

Operations Management, 10e (Heizer/Render)
Chapter 4 Forecasting

1) A naïve forecast for September sales of a product would be equal to the forecast for August.

Answer: FALSE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

2) The forecasting time horizon and the forecasting techniques used tend to vary over the life cycle of a product.

Answer: TRUE

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

3) Demand (sales) forecasts serve as inputs to financial, marketing, and personnel planning.

Answer: TRUE

Diff: 2

Topic: Types of forecasts

Objective: LO4-1

4) Forecasts of individual products tend to be more accurate than forecasts of product families.

Answer: FALSE

Diff: 2

Topic: Seven steps in the forecasting system

Objective: LO4-1

5) Most forecasting techniques assume that there is some underlying stability in the system.

Answer: TRUE

Diff: 2

Topic: Seven steps in the forecasting system

Objective: LO4-1

6) The sales force composite forecasting method relies on salespersons' estimates of expected sales.

Answer: TRUE

Diff: 1

Topic: Forecasting approaches

Objective: LO4-2

7) A time-series model uses a series of past data points to make the forecast.

Answer: TRUE

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

8) The quarterly "make meeting" of Lexus dealers is an example of a sales force composite forecast.

Answer: TRUE

Diff: 1

Topic: Forecasting approaches

Objective: LO4-2

9) Cycles and random variations are both components of time series.

Answer: TRUE

Diff: 1

Topic: Time-series forecasting

Objective: LO4-3

10) A naive forecast for September sales of a product would be equal to the sales in August.

Answer: TRUE

Diff: 1

Topic: Time-series forecasting

Objective: LO4-3

11) One advantage of exponential smoothing is the limited amount of record keeping involved.

Answer: TRUE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

12) The larger the number of periods in the simple moving average forecasting method, the greater the method's responsiveness to changes in demand.

Answer: FALSE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

13) Mean Squared Error and Coefficient of Correlation are two measures of the overall error of a forecasting model.

Answer: FALSE

Diff: 1

Topic: Time-series forecasting

Objective: LO4-4

14) In trend projection, the trend component is the slope of the regression equation.

Answer: TRUE

Diff: 1

Topic: Time-series forecasting

Objective: LO4-3

15) In trend projection, a negative regression slope is mathematically impossible.

Answer: FALSE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

16) Seasonal indices adjust raw data for patterns that repeat at regular time intervals.

Answer: TRUE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-5

17) The best way to forecast a business cycle is by finding a leading variable.

Answer: TRUE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

18) Linear-regression analysis is a straight-line mathematical model to describe the functional relationships between independent and dependent variables.

Answer: TRUE

Diff: 1

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-6

19) The larger the standard error of the estimate, the more accurate the forecasting model.

Answer: FALSE

Diff: 1

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-4

20) A trend projection equation with a slope of 0.78 means that there is a 0.78 unit rise in Y for every unit of time that passes.

Answer: TRUE

Diff: 2

Topic: Time-series forecasting: Trend projections

Objective: LO4-6

21) In a regression equation where Y is demand and X is advertising, a coefficient of determination (R^2) of .70 means that 70% of the variance in advertising is explained by demand.

Answer: FALSE

Diff: 2

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-6

22) Demand cycles for individual products can be driven by product life cycles.

Answer: TRUE

Diff: 2

Topic: Time-series forecasting

Objective: LO4-5

23) If a forecast is consistently greater than (or less than) actual values, the forecast is said to be biased.

Answer: TRUE

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-4

24) Focus forecasting tries a variety of computer models and selects the best one for a particular application.

Answer: TRUE

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-4

25) Many service firms use point-of-sale computers to collect detailed records needed for accurate short-term forecasts.

Answer: TRUE

Diff: 2

Topic: Forecasting in the service sector

Objective: LO4-4

26) Economic forecasts drive a company's projections for production.

Answer: FALSE

Diff: 1

Topic: Types of forecasts

Objective: LO4-1

27) Regression lines graphically depict "cause-and-effect" relationships.

Answer: FALSE

Diff: 2

Topic: Correlation coefficients for regression lines

Objective: LO4-6

28) What two numbers are contained in the daily report to the CEO of Walt Disney Parks & Resorts regarding the six Orlando parks?

A) yesterday's forecasted attendance and yesterday's actual attendance

B) yesterday's actual attendance and today's forecasted attendance

C) yesterday's forecasted attendance and today's forecasted attendance

D) yesterday's actual attendance and last year's actual attendance

E) yesterday's forecasted attendance and the year-to-date average daily forecast error

Answer: A

Diff: 2

Topic: Global company profile

Objective: no LO

29) Forecasts

A) become more accurate with longer time horizons

B) are rarely perfect

C) are more accurate for individual items than for groups of items

D) all of the above

E) none of the above

Answer: B

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

30) One use of short-range forecasts is to determine

- A) production planning
- B) inventory budgets
- C) research and development plans
- D) facility location
- E) job assignments

Answer: E

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

31) Forecasts are usually classified by time horizon into three categories

- A) short-range, medium-range, and long-range
- B) finance/accounting, marketing, and operations
- C) strategic, tactical, and operational
- D) exponential smoothing, regression, and time series
- E) departmental, organizational, and industrial

Answer: A

Diff: 1

Topic: What is forecasting?

Objective: LO4-1

32) A forecast with a time horizon of about 3 months to 3 years is typically called a

- A) long-range forecast
- B) medium-range forecast
- C) short-range forecast
- D) weather forecast
- E) strategic forecast

Answer: B

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

33) Forecasts used for new product planning, capital expenditures, facility location or expansion, and R&D typically utilize a

- A) short-range time horizon
- B) medium-range time horizon
- C) long-range time horizon
- D) naive method, because there is no data history
- E) all of the above

Answer: C

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

34) The three major types of forecasts used by business organizations are

- A) strategic, tactical, and operational
- B) economic, technological, and demand
- C) exponential smoothing, Delphi, and regression
- D) causal, time-series, and seasonal
- E) departmental, organizational, and territorial

Answer: B

Diff: 2

Topic: Types of forecasts

Objective: LO4-2

35) Which of the following is not a step in the forecasting process?

- A) Determine the use of the forecast.
- B) Eliminate any assumptions.
- C) Determine the time horizon.
- D) Select forecasting model.
- E) Validate and implement the results.

Answer: B

Diff: 2

Topic: The strategic importance of forecasting

Objective: LO4-2

36) The two general approaches to forecasting are

- A) qualitative and quantitative
- B) mathematical and statistical
- C) judgmental and qualitative
- D) historical and associative
- E) judgmental and associative

Answer: A

Diff: 1

Topic: Forecasting approaches

Objective: LO4-2

37) Which of the following uses three types of participants: decision makers, staff personnel, and respondents?

- A) executive opinions
- B) sales force composites
- C) the Delphi method
- D) consumer surveys
- E) time series analysis

Answer: C

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

- 38) The forecasting model that pools the opinions of a group of experts or managers is known as the
- A) sales force composition model
 - B) multiple regression
 - C) jury of executive opinion model
 - D) consumer market survey model
 - E) management coefficients model

Answer: C

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

- 39) Which of the following is not a type of qualitative forecasting?

- A) executive opinions
- B) sales force composites
- C) consumer surveys
- D) the Delphi method
- E) moving average

Answer: E

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

- 40) Which of the following techniques uses variables such as price and promotional expenditures, which are related to product demand, to predict demand?

- A) associative models
- B) exponential smoothing
- C) weighted moving average
- D) simple moving average
- E) time series

Answer: A

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

- 41) Which of the following statements about time-series forecasting is true?

- A) It is based on the assumption that future demand will be the same as past demand.
- B) It makes extensive use of the data collected in the qualitative approach.
- C) The analysis of past demand helps predict future demand.
- D) Because it accounts for trends, cycles, and seasonal patterns, it is more powerful than causal forecasting.
- E) All of the above are true.

Answer: C

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

42) Time-series data may exhibit which of the following behaviors?

- A) trend
- B) random variations
- C) seasonality
- D) cycles
- E) They may exhibit all of the above.

Answer: E

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

43) Gradual, long-term movement in time-series data is called

- A) seasonal variation
- B) cycles
- C) trends
- D) exponential variation
- E) random variation

Answer: C

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

44) Which of the following is not present in a time series?

- A) seasonality
- B) operational variations
- C) trend
- D) cycles
- E) random variations

Answer: B

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

45) The fundamental difference between cycles and seasonality is the

- A) duration of the repeating patterns
- B) magnitude of the variation
- C) ability to attribute the pattern to a cause
- D) all of the above
- E) none of the above

Answer: A

Diff: 2

Topic: Time-series forecasting

Objective: LO4-5

46) In time series, which of the following cannot be predicted?

- A) large increases in demand
- B) technological trends
- C) seasonal fluctuations
- D) random fluctuations
- E) large decreases in demand

Answer: D

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

47) What is the approximate forecast for May using a four-month moving average?

Nov.	Dec.	Jan.	Feb.	Mar.	April
39	36	40	42	48	46

- A) 38
- B) 42
- C) 43
- D) 44
- E) 47

Answer: D

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

48) Which time-series model below assumes that demand in the next period will be equal to the most recent period's demand?

- A) naive approach
- B) moving average approach
- C) weighted moving average approach
- D) exponential smoothing approach
- E) none of the above

Answer: A

Diff: 1

Topic: Time-series forecasting

Objective: LO4-3

49) John's House of Pancakes uses a weighted moving average method to forecast pancake sales. It assigns a weight of 5 to the previous month's demand, 3 to demand two months ago, and 1 to demand three months ago. If sales amounted to 1000 pancakes in May, 2200 pancakes in June, and 3000 pancakes in July, what should be the forecast for August?

- A) 2400
- B) 2511
- C) 2067
- D) 3767
- E) 1622

Answer: B

Diff: 2

Topic: Time series forecasting

AACSB: Analytic Skills

Objective: LO4-3

50) A six-month moving average forecast is better than a three-month moving average forecast if demand

- A) is rather stable
- B) has been changing due to recent promotional efforts
- C) follows a downward trend
- D) follows a seasonal pattern that repeats itself twice a year
- E) follows an upward trend

Answer: A

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

51) Increasing the number of periods in a moving average will accomplish greater smoothing, but at the expense of

- A) manager understanding
- B) accuracy
- C) stability
- D) responsiveness to changes
- E) All of the above are diminished when the number of periods increases.

Answer: D

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

52) Which of the following statements comparing the weighted moving average technique and exponential smoothing is **true**?

- A) Exponential smoothing is more easily used in combination with the Delphi method.
- B) More emphasis can be placed on recent values using the weighted moving average.
- C) Exponential smoothing is considerably more difficult to implement on a computer.
- D) Exponential smoothing typically requires less record keeping of past data.
- E) Exponential smoothing allows one to develop forecasts for multiple periods, whereas weighted moving averages does not.

Answer: D

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

53) Which time-series model uses past forecasts and past demand data to generate a new forecast?

- A) naive
- B) moving average
- C) weighted moving average
- D) exponential smoothing
- E) regression analysis

Answer: D

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

54) Which is **not** a characteristic of exponential smoothing?

- A) smoothes random variations in the data
- B) easily altered weighting scheme
- C) weights each historical value equally
- D) has minimal data storage requirements
- E) None of the above; they are all characteristics of exponential smoothing.

Answer: C

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

55) Which of the following smoothing constants would make an exponential smoothing forecast equivalent to a naive forecast?

- A) 0
- B) 1 divided by the number of periods
- C) 0.5
- D) 1.0
- E) cannot be determined

Answer: D

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

56) Given an actual demand of 103, a previous forecast value of 99, and an alpha of .4, the exponential smoothing forecast for the next period would be

- A) 94.6
- B) 97.4
- C) 100.6
- D) 101.6
- E) 103.0

Answer: C

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

57) A forecast based on the previous forecast plus a percentage of the forecast error is a(n)

- A) qualitative forecast
- B) naive forecast
- C) moving average forecast
- D) weighted moving average forecast
- E) exponentially smoothed forecast

Answer: E

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

58) Given an actual demand of 61, a previous forecast of 58, and an α of .3, what would the forecast for the next period be using simple exponential smoothing?

- A) 45.5
- B) 57.1
- C) 58.9
- D) 61.0
- E) 65.5

Answer: C

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

59) Which of the following values of alpha would cause exponential smoothing to respond the most slowly to forecast errors?

- A) 0.10
- B) 0.20
- C) 0.40
- D) 0.80
- E) cannot be determined

Answer: A

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

60) A forecasting method has produced the following over the past five months. What is the mean absolute deviation?

Actual	Forecast	Error	Error
10	11	-1	1
8	10	-2	2
10	8	2	2
6	6	0	0
9	8	1	1

- A) -0.2
- B) -1.0
- C) 0.0
- D) 1.2
- E) 8.6

Answer: D

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-4

61) The primary purpose of the mean absolute deviation (MAD) in forecasting is to

- A) estimate the trend line
- B) eliminate forecast errors
- C) measure forecast accuracy
- D) seasonally adjust the forecast
- E) all of the above

Answer: C

Diff: 2

Topic: Time-series forecasting

Objective: LO4-4

62) Given forecast errors of -1, 4, 8, and -3, what is the mean absolute deviation?

- A) 2
- B) 3
- C) 4
- D) 8
- E) 16

Answer: C

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-4

63) The last four months of sales were 8, 10, 15, and 9 units. The last four forecasts were 5, 6, 11, and 12 units. The Mean Absolute Deviation (MAD) is

- A) 2
- B) -10
- C) 3.5
- D) 9
- E) 10.5

Answer: C

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-4

64) A time series trend equation is $25.3 + 2.1 X$. What is your forecast for period 7?

- A) 23.2
- B) 25.3
- C) 27.4
- D) 40.0
- E) cannot be determined

Answer: D

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

65) For a given product demand, the time series trend equation is $53 - 4 X$. The negative sign on the slope of the equation

- A) is a mathematical impossibility
- B) is an indication that the forecast is biased, with forecast values lower than actual values
- C) is an indication that product demand is declining
- D) implies that the coefficient of determination will also be negative
- E) implies that the cumulative error will be negative

Answer: C

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

66) Yamaha manufactures which set of products with complementary demands to address seasonal fluctuations?

- A) golf clubs and skis
- B) swimming suits and winter jackets
- C) jet skis and snowmobiles
- D) pianos and guitars
- E) ice skates and water skis

Answer: C

Diff: 2

Topic: Time-series forecasting

Objective: LO4-5

67) Which of the following is **true** regarding the two smoothing constants of the Forecast Including Trend (FIT) model?

- A) One constant is positive, while the other is negative.
- B) They are called MAD and cumulative error.
- C) Alpha is always smaller than beta.
- D) One constant smoothes the regression intercept, whereas the other smoothes the regression slope.
- E) Their values are determined independently.

Answer: E

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

68) Demand for a certain product is forecast to be 800 units per month, averaged over all 12 months of the year. The product follows a seasonal pattern, for which the January monthly index is 1.25. What is the seasonally-adjusted sales forecast for January?

Answer: FALSE

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

69) A seasonal index for a monthly series is about to be calculated on the basis of three years' accumulation of data. The three previous July values were 110, 150, and 130. The average over all months is 190. The approximate seasonal index for July is

- A) 0.487
- B) 0.684
- C) 1.462
- D) 2.053
- E) cannot be calculated with the information given

Answer: B

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

70) A fundamental distinction between trend projection and linear regression is that

- A) trend projection uses least squares while linear regression does not
- B) only linear regression can have a negative slope
- C) in trend projection the independent variable is time; in linear regression the independent variable need not be time, but can be any variable with explanatory power
- D) linear regression tends to work better on data that lack trends
- E) trend projection uses two smoothing constants, not just one

Answer: C

Diff: 2

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-6

71) The degree or strength of a relationship between two variables is shown by the

- A) alpha
- B) mean
- C) mean absolute deviation
- D) correlation coefficient
- E) cumulative error

Answer: D

Diff: 2

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-6

72) If two variables were perfectly correlated, the correlation coefficient r would equal

- A) 0
- B) -1
- C) 1
- D) B or C
- E) none of the above

Answer: D

Diff: 2

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-6

73) The last four weekly values of sales were 80, 100, 105, and 90 units. The last four forecasts were 60, 80, 95, and 75 units. These forecasts illustrate

- A) qualitative methods
- B) adaptive smoothing
- C) slope
- D) bias
- E) trend projection

Answer: D

Diff: 1

Topic: Monitoring and controlling forecasts

Objective: LO4-7

74) The tracking signal is the

- A) standard error of the estimate
- B) absolute deviation of the last periods forecast
- C) mean absolute deviation (MAD)
- D) ratio of cumulative error/MAD
- E) mean absolute percentage error (MAPE)

Answer: D

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-7

75) Computer monitoring of tracking signals and self-adjustment if a signal passes a preset limit is characteristic of

- A) exponential smoothing including trend
- B) adaptive smoothing
- C) trend projection
- D) focus forecasting
- E) multiple regression analysis

Answer: B

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-7

76) Many services maintain records of sales noting

- A) the day of the week
- B) unusual events
- C) weather
- D) holidays
- E) all of the above

Answer: E

Diff: 2

Topic: Forecasting in the service sector

Objective: LO4-2

77) Taco Bell's unique employee scheduling practices are partly the result of using

- A) point-of-sale computers to track food sales in 15 minute intervals
- B) focus forecasting
- C) a six-week moving average forecasting technique
- D) multiple regression
- E) A and C are both correct.

Answer: E

Diff: 2

Topic: Forecasting in the service sector

Objective: LO4-3

78) Long-range forecasting is generally done in planning for

- A) job scheduling
- B) production levels
- C) cash budgeting
- D) capital expenditures
- E) planning purchasing

Answer: D

Diff: 2

Topic: Forecasting time horizons

Objective: LO4-1

79) Short-range forecasting tends to be _____ than longer-range forecasts

- A) less accurate
- B) more accurate
- C) about the same
- D) significantly more difficult
- E) significantly less difficult

Answer: B

Diff: 2

Topic: Forecasting time horizons

Objective: LO4-1

80) _____ expresses the error as a percent of the actual values, undistorted by a single large value.

- A) MAD
- B) MSE
- C) MAPE
- D) FIT
- E) The smoothing constant

Answer: C

Diff: 2

Topic: Measuring forecast error

Objective: LO4-4

81) If Brandon Edward were working to develop a forecast using a moving averages approach, but he noticed a detectable trend in the historical data, he should

- A) use weights to place more emphasis on recent data
- B) use weights to minimize the importance of the trend
- C) change to a naïve approach
- D) use a simple moving average
- E) change to a qualitative approach

Answer: A

Diff: 2

Topic: Moving averages

Objective: LO4-3

82) _____ forecasts are concerned with rates of technological progress, which can result in the birth of exciting new products, requiring new plants and equipment.

Answer: Technological

Diff: 1

Topic: Types of forecasts

Objective: LO4-1

83) _____ forecasts address the business cycle by predicting inflation rates, money supplies, housing starts, and other planning indicators.

Answer: Economic

Diff: 2

Topic: Types of forecasts

Objective: LO4-1

84) Demand forecasts, also called _____ forecasts, are projections of demand for a company's products or services.

Answer: sales

Diff: 2

Topic: Types of forecasts

Objective: LO4-1

85) _____ forecasts employ one or more mathematical models that rely on historical data and/or associative variables to forecast demand.

Answer: Quantitative

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

86) _____ is a forecasting technique based upon salespersons' estimates of expected sales.

Answer: Sales force composite

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

87) _____ forecasts use a series of past data points to make a forecast.

Answer: Time-series

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

88) A(n) _____ forecast uses an average of the most recent periods of data to forecast the next period.

Answer: moving average

Diff: 2

Topic: Forecasting approaches

Objective: LO4-3

89) The smoothing constant is a weighting factor used in _____.

Answer: exponential smoothing

Diff: 2

Topic: Forecasting approaches

Objective: LO4-3

90) Linear regression is known as a(n) _____ because it incorporates variables or factors that might influence the quantity being forecast.

Answer: associative model

Diff: 1

Topic: Forecasting approaches

Objective: LO4-2

91) A measure of forecast error that does not depend on the magnitude of the item being forecast is the _____.

Answer: mean absolute percent error or MAPE

Diff: 1

Topic: Forecasting approaches

Objective: LO4-4

92) _____ is a measure of overall forecast error for a model.

Answer: MAD or Mean Absolute Deviation

Diff: 2

Topic: Forecasting approaches

Objective: LO4-4

93) When one constant is used to smooth the forecast average and a second constant is used to smooth the trend, the forecasting method is _____.

Answer: exponential smoothing with trend adjustment or trend-adjusted smoothing or second-order smoothing or double smoothing

Diff: 2

Topic: Forecasting approaches

Objective: LO4-3

94) _____ is a time-series forecasting method that fits a trend line to a series of historical data points and then projects the line into the future for forecasts.

Answer: Trend projection

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

95) The _____ measures the strength of the relationship between two variables.

Answer: coefficient of correlation

Diff: 2

Topic: Associative forecasting methods: Regression and correlation analysis

Objective: LO4-6

96) If a barbershop operator noted that Tuesday's business was typically twice as heavy as Wednesday's, and that Friday's business was typically the busiest of the week, business at the barbershop is subject to _____.

Answer: seasonal variations

Diff: 2

Topic: Forecasting approaches: Seasonal variations in data

Objective: LO4-5

97) _____ forecasting tries a variety of computer models and selects the best one for a particular application.

Answer: Focus

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-7

98) _____ are useful if we can assume that market demands will stay fairly steady over time.

Answer: Moving averages

Diff: 2

Topic: Moving averages

Objective: LO4-3

99) An approach to exponential smoothing in which the smoothing constant is automatically changed to keep errors to a minimum is called _____.

Answer: adaptive smoothing

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-3

100) A skeptical manager asks what short-range forecasts can be used for. Give her three possible uses/purposes.

Answer: Any three of: planning purchasing, job scheduling, work force levels, job assignments, production levels.

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

101) A skeptical manager asks what long-range forecasts can be used for. Give her three possible uses/purposes.

Answer: Any three of: planning new products, capital expenditures, facility location or expansion, research and development.

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

102) Describe the three forecasting time horizons and their use.

Answer: *Forecasting time horizons* are: short range—generally less than three months, used for purchasing, job scheduling, work force levels, production levels; medium range—usually from three months up to three years, used for sales planning, production planning and budgeting, cash budgeting, analyzing operating plans; long range—usually three years or more, used for new product development, capital expenditures, facility planning, and R&D.

Diff: 2

Topic: What is forecasting?

Objective: LO4-1

103) List and briefly describe the three major types of forecasts.

Answer: The three types are economic, technological, and demand; economic refers to macroeconomic, growth and financial variables; technological refers to forecasting amount of technological advance, or futurism; demand refers to product demand.

Diff: 2

Topic: Types of forecasts

Objective: LO4-2

104) Identify the seven steps involved in forecasting.

Answer:

1. Determine the use of the forecast.
2. Select the items that are to be forecast.
3. Determine the time horizon of the forecast.
4. Select the forecasting model(s).
5. Gather the data needed to make the forecast.
6. Make the forecast.
7. Validate the forecasting mode and implement the results.

Diff: 2

Topic: Seven steps in the forecasting system

Objective: LO4-2

105) What are the realities of forecasting that companies face?

Answer: First, forecasts are seldom perfect. Second, most forecasting techniques assume that there is some underlying stability in the system. Finally, both product family and aggregated forecasts are more accurate than individual product forecasts.

Diff: 2

Topic: Seven steps in the forecasting system

Objective: LO4-2

106) What are the differences between quantitative and qualitative forecasting methods?

Answer: Quantitative methods use mathematical models to analyze historical data. Qualitative methods incorporate such factors as the decision maker's intuition, emotions, personal experiences, and value systems in determining the forecast.

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

107) Identify four quantitative forecasting methods.

Answer: The list includes naive, moving averages, exponential smoothing, trend projection, and linear regression.

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

108) What is a time-series forecasting model?

Answer: A *time-series* forecasting model is any mathematical model that uses historical values of the quantity of interest to predict future values of that quantity.

Diff: 1

Topic: Forecasting approaches

Objective: LO4-2

109) What is the difference between an associative model and a time-series model?

Answer: A *time-series* model uses only historical values of the quantity of interest to predict future values of that quantity. The *associative* model, on the other hand, attempts to identify underlying factors that control the variation of the quantity of interest, predict future values of these factors, and use these predictions in a model to predict future values of the specific quantity of interest.

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

110) Name and discuss three qualitative forecasting methods.

Answer: *Qualitative forecasting methods* include: jury of executive opinion, where high-level managers arrive at a group estimate of demand; sales force composite, where salespersons' estimates are aggregated; Delphi method, where respondents provide inputs to a group of decision makers; the group of decision makers, often experts, then make the actual forecast; consumer market survey, where consumers are queried about their future purchase plans.

Diff: 2

Topic: Forecasting approaches

Objective: LO4-2

111) Identify four components of a time series. Which one of these is rarely forecast? Why is this so?

Answer: Trend, seasonality, cycles, and random variation. Since random variations follow no discernible pattern, they cannot be predicted, and thus are not forecast.

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

112) Compare seasonal effects and cyclical effects.

Answer: A cycle is longer (typically several years) than a season (typically days, weeks, months, or quarters). A cycle has variable duration, while a season has fixed duration and regular repetition.

Diff: 2

Topic: Time-series forecasting

Objective: LO4-5

113) Distinguish between a moving average model and an exponential smoothing model.

Answer: Exponential smoothing is a weighted moving average model wherein previous values are weighted in a specific manner--in particular, all previous values are weighted with a set of weights that decline exponentially.

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

114) Describe three popular measures of forecast accuracy.

Answer: *Measures of forecast accuracy* include: (a) *MAD* (mean absolute deviation) is a sum of the absolute values of individual errors divided by the number of periods of data. (b) *MSE* (mean squared error) is the average of the squared differences between the forecast and observed values. (c) *MAPE* (mean absolute percent error) is independent of the magnitude of the variable being forecast.

Diff: 2

Topic: Forecasting approaches: Measuring forecast error

Objective: LO4-4

115) Give an example—other than a restaurant or other food-service firm—of an organization that experiences an hourly seasonal pattern. (That is, each hour of the day has a pattern that tends to repeat day after day.) Explain.

Answer: Answer will vary. However, two non-food examples would be banks and movie theaters.

Diff: 2

Topic: Time-series forecasting

AACSB: Reflective Thinking

Objective: LO4-5

116) Explain the role of regression models (time series and otherwise) in forecasting. That is, how is trend projection able to forecast? How is regression used for causal forecasting?

Answer: For trend projection, the independent variable is time. The trend projection equation has a slope that is the change in demand per period. To forecast the demand for period t , perform the calculation $a + bt$. For causal forecasting, the independent variables are predictors of the forecast value or dependent variable. The slope of the regression equation is the change in the Y variable per unit change in the X variable.

Diff: 3

Topic: Time-series forecasting

Objective: LO4-6

117) Identify three advantages of the moving average forecasting model. Identify three disadvantages of the moving average forecasting model.

Answer: Three advantages of the model are that it uses simple calculations, it smoothes out sudden fluctuations, and it is easy for users to understand. The disadvantages are that the averages always stay within past ranges, that they require extensive record keeping of past data, and that they do not pick up on trends very well.

Diff: 2

Topic: Time-series forecasting

Objective: LO4-3

118) What does it mean to "decompose" a time series?

Answer: To *decompose a time series* means to break past data down into components of trends, seasonality, cycles, and random blips, and to project them forward.

Diff: 1

Topic: Time-series forecasting

Objective: LO4-3

119) Distinguish a dependent variable from an independent variable.

Answer: The independent variable is related to some behavior in the dependent variable; the dependent variable shows the effect of changes in the independent variable.

Diff: 2

Topic: Associative forecasting methods: Regression and correlation

Objective: LO4-6

120) Explain, in your own words, the meaning of the coefficient of determination.

Answer: The coefficient of determination measures the amount (percent) of total variation in the data that is explained by the model.

Diff: 2

Topic: Associative forecasting methods: Regression and correlation

Objective: LO4-6

121) What is a tracking signal? Explain the connection between adaptive smoothing and tracking signals.
Answer: A tracking signal is a measure of how well the forecast actually predicts. The larger the absolute tracking signal, the worse the forecast is performing. Adaptive smoothing sets limits to the tracking signal, and makes changes to its forecasting models when the tracking signal goes beyond those limits.

Diff: 2

Topic: Monitoring and controlling forecasts

Objective: LO4-7

122) What is focus forecasting?

Answer: It is a forecasting method that tries a variety of computer models, and selects the one that is best for a particular application.

Diff: 1

Topic: Monitoring and controlling forecasts

Objective: LO4-7

123) What is the key difference between weighted moving average and simple moving average approaches to forecasting?

Answer: Simple moving averages are useful where there is no identifiable trend in the historical data, i.e. demand has been fairly steady over time. If there was an identifiable trend, weighted moving averages would provide a more accurate forecast since higher weights would be put on the most recent data.

Diff: 2

Topic: Time series forecasting; Moving averages

Objective: LO4-3

124) Weekly sales of ten-grain bread at the local organic food market are in the table below. Based on this data, forecast week 9 using a five-week moving average.

<u>Week</u>	<u>Sales</u>
1	415
2	389
3	420
4	382
5	410
6	432
7	405
8	421

Answer: $(382+410+432+405+421)/5 = 410.0$

Diff: 1

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

125) Given the following data, calculate the three-year moving averages for years 4 through 10.

Year	Demand
1	74
2	90
3	59
4	91
5	140
6	98
7	110
8	123
9	99

Answer:

Year	Demand	3-Year Moving Ave.
1	74	
2	90	
3	59	
4	91	74.33
5	140	80.00
6	98	96.67
7	110	109.67
8	123	116.00
9	99	110.33
		110.67

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

126) What is the forecast for May based on a weighted moving average applied to the following past demand data and using the weights: 4, 3, 2 (largest weight is for most recent data)?

Nov.	Dec.	Jan.	Feb.	Mar.	April
37	36	40	42	47	43

Answer: $2 \times 42 + 3 \times 47 + 4 \times 43 = 84 + 141 + 172 = 397$; $397/9 = 44.1$

Diff: 1

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

127) Weekly sales of copy paper at Cubicle Suppliers are in the table below. Compute a three-period moving average and a four-period moving average for weeks 5, 6, and 7. Compute MAD for each forecast. Which model is more accurate? Forecast week 8 with the more accurate method.

<u>Week</u>	<u>Sales (cases)</u>
1	17
2	21
3	27
4	31
5	19
6	17
7	21

Answer:

Week	Sales (cases)	3MA	error	4MA	error
1	17				
2	21				
3	27				
4	31	21.7	9.3		
5	19	26.3	7.3	24.0	5.0
6	17	25.7	8.7	24.5	7.5
7	21	22.3	1.3	23.5	2.5
8		19.0		22.0	

The four-week moving average is more accurate. The forecast with the 4-moving average is 22.0.

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-4

128) The last four weekly values of sales were 80, 100, 105, and 90 units. The last four forecasts (for the same four weeks) were 60, 80, 95, and 75 units. Calculate MAD, MSE, and MAPE for these four weeks.

Sales	Forecast	Error	Error squared	Pct. error
80	60	20	400	.25
100	80	20	400	.20
105	95	10	100	.095
90	75	15	225	.167

Answer: $MAD = 65/4 = 16.25$; $MSE = 1125/4 = 281.25$; $MAPE = 0.712/4 = .178$ or 17.8%

Diff: 2

Topic: Time series forecasting: Measuring forecast error

AACSB: Analytic Skills

Objective: LO4-4

129) A management analyst is using exponential smoothing to predict merchandise returns at an upscale branch of a department store chain. Given an actual number of returns of 154 items in the most recent period completed, a forecast of 172 items for that period, and a smoothing constant of 0.3, what is the forecast for the next period? How would the forecast be changed if the smoothing constant were 0.6? Explain the difference in terms of alpha and responsiveness.

Answer: 166.6; 161.2 The larger the smoothing constant in an exponentially smoothed forecast, the more responsive the forecast.

Diff: 1

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

130) The following trend projection is used to predict quarterly demand: $Y = 250 - 2.5t$, where $t = 1$ in the first quarter. Seasonal (quarterly) indices are Quarter 1 = 1.5; Quarter 2 = 0.8; Quarter 3 = 1.1; and Quarter 4 = 0.6. What is the seasonally adjusted forecast for the next four quarters?

Answer:	<u>Quarter</u>	<u>Projection</u>	<u>Adjusted</u>
1	247.5	371.25	
2	245	196	
3	242.5	266.75	
4	240	144	

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

131) Jim's department at a local department store has tracked the sales of a product over the last ten weeks. Forecast demand using exponential smoothing with an alpha of 0.4, and an initial forecast of 28.0 for period 1. Calculate the MAD. What do you recommend?

Period	Demand
1	24
2	23
3	26
4	36
5	26
6	30
7	32
8	26
9	25
10	28

Answer: Period	Demand	Forecast	Error		Absolute
1	24	28.00			
2	23	26.40	-3.40		3.40
3	26	25.04	0.96		0.96
4	36	25.42	10.58		10.58
5	26	29.65	-3.65		3.65
6	30	28.19	1.81		1.81
7	32	28.92	3.08		3.08
8	26	30.15	-4.15		4.15
9	25	28.49	-3.49		3.49
10	28	27.09	0.91		0.91
		Total	2.64		32.03
		Average	0.29		3.56
			Bias		MAD

The tracking signal $RSFE/MAD = 2.64/3.56 = .742$ is low; therefore, keep using the forecasting method.

Diff: 2

Topic: Time-series forecasting, and monitoring and controlling forecasts

AACSB: Analytic Skills

Objective: LO4-4

132) Favors Distribution Company purchases small imported trinkets in bulk, packages them, and sells them to retail stores. They are conducting an inventory control study of all their items. The following data are for one such item, which is not seasonal.

- Use trend projection to estimate the relationship between time and sales (state the equation).
- Calculate forecasts for the first four months of the next year.

	1	2	3	4	5	6	7	8	9	10	11	12
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sales	51	55	54	57	50	68	66	59	67	69	75	73

Answer: The trend projection equation is $Y = 48.32 + 2.105 T$. The next four months are forecast to be 75.68, 77.79, 79.89, and 82.00.

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-6

133) Use exponential smoothing with trend adjustment to forecast deliveries for period 10. Let $\alpha = 0.4$, $\beta = 0.2$, and let the initial trend value be 4 and the initial forecast be 200.

<u>Period</u>	<u>Actual Demand</u>
1	200
2	212
3	214
4	222
5	236
6	221
7	240
8	244
9	250
10	266

Answer:

	<u>Actual</u>	<u>Forecast</u>	<u>Trend</u>	<u>FIT</u>
1	200	200.00	4.00	
2	212	202.40	3.68	206.08
3	214	208.45	4.15	212.60
4	222	213.16	4.27	217.43
5	236	219.26	4.63	223.89
6	221	228.73	5.60	234.33
7	240	229.00	4.53	233.53
8	244	236.12	5.05	241.17
9	250	242.30	5.28	247.58
10	266	248.55	5.47	254.02

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

134) A small family-owned restaurant uses a seven-day moving average model to determine manpower requirements. These forecasts need to be seasonalized because each day of the week has its own demand pattern. The seasonal indices for each day of the week are: Monday, 0.445; Tuesday, 0.791; Wednesday, 0.927; Thursday, 1.033; Friday, 1.422; Saturday, 1.478; and Sunday 0.903. Average daily demand based on the most recent moving average is 194 patrons. What is the seasonalized forecast for each day of next week?

Answer: The average value multiplied by each day's seasonal index. Monday: $194 \times .445 = 86$; Tuesday: $194 \times .791 = 153$; Wednesday: $194 \times .927 = 180$; Thursday: $194 \times 1.033 = 200$; Friday: $194 \times 1.422 = 276$; Saturday: $194 \times 1.478 = 287$; and Sunday: $194 \times .903 = 175$.

Diff: 2

Topic: Associative forecasting methods: Regression and correlation

AACSB: Analytic Skills

Objective: LO4-5

135) A restaurant has tracked the number of meals served at lunch over the last four weeks. The data shows little in terms of trends, but does display substantial variation by day of the week. Use the following information to determine the seasonal (daily) index for this restaurant.

	Week			
Day	1	2	3	4
Sunday	40	35	39	43
Monday	54	55	51	59
Tuesday	61	60	65	64
Wednesday	72	77	78	69
Thursday	89	80	81	79
Friday	91	90	99	95
Saturday	80	82	81	83

Answer:

<u>Day</u>	<u>Index</u>
Sunday	0.5627
Monday	0.7855
Tuesday	0.8963
Wednesday	1.0618
Thursday	1.1800
Friday	1.3444
Saturday	1.1692

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

136) A firm has modeled its experience with industrial accidents and found that the number of accidents per year (Y) is related to the number of employees (X) by the regression equation $Y = 3.3 + 0.049X$. R-Square is 0.68. The regression is based on 20 annual observations. The firm intends to employ 480 workers next year. How many accidents do you project? How much confidence do you have in that forecast?

Answer: $Y = 3.3 + 0.049 \times 480 = 3.3 + 23.52 = 26.82$ accidents. This is not a time series, so next year = year 21 is of no relevance. Confidence comes from the coefficient of determination; the model explains 68% of the variation in number of accidents, which seems respectable.

Diff: 2

Topic: Associative forecasting methods: Regression and correlation

AACSB: Analytic Skills

Objective: LO4-6

137) Demand for a certain product is forecast to be 8,000 units per month, averaged over all 12 months of the year. The product follows a seasonal pattern, for which the January monthly index is 1.25. What is the seasonally-adjusted sales forecast for January?

Answer: $8,000 \times 1.25 = 10,000$

Diff: 1

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

138) A seasonal index for a monthly series is about to be calculated on the basis of three years' accumulation of data. The three previous July values were 110, 135, and 130. The average over all months is 160. The approximate seasonal index for July is:

Answer: $(110 + 135 + 130)/3 = 125$; $125/160 = 0.781$

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

139) Marie Bain is the production manager at a company that manufactures hot water heaters. Marie needs a demand forecast for the next few years to help decide whether to add new production capacity. The company's sales history (in thousands of units) is shown in the table below. Use exponential smoothing with trend adjustment, to forecast demand for period 6. The initial forecast for period 1 was 11 units; the initial estimate of trend was 0. The smoothing constants are $\alpha = .3$ and $\beta = .3$

<u>Period</u>	<u>Actual</u>
1	12
2	15
3	16
4	16
5	18
6	20

Answer:

<u>Period</u>	<u>Actual</u>	<u>Forecast</u>	<u>Trend</u>	<u>FIT</u>
1	12	11.00	0.00	
2	15	11.30	0.09	11.39
3	16	12.47	0.41	12.89
4	16	13.82	0.69	14.52
5	18	14.96	0.83	15.79
6	20	16.45	1.03	17.48

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-3

140) The quarterly sales for specific educational software over the past three years are given in the following table. Compute the four seasonal factors.

	<u>YEAR 1</u>	<u>YEAR 2</u>	<u>YEAR 3</u>
Quarter 1	1710	1820	1830
Quarter 2	960	910	1090
Quarter 3	2720	2840	2900
Quarter 4	2430	2200	2590

Answer:

	<u>Avg.</u>	<u>Sea. Fact.</u>
Quarter 1	1786.67	0.8933
Quarter 2	986.67	0.4933
Quarter 3	2820.00	1.4100
Quarter 4	2406.67	1.2033
Grand Average	2000.00	

Diff: 2

Topic: Time-series forecasting

AACSB: Analytic Skills

Objective: LO4-5

141) An innovative restaurateur owns and operates a dozen "Ultimate Low-Carb" restaurants in northern Arkansas. His signature item is a cheese-encrusted beef medallion wrapped in lettuce. Sales (X, in millions of dollars) is related to Profits (Y, in hundreds of thousands of dollars) by the regression equation $Y = 8.21 + 0.76 X$. What is your forecast of profit for a store with sales of \$40 million? \$50 million?

Answer: Students must recognize that sales is the independent variable and profits is dependent; the problem is not a time series. A store with \$40 million in sales: $40 \times 0.76 = 30.4$; $30.4 + 8.21 = 38.61$, or \$3,861,000 in profit; \$50 million in sales is estimated to profit 46.21 or \$4,621,000.

Diff: 2

Topic: Associative forecasting methods: Regression and correlation

AACSB: Analytic Skills

Objective: LO4-6

142) Arnold Tofu owns and operates a chain of 12 vegetable protein "hamburger" restaurants in northern Louisiana. Sales figures and profits for the stores are in the table below. Sales are given in millions of dollars; profits are in hundreds of thousands of dollars. Calculate a regression line for the data. What is your forecast of profit for a store with sales of \$24 million? \$30 million?

<u>Store</u>	<u>Profits</u>	<u>Sales</u>
1	14	6
2	11	3
3	15	5
4	16	5
5	24	15
6	28	18
7	22	17
8	21	12
9	26	15
10	43	20
11	34	14
12	9	5

Answer: Students must recognize that "sales" is the independent variable and profits is dependent. Store number is not a variable, and the problem is not a time series. The regression equation is $Y = 5.936 + 1.421X$ (Y = profit, X = sales). A store with \$24 million in sales is estimated to profit 40.04 or \$4,004,000; \$30 million in sales should yield 48.566 or \$4,856,600 in profit.

Diff: 2

Topic: Associative forecasting methods: Regression and correlation

Objective: LO4-6

143) The department manager using a combination of methods has forecast sales of toasters at a local department store. Calculate the MAD for the manager's forecast. Compare the manager's forecast against a naive forecast. Which is better?

<u>Month</u>	<u>Unit Sales</u>	<u>Manager's Forecast</u>
January	52	
February	61	
March	73	
April	79	
May	66	
June	51	
July	47	50
August	44	55
September	30	52
October	55	42
November	74	60
December	125	75

Answer:

<u>Month</u>	<u>Actual</u>	<u>Manager's</u>	<u>Abs. Error</u>	<u>Naive</u>	<u>Abs. Error</u>
January	52				
February	61				
March	73				
April	79				
May	66				
June	51				
July	47	50	3	51	4
August	44	55	11	47	3
September	30	52	22	44	14
October	55	42	13	30	25
November	74	60	14	55	19
December	125	75	50	74	51

The manager's forecast has a MAD of 18.83, while the naive is 19.33. Therefore, the manager's forecast is slightly better than the naive.

Diff: 2

Topic: Monitoring and controlling forecasts

AACSB: Analytic Skills

Objective: LO4-4

144) The last seven weeks of demand at a new car dealer are shown below. Use a three-period weighted-moving average to determine a forecast for the 8th week using weights of 1, 2, and 3. Calculate the MAD for this forecast. What does the MAD indicate?

<u>Week</u>	<u>Sales</u>
1	25
2	30
3	27
4	31
5	27
6	29
7	30

Answer:

<u>Week</u>	<u>Sales</u>	<u>3WMA</u>	<u> error </u>
1	25		
2	30		
3	27		
4	31	28	3
5	27	30	3
6	29	28	1
7	30	29	1
8		29	

$$\text{MAD} = 8/4 = 2$$

An MAD of 2 means that the forecasting technique used was typically off by 2 units each period.

Diff: 2

Topic: Time-series forecasting, moving averages, and measuring forecast error

Objective: LO4-4