)\\ &= 0.067589 \text{ or } 6.7589\,\%\end{aligned}$$

Question 33
L2R11TB-AC017-1512
LOS: LOS-6250
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium
A random walk *most likely* has:

- ○ an undefined mean-reverting level and a variance that is finite.
- ○ a defined mean-reverting level and a variance that approaches infinity.
- ◉ an undefined mean-reverting level and a variance that approaches infinity.

Rationale
❌ **an undefined mean-reverting level and a variance that is finite.**

The random error is assumed to have constant variance and its value in one period is uncorrelated with the random errors for previous periods. Given these assumptions, the best estimate of any *xt* is previous period's value (*xt* – 1) and an AR(1) model is a special case where $b_0 = 0$ and $b_1 = 1$. The mean-reverting level for a time series that is a random walk is as follows:

$$x_t = \frac{b_0}{1 - b_1} = \frac{0}{0}$$

As shown, a random walk has an undefined mean-reverting level. In addition, as *t* grows large, the variance of x_t grows without an upper bound and approaches infinity.

Rationale
❌ **a defined mean-reverting level and a variance that approaches infinity.**

The random error is assumed to have constant variance and its value in one period is uncorrelated with the random errors for previous periods. Given these assumptions, the best estimate of any *xt* is previous period's value (*xt* – 1) and an AR(1) model is a special case where $b_0 = 0$ and $b_1 = 1$. The mean-reverting level for a time series that is a random walk is as follows:

$$x_t = \frac{b_0}{1 - b_1} = \frac{0}{0}$$

As shown, a random walk has an undefined mean-reverting level. In addition, as *t* grows large, the variance of x_t grows without an upper bound and approaches infinity.

Rationale
✅ **an undefined mean-reverting level and a variance that approaches infinity.**

The random error is assumed to have constant variance and its value in one period is uncorrelated with the random errors for previous periods. Given these assumptions, the best estimate of any *xt* is previous period's value (*xt* – 1) and an AR(1) model is a special case where $b_0 = 0$ and $b_1 = 1$. The mean-reverting level for a time series that is a random walk is as follows:

$$x_t = \frac{b_0}{1 - b_1} = \frac{0}{0}$$

As shown, a random walk has an undefined mean-reverting level. In addition, as t grows large, the variance of x_t grows without an upper bound and approaches infinity.

Question 34
L2QM-PQ1115-1410
LOS: LOS-6260
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium

Consider the following statements:

Statement 1: In the Dicky-Fuller test for unit root, the dependent variable is the first-difference of the time series, while the independent variable is the first lag of the time series.

Statement 2: The null hypothesis for the Dicky-Fuller test is that g_1 equals 0.

Which of the following is *most likely*?

- (•) Both statements are correct.
- ( ) Only Statement 2 is correct.
- ( ) Both statements are incorrect.

Rationale

This Answer is Correct

- In the Dicky-Fuller test for unit root, the dependent variable is the first-difference of the time series ($x_t - x_{t-1}$), while the independent variable is the first lag of the time series (x_{t-1}).
- The null hypothesis for the Dicky-Fuller test is that the time series has a unit root ($b_1 = 1$). Since $g_1 = b_1 - 1$, the null hypothesis for the test is that $g_1 = 0$.

Question 35
L2R11TB-AC010-1512
LOS: LOS-6180
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium
When identifying whether there is serial correlation in a linear trend time series model, it is *most likely* that an analyst would use:

- (selected) the Durbin-Watson coefficient.
- calculation of autocorrelations over different lags.
- an analysis of the instability of the trend coefficients.

Rationale
✔ **the Durbin-Watson coefficient.**
The Durbin-Watson (DW) test can be used so long as the independent variable is not a lagged value of the dependent variable.

Rationale
✖ **calculation of autocorrelations over different lags.**
The Durbin-Watson (DW) test can be used so long as the independent variable is not a lagged value of the dependent variable.

Rationale
✖ **an analysis of the instability of the trend coefficients.**
The Durbin-Watson (DW) test can be used so long as the independent variable is not a lagged value of the dependent variable.

Question 36
L2QM-TB0015-1412
LOS: LOS-6260
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium
Which of the following tests is used to investigate the presence of a unit root in a time series?

- (selected) Dickey Fuller test.
- Durbin Watson test.
- Autocorrelation analysis.

Rationale

This Answer is Correct

The Dickey Fuller test is used to investigate the presence of a unit root in a time series. The Durbin Watson test is used to test for serial correlation in a model, except for autoregressive models where serial correlation must be investigated through direct autocorrelation analysis.

Question 37
L2R11TB-AC008-1512
LOS: LOS-6180
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium
A log linear trend model is *most* suitable for a time series that is:

- serially correlated.
- declining at a relative rate.
- growing at an absolute rate.

Rationale
serially correlated.
When the change is absolute, a trend model is suitable, assuming no serial correlation. When the change is relative (e.g., a percentage change), a log linear trend is more suitable. When there is serial correlation, an autoregressive model is more suitable.

Rationale
declining at a relative rate.
When the change is absolute, a trend model is suitable, assuming no serial correlation. When the change is relative (e.g., a percentage change), a log linear trend is more suitable. When there is serial correlation, an autoregressive model is more suitable.

Rationale
growing at an absolute rate.
When the change is absolute, a trend model is suitable, assuming no serial correlation. When the change is relative (e.g., a percentage change), a log linear trend is more suitable. When there is serial correlation, an autoregressive model is more suitable.

Question 38
L2QM-ITEMSET-PQ1101-1411
LOS: LOS-6170
Lesson Reference: Lesson 1: Trend Models
Difficulty: medium

Use the following information to answer the next three questions.

An analyst wants to estimate the linear trend in the GDP growth rate in Elantica over time. He uses the monthly observations of the GDP growth rate (expressed as annual percentage rates) over the period from January 1991 to December 2010 and obtains the following regression results:

Regression Statistics	
R-squared	0.6421
Standard error	2.3547
Observations	240
Durbin-Watson	1.24

	Coefficient	**Standard Error**	***t*-Stat**
Intercept	5.3182	0.6297	8.4456
Trend	0.0079	0.0021	3.7619

i.
Which of the following is *most likely* regarding a hypothesis test to determine whether the trend coefficient equals 0 at the 5% significance level?

- (selected) The null hypothesis can be rejected. The analyst should conclude that the trend coefficient is significantly different from zero.
- The null hypothesis cannot be rejected. The analyst should conclude that the trend coefficient is not significantly different from zero.
- The null hypothesis cannot be rejected. The analyst should conclude that the trend coefficient is significantly different from zero.

Rationale
This Answer is Correct

$H_0 : b_1 = 0$, versus $H_a : b_1 \neq 0$

At the 5% significance level, with 238 degrees of freedom, the critical *t*-values for a two-tailed test are approximately −1.972 and +1.972. Since the *t*-stat for the trend coefficient (3.7619) is greater than the positive critical value (1.972), the analyst can reject the null hypothesis. He should conclude that the trend coefficient is significantly different from zero.

ii.
Based on the regression results, the predicted GDP growth rate for July 2012 is *closest to*:

- 7.27%
- 7.21%
- (selected) 7.36%

Rationale
This Answer is Correct

GDP growth rate = 5.3182 + 0.0079t

t = 259 (July 2012)

GDP growth rate = 5.3182 + 0.0079 (259) = 7.3643%

iii.

Which of the following is most likely?

- GDP growth rate increased by approximately 0.79% each month during the sample period.
- GDP growth rate increased by approximately 5.3182% during the sample period.
- GDP growth rate increased by approximately 0.0079% each month during the sample period.

Rationale

This Answer is Correct

The trend coefficient of 0.0079 tells us that the GDP growth rate increased by approximately 0.0079% each month during the sample period. Note that the regression used monthly observations.

Question 39
L2R11TB-AC021-1512
LOS: LOS-6280
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: medium

An analyst has constructed an autoregressive time series model of order 1 based on 40 observations. The model is designed to forecast quarterly earnings per share and is based on the first difference of the natural logarithms of earnings per share. Details of the model are as follows.

Regression Statistics	
$R2$	0.39
Observations	40
Durbin-Watson	2.02

	Coefficient	**Standard Error**	***t*-Statistic**
Intercept	0.06	0.02	3.0
Lag 1	0.21	0.08	2.6

Autocorrelations of the Residual

Lag	**Autocorrelation**	**Standard Error**	***t*-Statistic**
1	0.21	0.158	1.329
2	0.11	0.158	0.692
3	0.19	0.158	1.203
4	0.35	0.158	2.215

If significance testing is conducted at the 5% error level, it is *most likely* that:

- (selected) the model needs to be adjusted for seasonality.
- there is no seasonality because the Durbin Watson coefficient is approximately 2.
- there is no seasonality because none of the autocorrelations of the residuals are significant.

Rationale
✓ **the model needs to be adjusted for seasonality.**
The Durbin-Watson coefficient is irrelevant. At a 5% level of significance and sample size of 40, the *t*-critical statistic is approximately 2.0. The lag 4 autocorrelation is significant, suggesting that there is seasonality in the quarterly earnings per share.

Rationale
✗ **there is no seasonality because the Durbin Watson coefficient is approximately 2.**
The Durbin-Watson coefficient is irrelevant. At a 5% level of significance and sample size of 40, the *t*-critical statistic is approximately 2.0. The lag 4 autocorrelation is significant, suggesting that there is seasonality in the quarterly earnings per share.

Rationale
✗ **there is no seasonality because none of the autocorrelations of the residuals are significant.**
The Durbin-Watson coefficient is irrelevant. At a 5% level of significance and sample size of 40, the *t*-critical statistic is approximately 2.0. The lag 4 autocorrelation is significant, suggesting that there is seasonality in the quarterly earnings per share.

Question 40
L2QM-TBB210-1412
LOS: LOS-6230
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

George Clinton, CFA, is a quantitative analyst using autoregressive time series models to forecast macro-economic data. He notes the following results from two models he has been testing:

Model	Standard Error	RMSE
AR(1)	3.3053	3.5992
AR(2)	2.9876	3.8012

Which of the following statements regarding the accuracy of the two models is *most likely* to be accurate?

- (selected) The AR(1) model is more accurate at forecasting than the AR(2) model.
- The AR(2) model is more accurate at forecasting than the AR(1) model.
- Neither model has an adequate level of forecasting accuracy.

Rationale

This Answer is Correct

Since root mean squared error (RMSE) is based on out-of-sample data, it is considered a better reflection of the forecasting accuracy of the model than the standard error which is based on in-sample data used to generate the model. A lower RMSE implies a more accurate model.

Question 41
L2QM-TBX105-1502
LOS: LOS-6270
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: easy
Which of the following best describes the construction of the regression used in a Dickey-Fuller test for a unit root in an AR(1) model?

	Dependent Variable	Independent Variable
A.	First difference	Lagged first difference
B.	First difference	First lag
C.	First lag	First difference

- ○ Row A
- ◉ Row B
- ○ Row C

Rationale

This Answer is Correct

The Dickey-Fuller test involves conducting the following regression:

$$x_t - x_{t-1} = b_0 + g_1 x_{t-1} + \varepsilon_t$$

The null hypothesis of the test is that g_t is zero and hence the time series has a unit root. The alternative hypothesis is $g_t < 0$ in which case the time series is covariance stationary.

Question 42
L2R11TB-AC015-1512
LOS: LOS-6230
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

Details of the standard error for in-sample predictions and root mean squared error for the out-of-sample predictions for an AR(1) and AR(2) model are as follows.

Model	In-Sample Standard Error	Out-of-Sample Root Mean Squared Error
AR(1)	3.7	2.1
AR(2)	4.5	2.0

An evaluation of the two models in terms of their real world contribution is *most likely* to prefer:

- AR(1) model.
- AR(2) model.
- either model, depending on whether the analyst believes in-sample or out- of-sample errors are more important.

Rationale
AR(1) model.
The AR(2) model has a lower root mean squared error for its out-of-sample forecasting, a sign of better accuracy.

Rationale
AR(2) model.
The AR(2) model has a lower root mean squared error for its out-of-sample forecasting, a sign of better accuracy.

Rationale
either model, depending on whether the analyst believes in-sample or out- of-sample errors are more important.
The AR(2) model has a lower root mean squared error for its out-of-sample forecasting, a sign of better accuracy.

Question 43
L2QM-TBX107-1502
LOS: LOS-6300
Lesson Reference: Lesson 4: Seasonality, ARCH Models, Regressions with More Than One Time Series
Difficulty: easy
Multiple linear regression of several time series should *not* be used when:

- ○ None of the time series in the model has a unit root.
- ◉ At least one time series has a unit root while at least one other time series does not have a unit root.
- ○ All time series have a unit root and are cointegrated.

Rationale

This Answer is Correct

If at least one time series (the dependent variable or one of the independent variables) has a unit root while at least one time series (the dependent variable or one of the independent variables) does not, the error term in the regression cannot be covariance stationary and consequently multiple linear regression should not be used.

Question 44
L2QM-PQ1114-1410
LOS: LOS-6190
Lesson Reference: Lesson 2: Autoregressive (AR) Time Series Models
Difficulty: medium

Consider the following statements:

Statement 1: An AR model can be estimated using ordinary least squares if the errors are heteroskedastic.

Statement 2: The Durbin-Watson test can be used to test for serial correlation in an AR model because the independent variables include the past values of the dependent variable.

Which of the following is *most likely*?

- ○ Only Statement 1 is correct.
- ○ Only Statement 2 is correct.
- ◉ Both statements are incorrect.

Rationale

This Answer is Correct

An appropriately-specified AR model should have **homoskedastic** (not heteroskedastic) errors.

Durbin-Watson test **cannot** be used to test for serial correlation in an AR model. Instead we use another test based on **autocorrelations of the error term**.

Question 45
L2QM-PQ1111-1410
LOS: LOS-6250
Lesson Reference: Lesson 3: Random Walks and Unit Roots
Difficulty: medium

Consider the following statements:

Statement 1: Unlike a simple random walk, a random walk with a drift has an intercept term that is different from 0.

Statement 2: Similar to a simple random walk, a random walk with a drift is not covariance stationary.

Which of the following is *most likely*?

- ○ Only Statement 1 is correct.
- ○ Only Statement 2 is correct.
- ◉ Both statements are correct.

Rationale

This Answer is Correct

A simple random walk has an intercept term equal to 0, while a random walk with a drift has an intercept term that is different from 0. Both a random walk and a random walk with a drift have a slope coefficient of 1, which means that they do not have finite mean-reverting levels, and are therefore not covariance stationary.