***Business Analytics, 2e, GE* (Evans)**

**Chapter 9 Forecasting Techniques**

1) The Delphi method used for forecasting:

A) obtains forecasts through a comparative analysis with a previous situation.

B) uses measures that are believed to influence the behavior of a variable that the researcher wishes to forecast.

C) uses a single measure that weights multiple indicators and provides a measure of overall expectation.

**D) uses a panel of experts, whose identities are typically kept confidential from one another, to respond to a sequence of questionnaires.**

**Answer: D**

Diff: 1

Blooms: Remember

Topic: Qualitative and Judgmental Forecasting

LO1: Explain how judgmental approaches are used for forecasting.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

2) Before launching a new line of toys, Toys Inc. used the method of historical analogy to obtain a forecast. In this scenario, Toys Inc.:

A) noted the behavior of its current customers while they use their products.

B) used a panel of experts, whose identities were kept confidential from one another, to respond to a sequence of questionnaires.

**C) noted the consumer response to similar previous products to marketing campaigns and used the responses as a basis to predict how the new marketing campaign might fare.**

D) used a brainstorming session among a group of experts to draw new ideas.

Answer: C

Diff: 1

Blooms: Apply

AACSB: Analytic Skills

Topic: Qualitative and Judgmental Forecasting

LO1: Explain how judgmental approaches are used for forecasting.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

3) In forecasting, what is an index?

**A) It is a single measure that weights multiple indicators and provides a measure of overall expectation.**

B) It is a stream of historical data, such as weekly sales.

C) It is a time series that does not have trend, seasonal, or cyclical effects but is relatively constant and only exhibits random behavior.

D) It is a measure that provides a complete forecast.

Answer: A

Diff: 1

Blooms: Apply

AACSB: Analytic Skills

Topic: Qualitative and Judgmental Forecasting

LO1: Explain how judgmental approaches are used for forecasting.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

4) What is a stream of historical data known as?

**A) a time series**

B) an index

C) a complex number

D) anorthopole

Answer: A

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: List different types of statistical forecasting models.

5) Time-series models may exhibit seasonal effects or cyclical effects. A seasonal effect differs from a cyclical effect in that a seasonal effect:

A) has no trend, is relatively constant, and only exhibits random behavior.

B) describes ups and downs over a time frame such as several years.

**C) is one that repeats at fixed intervals of time, typically a year, month, week, or day.**

D) is based on analysis of historical time-series data and are predicated on the assumption that the future is an extrapolation of the past.

Answer: C

Diff: 2

Blooms: Understand

Topic: Statistical Forecasting Models

LO1: List different types of statistical forecasting models.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

6) The data for the number of hand-held gaming devices sold for the past 5 weeks are 15 units, 20 units, 25 units, 30 units, and 17 units respectively. The time series appears to be relatively stable, without trend, seasonal, or cyclical effects; thus, a moving average model would be appropriate. Setting *k* = 3 the three-period moving average forecast for week 6 is \_\_\_\_\_\_\_\_.

A) 20 units

**B) 24 units**

C) 30 units

D) 17 units

Answer: B

Diff: 2

Blooms: Apply

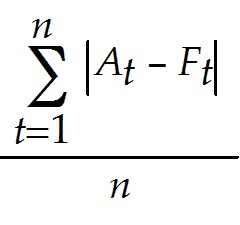
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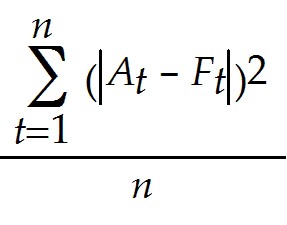
Topic: Statistical Forecasting Models

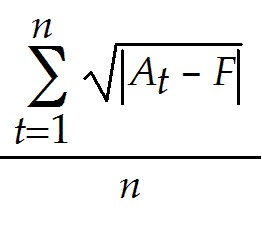
LO1: Apply moving average and exponential smoothing models to stationary time series.

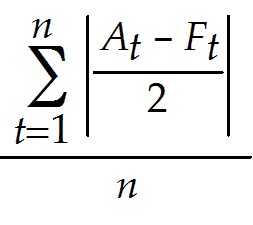
LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

7) If the actual value of a time series at time *t* and the forecast value for time *t* is denoted by *At* and *Ft* respectively, then the formula for the mean absolute deviation over a range of forecasted values is \_\_\_\_\_\_\_\_.

**A) MAD = **

B) MAD = 

C) MAD = 

D) MAD = 

Answer: A

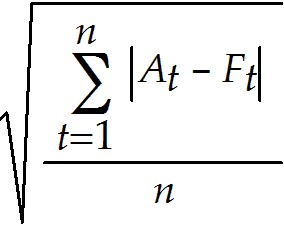
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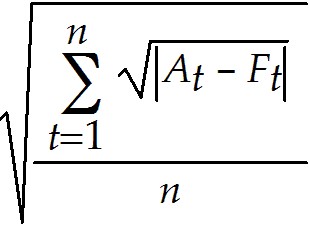
Blooms: Remember

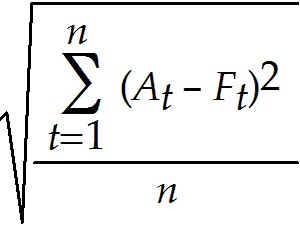
Topic: Statistical Forecasting Models

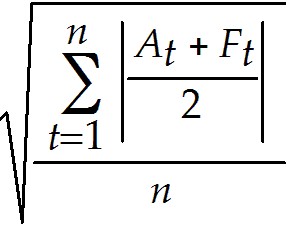
LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

8) Identify the formula used to calculate the root mean square error over a range of forecasted values, if the actual value of the time series at time *t* and the forecast value for time *t* are denoted by *At* and *Ft* respectively.

A) RMSE = 

B) RMSE = 

C) RMSE =

D) RMSE =

Answer: C

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

9) The actual value of the time series at time *t* and the forecast value for time *t* is denoted by *At* and *Ft* respectively. What is the formula used for calculating the mean absolute percentage error over a range of forecasted values?

A) MAPE =

B) MAPE =

C) MAPE =

D) MAPE = × 100

Answer: D

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

Use the data given below to answer the following question(s).

The details of the clock sales at a supermarket for the past 6 weeks are shown in the table below. The time series appears to be relatively stable, without trend, seasonal, or cyclical effects. The simple moving average value of *k* is set at 2.

|  |  |
| --- | --- |
| **Week** | **Units sold** |
| 1 | 88 |
| 2 | 44 |
| 3 | 54 |
| 4 | 65 |
| 5 | 72 |
| 6 | 85 |

10) For the given data, the simple moving average mean absolute deviation is \_\_\_\_\_\_\_\_.

A) 0.21

B) 20.12

C) 14.25

D) 207.13

Answer: C

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

11) For the given data, what is the value of the simple moving average mean square error?

A) 0.21

B) 20.12

C) 14.25

D) 207.13

Answer: D

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

12) Using the data, determine the value of the simple moving average root mean square error.

A) 0.21

B) 14.39

C) 20.12

D) 207.13

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

13) For the given data, calculate the value of the simple moving average mean absolute percentage error.

A) 20.90

B) 23.45

C) 14.39

D) 25.56

Answer: A

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

14) If the smoothing constant is assumed to be 0.7, and setting *F*1 and *F*2 = A1, the exponential smoothing sales forecast for week 7 is approximately \_\_\_\_\_\_\_\_.

A) 50 clocks

B) 80 clocks

C) 60 clocks

D) 70 clocks

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

Use the data given below to answer the following question(s).

The table provided below gives the sales details of the number of android smart phones at an electronic retail store for the past 6 weeks. The time series appears to be relatively stable, without trend, seasonal, or cyclical effects. (Hint: Optimize α value in 0.1 increments)

|  |  |
| --- | --- |
| **Week** | **Units sold** |
| 1 | 88 |
| 2 | 44 |
| 3 | 54 |
| 4 | 65 |
| 5 | 72 |
| 6 | 85 |

15) Calculate the value of the mean absolute percentage error for the given data.

A) 20.90

B) 16.60

C) 21.72

D) 29.97

Answer: D

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

16) Which of the following is the value of the root mean square error for the given data?

A) 11.56

B) 21.77

C) 13.87

D) 20.13

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

17) What is the forecasted value for the 3rd week?

A) 53 phones

B) 64 phones

C) 71 phones

D) 49 phones

Answer: A

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

18) What is the difference between the forecasted and the actual value for the 3rd week?

A) 1phones

B) 6 phones

C) 4 phones

D) 3 phones

Answer: A

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

19) What is the forecasted value for the 7th week?

A) 53 phones

B) 82phones

C) 71 phones

D) 49 phones

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Statistical Forecasting Models

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

**20) In the linear trend equation, *Ft+k*= *at* + *btk, at* is known as the \_\_\_\_\_\_\_\_.**

**A) level**

B) trend

C) slope

D) forecast

Answer: A

Diff: 1

Blooms: Remember

Topic: Forecasting Models for Time Series with a Linear Trend

LO2: Identify the components of simple linear regression models and discuss their applications

21) In the linear trend equation *Ft+k*= *at* + *btk*, identify the term that signifies the trend.

**A) *bt***

B) *k*

C) *at*

D) *Ft* + *k*

Answer: A

Diff: 1

Blooms: Remember

Topic: Forecasting Models for Time Series with a Linear Trend

LO2: Identify the components of simple linear regression models and discuss their applications

22) What is the formula used to calculate the value of *at* in the linear trend equation *Ft+k*= *at* + *btk* while using double exponential smoothing?

A) *at* = *β*(*bt* - *bt*-1) + (1 -*β*)*bt*-1

B) *at* = α*Ft*-1 + (1 - *α*)(*at*+1 + *bt+1*)

**C) *at* = α*Ft* + (1 - *α*)(*at*-1 + *bt-1*)**

D) *at* = *β*(*bt* + *bt*-1) + (1 + *γ*)*bt*-1

Answer: C

Diff: 1

Blooms: Remember

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Identify the components of simple linear regression models and discuss their applications

23) What is the formula used to calculate the value of *bt* in the linear trend equation *Ft+k*= *at* + *btk* while using double exponential smoothing?

A) *bt* = *β*(*bt* - *bt*-1) + (1 -*β*)*bt*-1

B) *bt* = α*Ft*-1 + (1 - *α*)(*at*+1 + *bt+*1)

C) *bt* = α*Ft* + (1 - *α*)(*at*-1 + *bt-1*)

**D) *bt* = *β*(*at* - *at*-1) + (1 -*β*)*bt*-1**

Answer: D

Diff: 1

Blooms: Remember

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Identify the components of simple linear regression models and discuss their applications

Use the data given below to answer the following question(s).

The worldwide sales of cars from 1981-1990 are shown in the table below. Given:  *α* = 0.2 and  *β* = 0.15 (Hint: Use XLMiner)

|  |  |
| --- | --- |
| **Year** | **Units sold in thousands** |
| 1981 | 888 |
| 1982 | 900 |
| 1983 | 1000 |
| 1984 | 1200 |
| 1985 | 1100 |
| 1986 | 1300 |
| 1987 | 1250 |
| 1988 | 1150 |
| 1989 | 1100 |
| 1990 | 1200 |

24) Calculate the value of the mean absolute percentage error using double exponential smoothing for the given data.

A) 1.80

B) 8.10

C) 91.27

D) 11976.17

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Use a modern software tool to perform statistical calculations.

25) Identify the value of the mean square error using double exponential smoothing for the given set of data.

A) 8.10

B) 1.80

C) 91.27

D) 11976.17

Answer: D

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Use a modern software tool to perform statistical calculations.

26) Using the double exponential smoothing, calculate the value of the mean absolute deviation for the given data.

A) 8.10

B) 1.80

C) 91.27

D) 11976.17

Answer: C

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Use a modern software tool to perform statistical calculations.

27) Using the double exponential smoothing, find the value of the root mean square error for the given data.

A) 8.10

B) 91.27

C) 11976.17

D) 109.44

Answer: D

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Use a modern software tool to perform statistical calculations.

28) Which of the following equations is the trend line equation for the given data? (Note: the fitted model assumes that the years are numbered 1 through 10, not the actual dates.)

A) 60.123*x* + 481.56

B) 48.16*x* + 481.86

C) 32.17*x* + 931.87

D) 57.15*x* + 503.81

Answer: C

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply regression-based forecasting to time series with a lineartrend.

LO2: Use a modern software tool to perform statistical calculations.

29) For the given data, what is the sales forecast for the year 1992 (in thousands)?

A) 1256.87

B) 1317.91

C) 1285.74

D) 1350.08

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply regression-based forecasting to time series with a linear trend.

LO2: Use a modern software tool to perform statistical calculations.

Use the data given below to answer the following question(s).

The worldwide sales of cars from 1981-1990 are shown in the table below. Given: α = 0.2, γ = 0.05, and season length = 1. (Hint: Use XLMiner).

|  |  |
| --- | --- |
| **Year** | **Units sold in thousands** |
| 1 | 750 |
| 2 | 823 |
| 3 | 1034 |
| 4 | 1945 |
| 5 | 1556 |
| 6 | 1300 |
| 7 | 1346 |
| 8 | 1150 |
| 9 | 967 |
| 10 | 1200 |

30) Calculate the value of the mean absolute percentage error using the Holt-Winters no-trend model for the given data.

A) 8.10

B) 18.39

C) 21.70

D) 10.97

Answer: C

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Use Holt-Winters and regression models to forecast time series with seasonality.

LO2: Use a modern software tool to perform statistical calculations.

31) Determine the value of the mean absolute deviation using the Holt-Winters no-trend model for the given data.

A) 367.35

B) 18.39

C) 21.70

D) 252.55

Answer: D

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Use Holt-Winters and regression models to forecast time series with seasonality.

LO2: Use a modern software tool to perform statistical calculations.

32) Which of the following is the value of the root mean square error for the given data?

A) 252.55

B) 367.35

C) 21.70

D) 109.76

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Use Holt-Winters and regression models to forecast time series with seasonality.

LO2: Use a modern software tool to perform statistical calculations.

33) Which of the following is the forecast value for the 6th year?

A) 1256.06

B) 1328.04

C) 1321.31

D) 1327.24

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Use Holt-Winters and regression models to forecast time series with seasonality.

LO2: Use a modern software tool to perform statistical calculations.

34) If the given time series has no trend and no seasonality, the most appropriate forecasting model to determine the forecast of the time series is the \_\_\_\_\_\_\_\_ model.

**A) single moving average**

B) Holt-Winters no-trend smoothing

C) double exponential smoothing

D) Holt-Winters additive

Answer: A

Diff: 1

Blooms: Remember

Topic: Selecting Appropriate Time-Series-Based Forecasting

LO1: Identify the appropriate choice of forecasting model based on the characteristics of a time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

35) If the given time series has a trend and no seasonality, the most appropriate forecasting model to determine the forecast of the time series is the \_\_\_\_\_\_\_\_ model.

A) single exponential smoothing

B) Holt-Winters no trend smoothing

**C) double exponential smoothing**

D) Holt-Winters additive

Answer: C

Diff: 1

Blooms: Remember

Topic: Selecting Appropriate Time-Series-Based Forecasting

LO1: Identify the appropriate choice of forecasting model based on the characteristics of a time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

36) If the given time series has a trend and seasonality, the most appropriate forecasting model to determine the forecast of the time series is the \_\_\_\_\_\_\_\_ model.

A) multiple regression

B) Holt-Winters no trend smoothing

C) double exponential smoothing

**D) Holt-Winters multiplicative**

Answer: D

Diff: 1

Blooms: Remember

Topic: Selecting Appropriate Time-Series-Based Forecasting

LO1: Identify the appropriate choice of forecasting model based on the characteristics of a time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

Use the data given below to answer the following question(s).

The table below provides the sales data for JD Inc. for the year 1998. Given: *α =* 0.2, *β = 0*.15, and *γ =* 0.05 (Hint: Use an additive Holt-Winters model.)

|  |  |  |
| --- | --- | --- |
| Umbrella Sales of JD Inc. | | |
| **Year** | **Month** | **Units** |
| 1 | Jan | 3980 |
| 1 | Feb | 4000 |
| 1 | Mar | 4740 |
| 1 | April | 4720 |
| 1 | May | 4920 |
| 1 | Jun | 5140 |
| 1 | July | 4640 |
| 1 | Aug | 4520 |
| 1 | Sep | 4480 |
| 1 | Oct | 4690 |
| 1 | Nov | 4210 |
| 1 | Dec | 4418 |
| 2 | Jan | 4380 |
| 2 | Feb | 4400 |
| 2 | Mar | 5140 |
| 2 | April | 5120 |
| 2 | May | 5320 |
| 2 | Jun | 5540 |
| 2 | July | 5040 |
| 2 | Aug | 4920 |
| 2 | Sep | 4880 |
| 2 | Oct | 5090 |
| 2 | Nov | 4610 |
| 2 | Dec | 4818 |

37) Using an appropriate Holt-Winters trend model, calculate the value of the mean absolute percentage error for the given data.

A) 8.10

B) 330.01

C) 384.83

D) 7.21

Answer: D

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply Holt-Winters forecasting models to time series with both trend and seasonality.

LO2: Use a modern software tool to perform statistical calculations.

38) What is the value of the mean absolute deviation for the given data?

A) 8.10

B) 340.73

C) 14.82

D) 7.62

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply Holt-Winters forecasting models to time series with both trend and seasonality.

LO2: Use a modern software tool to perform statistical calculations.

39) Calculate the value of the mean square error using an appropriate Holt-Winters trend model for the given data.

A) 8.10

B) 346.26

C) 140942.78

D) 7.62

Answer: C

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply Holt-Winters forecasting models to time series with both trend and seasonality.

LO2: Use a modern software tool to perform statistical calculations.

40) What will be the predicted sales for umbrellas for the month of February of year 2?

A) 4530.19

B) 4648.21

C) 4883.76

D) 4818.07

Answer: B

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply Holt-Winters forecasting models to time series with both trend and seasonality.

LO2: Use a modern software tool to perform statistical calculations.

Use the data shown below to answer the following question(s).

The table below is the data set of the Shiller Real Home Price Index for the years 1946-1956.

|  |  |
| --- | --- |
| Year | Real Home Price Index |
| 1946 | 106.5058955 |
| 1947 | 109.3296707 |
| 1948 | 101.2225795 |
| 1949 | 100.0466076 |
| 1950 | 105.8948393 |
| 1951 | 103.8986687 |
| 1952 | 103.9743275 |
| 1953 | 114.7133093 |
| 1954 | 114.199126 |
| 1955 | 115.4621261 |
| 1956 | 115.3166155 |

41) Setting *k* = 3, determine the simple moving average forecast for the year 1950.

Answer: Year 1950 forecast = (100.0466076 + 101.2225795 + 109.3296707)/3 = 103.5329526 ≈ 104.

Diff: 2

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Stationary Time Series

LO1: Apply moving average and exponential smoothing models to stationary time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

42) Setting *k* = 5, calculate the simple moving average forecast for the year 1951.

Answer: Year 1951 forecast = (106.5058955 + 109.3296707 + 101.2225795 + 100.0466076 + 105.8948393)/5 = 104.5999185 ≈ 105.

Diff: 2

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Stationary Time Series

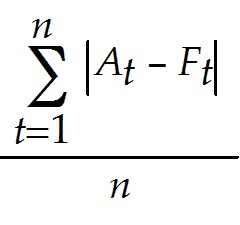
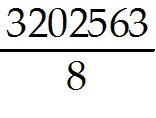
LO1: Apply moving average and exponential smoothing models to stationary time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

43) Setting *k* = 3, determine the value of mean absolute deviation.

Answer:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Real Home Price Index | *F*t | *At* — *Ft* | |*At* — *Ft*| | (*At* — *Ft*)2 |
| 1946 | 106.5058955 |  |  |  |  |
| 1947 | 109.3296707 |  |  |  |  |
| 1948 | 101.2225795 |  |  |  |  |
| 1949 | 100.0466076 | 105.6860486 | -5.63944 | 5.639441 | 31.80329 |
| 1950 | 105.8948393 | 103.5329526 | 2.361887 | 2.361887 | 5.578509 |
| 1951 | 103.8986687 | 102.3880088 | 1.51066 | 1.51066 | 2.282093 |
| 1952 | 103.9743275 | 103.2800385 | 0.694289 | 0.694289 | 0.482037 |
| 1953 | 114.7133093 | 104.5892785 | 10.12403 | 10.12403 | 102.496 |
| 1954 | 114.199126 | 107.5287685 | 6.670358 | 6.670358 | 44.49367 |
| 1955 | 115.4621261 | 110.9622543 | 4.499872 | 4.499872 | 20.24885 |
| 1956 | 115.3166155 | 114.7915205 | 0.525095 | 0.525095 | 0.275725 |
|  | SUM |  |  | 32.02563 | 207.6602 |

MAD =  =  = 4.00

The mean absolute deviation is 4.00.

Diff: 2

Blooms: Apply

AACSB: Analytic Skills

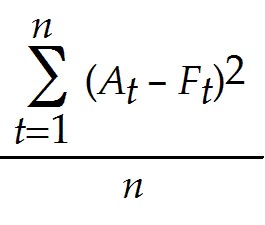
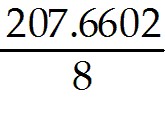
Topic: Forecasting Models for Stationary Time Series

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

44) Setting *k* = 3, determine the value of root mean square of errors.

Answer:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Real Home Price Index | *F*t | *At* — *Ft* | |*At* — *Ft*| | (*At* — *Ft*)2 |
| 1946 | 106.5058955 |  |  |  |  |
| 1947 | 109.3296707 |  |  |  |  |
| 1948 | 101.2225795 |  |  |  |  |
| 1949 | 100.0466076 | 105.6860486 | -5.63944 | 5.639441 | 31.80329 |
| 1950 | 105.8948393 | 103.5329526 | 2.361887 | 2.361887 | 5.578509 |
| 1951 | 103.8986687 | 102.3880088 | 1.51066 | 1.51066 | 2.282093 |
| 1952 | 103.9743275 | 103.2800385 | 0.694289 | 0.694289 | 0.482037 |
| 1953 | 114.7133093 | 104.5892785 | 10.12403 | 10.12403 | 102.496 |
| 1954 | 114.199126 | 107.5287685 | 6.670358 | 6.670358 | 44.49367 |
| 1955 | 115.4621261 | 110.9622543 | 4.499872 | 4.499872 | 20.24885 |
| 1956 | 115.3166155 | 114.7915205 | 0.525095 | 0.525095 | 0.275725 |
|  | SUM |  |  | 32.02563 | 207.66 |

MSE =  =  = 25.95752173

RMSE = = 5.09

The value of root mean square errors is 5.09.

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

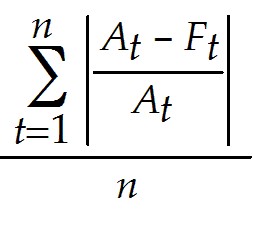
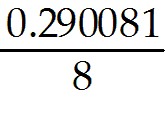
Topic: Forecasting Models for Stationary Time Series

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

45) Setting *k* = 3, determine the value of mean absolute percentage of error.

Answer:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Real Home Price Index | *F*t | *At* — *Ft* | |*At* — *Ft*| |  |
| 1946 | 106.5058955 |  |  |  |  |
| 1947 | 109.3296707 |  |  |  |  |
| 1948 | 101.2225795 |  |  |  |  |
| 1949 | 100.0466076 | 105.6860486 | -5.63944 | 5.639441 | 0.056368 |
| 1950 | 105.8948393 | 103.5329526 | 2.361887 | 2.361887 | 0.022304 |
| 1951 | 103.8986687 | 102.3880088 | 1.51066 | 1.51066 | 0.01454 |
| 1952 | 103.9743275 | 103.2800385 | 0.694289 | 0.694289 | 0.006678 |
| 1953 | 114.7133093 | 104.5892785 | 10.12403 | 10.12403 | 0.088255 |
| 1954 | 114.199126 | 107.5287685 | 6.670358 | 6.670358 | 0.05841 |
| 1955 | 115.4621261 | 110.9622543 | 4.499872 | 4.499872 | 0.038973 |
| 1956 | 115.3166155 | 114.7915205 | 0.525095 | 0.525095 | 0.004554 |
|  | SUM |  |  | 32.02563 | 0.290081 |

MAPE =  × 100 =  × 100 = 3.63

The value of mean absolute percentage of error is 3.63.

Diff: 3

Blooms: Apply

AACSB: Analytic Skills

Topic: Forecasting Models for Stationary Time Series

LO1: State three error metrics used for measuring forecast accuracy and explain the differences among them.

46) Indicators are measures that are believed to influence the behavior of a variable an individual wishes to forecast.

Answer: TRUE

Diff: 1

Blooms: Remember

Topic: Qualitative and Judgmental Forecasting

LO1: Explain how judgmental approaches are used for forecasting.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

**47) The indexes in the forecasting indicators provide a complete forecast.**

**Answer: FALSE**

**Diff: 1**

Blooms: Remember

Topic: Qualitative and Judgmental Forecasting

LO1: Explain how judgmental approaches are used for forecasting.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

**48) A cyclical effect is one that repeats at fixed intervals of time, typically a year, month, week, or day.**

**Answer: FALSE**

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: Apply moving average and exponential smoothing models to stationary time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

**49) The Holt-Winters additive model applies to time series whose amplitude increases or decreases over time.**

**Answer: FALSE**

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: Use Holt-Winters and regression models to forecast time series with seasonality.

**50) If a time series has seasonality but no trend, the most appropriate model used for forecasting is the Holt-Winters multiplicative model.**

**Answer: FALSE**

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: Use Holt-Winters and regression models to forecast time series with seasonality.

51) Write a short note on indicators and indexes used in forecasting.

Answer: Indicators are measures that are believed to influence the behavior of a variable an individual wishes to forecast. By monitoring changes in indicators, the individual expects to gain insight about the future behavior of the variable to help forecast the future.

Indicators are often combined quantitatively into an index, a single measure that weights multiple indicators, thus providing a measure of overall expectation. For example, financial analysts use the Dow Jones Industrial Average as an index of general stock market performance. Indexes do not provide a complete forecast, but rather a better picture of direction of change, and thus play an important role in judgmental forecasting.

Diff: 1

Blooms: Remember

Topic: Qualitative and Judgmental Forecasting

LO1: Explain how judgmental approaches are used for forecasting.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

52) What is simple exponential smoothing?

Answer: A versatile, yet highly effective approach for short-range forecasting is simple exponential smoothing. The basic simple exponential smoothing model is:

*Ft*+1 = (1 - *α*)*Ft* + *a*A*t*

*Ft*+1= *Ft* + *α*(A*t* - *Ft*)

where *Ft*+1 is the forecast for time period t *+* 1*, Ft* is the forecast for period *t, At* is the observed value in period *t*, and α is a constant between 0 and 1 called the smoothing constant.

Diff: 1

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: Apply moving average and exponential smoothing models to stationary time series.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

53) Explain the significance of using double moving average and double exponential smoothing models.

Answer: For time series with a linear trend but no significant seasonal components, double moving average and double exponential smoothing models are more appropriate than using simple moving average or exponential smoothing models. Both methods are based on the linear trend equation:

*Ft*+*k* = *at* + *bt*k

That is, the forecast for *k* periods into the future from period *t* is a function of a base value *at,* also known as the level, and a trend, or slope, *bt*. Double moving average and double exponential smoothing differ in how the data are used to arrive at appropriate values for *at* and *bt*.

In double exponential smoothing, the estimates of *at* and *bt* are obtained from the following equations:

*at* = α*Ft* + (1 - *α*)(*at*-1 + *bt-1*)

*bt* = β(*αt* - *at*-1) + (1 - β)*bt-1*)

Diff: 2

Blooms: Remember

Topic: Forecasting Models for Time Series with a Linear Trend

LO1: Apply double exponential smoothing models to time series with a linear trend.

LO2: Discuss the applications of time-series forecasting, trend models, and qualitative approaches

54) Explain the different types of Holt-Winters models used in forecasting.

Answer: Holt-Winters models are similar to exponential smoothing models in that smoothing constants are used to smooth out variations in the level and seasonal patterns over time. For time series with seasonality but no trend, *XLMiner* supports a Holt-Winters method but does not have the ability to optimize the parameters.

Many time series exhibit both trend and seasonality. Such might be the case for growing sales of a seasonal product. These models combine elements of both the trend and seasonal models. Two types of Holt-Winters smoothing models are often used.

The Holt-Winters additive model is based on the equation:

*Ft*+1 = *at* + *bt* + S*t*–*s+1*

and the Holt-Winters multiplicative model is:

*Ft*+1 = (*at* + *bt)*S*t*–*s+1*

The additive model applies to time series with relatively stable seasonality, while the multiplicative model applies to time series whose amplitude increases or decreases over time. Therefore, a chart of the time series should be viewed first to identify the appropriate type of model to use. Three parameters, α, *β* , and γ, are used to smooth the level, trend, and seasonal factors in the time series. *XLMiner* supports both models.

Diff: 2

Blooms: Remember

Topic: Statistical Forecasting Models

LO1: Use Holt-Winters and regression models to forecast time series with seasonality. Apply Holt-Winters forecasting models to time series with both trend and seasonality.

55) Explain econometric models used in forecasting with examples.

Answer: Student examples may vary.

Explanatory/causal models, often called econometric models, seek to identify factors that explain statistically the patterns observed in the variable being forecast, usually with regression analysis. For instance, a manufacturer of hospital equipment might include such variables as hospital capital spending and changes in the proportion of people over the age of 65 in building models to forecast future sales.

Diff: 1

Blooms: Remember

Topic: Regression Forecasting with Causal Variables

LO1: Explain how regression techniques can be used to forecast with explanatory or causal variables.