Chapter 4 quiz

Concept Question 1.1

Which of the following statements is NOT true regarding forecasting?

- A. Forecasting is exclusively an objective prediction. ✔
- B. Forecasting is the art and science of predicting future events.
- C. Forecasting may involve taking historical data and projecting them into the future with a mathematical model.
- D. A forecast is usually classified by the future time horizon that it covers.

Concept Question 1.2

The forecasting time horizon that would typically be easiest to predict for would be the

- A. short range. ✔
- B. medium range.
- C. intermediate range.
- D. long range.

Concept Question 1.3

A forecast that addresses the business cycle by predicting planning indicators is

- A. a demand forecast.
- B. an environmental forecast.
- C. a technological forecast.
- D. an economic forecast. ✔

Concept Question 1.4

A forecast that projects a company's sales is

- A. a demand forecast. ✔
- B. an environmental forecast.
- C. a technological forecast.
- D. an economic forecast.

Concept Question 2.1

CPFR is

- A. complete, planning, forecasting, and replenishment.
- B. collaborative, planning, forecasting, and replenishment. ✔
- C. complete, partner, forecasting, and replenishment.
- D. collaborative, partner, forecasting, and replenishment.

Concept Question 2.2

The goal of CPFR is to

- A. ensure product innovation.
- B. create significantly more accurate information that can power the supply chain. ✔
- C. determine which model needs to be used to predict future events.
- D. create good relations with suppliers.

Concept Question 3.1

Which of the following is the FIRST step in a forecasting system?

- A. Select the items to be forecasted.
- B. Select the forecast model(s).
- C. Determine the time horizon of the forecast.
- D. Determine the use of the forecast. ✔

Concept Question 3.2

Which of the following is the FINAL step in a forecasting system?

- A. Make the forecast.
- B. Validate and implement the results. ✔
- C. Select the forecast model(s).
- D. Gather the data needed to make the forecast.

Concept Question 4.1

Which of the following is a quantitative forecasting method?

- A. sales force composite
- B. jury of executive opinion
- C. market survey
- D. exponential smoothing ✔

Concept Question 4.2

Which of the following is a qualitative forecasting method?

- A. linear regression
- B. naive approach
- C. trend projection
- D. Delphi method ✔

Concept Question 4.3

Which forecasting model is based upon salespersons' estimates of expected sales?

- A. jury of executive opinion
- B. sales force composite ✔
- C. market survey
- D. Delphi method

Concept Question 4.4

Which of the following is NOT a time-series model?

- A. moving averages
- B. exponential smoothing
- C. naive approach
- D. multiple regression ✔

Concept Question 5.1

What is a data pattern that repeats itself after a period of days, weeks, months, or quarters?

- A. random variation
- B. seasonality ✔
- C. cycle
- D. trend

Concept Question 5.3

When using exponential smoothing, the smoothing constant

- A. should be chosen to maximize positive bias.
- B. can be determined using MAD. ✔
- C. indicates the accuracy of the previous forecast.
- D. is typically between .75 and .95 for most business applications.

Concept Question 5.4

"Today's forecast equals yesterday's actual demand" is referred as

- A. a moving average.
- B. exponential smoothing.
- C. the Delphi method.
- D. the naive approach. ✔

Concept Question 6.1

Linear regression is most similar to which of the following?

- A. the simple moving average method of forecasting
- B. the naive method of forecasting
- C. the trend projection method of forecasting ✔
- D. the weighted moving average method of forecasting

Concept Question 6.2

Which forecasting method considers several variables that are related to the variable being predicted?

- A. weighted moving average
- B. exponential smoothing
- C. multiple regression ✔
- D. simple regression

Concept Question 6.4

A measure of the strength of the relationship between two variables is referred to as the

- A. coefficient of determination.
- B. coefficient of correlation. ✔
- C. standard deviation of the estimate.
- D. standard error of the estimate.

Concept Question 7.1

A tracking signal

- A. that is negative indicates that demand is greater than the forecast.
- B. cannot be used with exponential smoothing.
- C. is a measurement of how well a forecast is predicting actual values. ✔
- D. is computed as the mean absolute deviation (MAD) divided by the running sum of the forecast errors (RSFE).

Concept Question 7.4

A consistent tendency for forecasts to be greater or less than the actual values is called ________ error.

- A. an extreme
- B. a bias ✔
- C. an unbalanced
- D. a trend

Concept Question 8.1

Which one of the following statements is NOT true about the forecasting in the service sector?

- A. Hourly demand forecasts may be necessary.
- B. Detailed forecasts of demand are not needed. ✔
- C. Forecasting in the service sector presents some unusual challenges.
- D. Demand patterns are often different from those in non-service sectors.

Problem 4.1

Week Of	Pints Used
August 31	360
September 7	370
September 14	408
September 21	383
September 28	371
October 5	371

a) The forecasted demand for the week of October 12 using a 3-week moving average = 375.00 pints *(round your response to two decimal places).*

b) Using a 3-week weighted moving average, with weights of 0.20, 0.35, and 0.45, using 0.45 for the most recent week, the forecasted demand for the week of October 12 = 373.40 pints *(round your response to two c remember to use the weights in appropriate order — the largest weight applies to most recent period and smallest weight applies to oldest period.)*

c) If the forecasted demand for the week of August 31 is 360 and $\alpha = 0.30$, using exponential smoothing, develop the forecast for each of the weeks with the known demand and the forecast for the week of October 12 *two decimal places).*

Week Of	Pints Used	Forecast for this Date
August 31	360	360
September 7	370	360.00
September 14	408	363.00
September 21	383	376.50
September 28	371	378.45
October 5	371	376.22
October 12	-	374.65

$$\text{Moving average} = \frac{\sum \text{demand in previous } n \text{ periods}}{n}$$

a.	(383+371+371)/3 = 375			
	375.00			
b.	((0.20*383)+(0.35*371)+(0.45*371)/(0.20+0.35+0.45))=373.40			
	373.40			
c.	Week of	Pints Used	Forecasted for this Date	
	31-Aug	360	360	
	7-Sep	370	360.00	360+(0.30)(360-360)=360
	14-Sep	408	363.00	360+(0.30)(370-360)=363
	21-Sep	383	**376.50**	363+(0.30)(408-363)=376.50
	28-Sep	371	**378.45**	376.50+(0.30)(383-376.50)=378.45
	5-Oct	371	**376.22**	378.45+(0.30)(371-378.45)=376.22
	12-Oct	-	**374.65**	376.22+(0.30)(371-376.22)=374.65

$$\text{Weighted moving average} = \frac{\sum (\text{weight for period } n) \times (\text{demand in period } n)}{\sum \text{weights}}$$

Exponential Smoothing

New forecast = Last period's forecast + α (Last period's actual demand – Last period's forecast)

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

where
F_t = new forecast
F_{t-1} = previous forecast
α = smoothing (or weighting) constant ($0 \le \alpha \le 1$)

Problem 4.1

Question Help

The following table gives the number of pints of type A blood used at Damascus Hospital in the past 6 weeks:

Week Of	Pints Used
August 31	360
September 7	389
September 14	410
September 21	378
September 28	368
October 5	374

a) The forecasted demand for the week of October 12 using a 3-week moving average = 373.33 pints *(round your response to two decimal places).*

b) Using a 3-week weighted moving average, with weights of 0.20, 0.25, and 0.55, using 0.55 for the most recent week, the forecasted demand for the week of October 12 = 373.30 pints *(round your response to two decimal places and remember to use the weights in appropriate order — the largest weight applies to most recent period and smallest weight applies to oldest period.)*

c) If the forecasted demand for the week of August 31 is 360 and $\alpha = 0.20$, using exponential smoothing, develop the forecast for each of the weeks with the known demand and the forecast for the week of October 12 *(round your responses to two decimal places).*

Week Of	Pints Used	Forecast for this Date
August 31	360	360
September 7	389	360.00
September 14	410	365.80
September 21	378	374.64
September 28	368	375.31
October 5	374	373.85
October 12	-	373.88

a.	**373.33**	(378+368+374)/3=373.33		
b.	**373.30**	((378*0.2)+(368*0.25)+(374*0.55))/(0.2+0.25+0.55)=373.30		
c.	week of	pints used	forecast	
	21-Aug	360	360	
	7-Sep	389	**360**	360+(0.2)*(360-360)=360
	14-Sep	410	**365.80**	360+(0.2)*(389-360)=365.80
	21-Sep	378	**374.64**	365.8+(0.2)*(410-365.80)=374.64
	28-Sep	368	**375.31**	374.64+(0.2)*(378-374.64)=375.31
	5-Oct	374	**373.85**	375.312+(0.2)*(368-375.312)=373.85
	23-Oct		**373.88**	373.85+(0.2)*(374-373.85)=373.88

Problem 4.14

Following are two weekly forecasts made by two different methods for the number of gallons of gasoline, in thousands, demanded at a local gasoline station. Also shown are actual demand levels, in thousands of gallons:

Week	Forecast Method 1	Actual Demand
1	0.85	0.70
2	1.05	1.05
3	0.95	1.00
4	1.17	1.04

Week	Forecast Method 2	Actual Demand
1	0.77	0.70
2	1.20	1.05
3	0.92	1.00
4	1.17	1.04

The MAD for Method 1 = 0.083 thousand gallons *(round your response to three decimal places).*

The mean squared error (MSE) for Method 1 = 0.010 thousand gallons^2 *(round your response to three decimal places).*

The MAD for Method 2 = 0.108 thousand gallons *(round your response to three decimal places).*

The mean squared error (MSE) for Method 2 = 0.013 thousand gallons^2 *(round your response to three decimal places).*

week	forecast method 1	Actual Demand	Error	Error-squared
1	0.85	0.70	0.15	0.0225
2	1.05	1.05	0.00	0
3	0.95	1.00	0.05	0.0025
4	1.17	1.04	0.13	0.0169

We	Forecast Method 2	Actual Demand	Error	Error-squared
1	0.77	0.70	0.07	0.0049
2	1.2	1.05	0.15	0.0225
3	0.92	1.00	0.08	0.0064
4	1.17	1.04	0.13	0.0169

a. MAD = sum of error/n **0.083**

(0.15+0+0.05+0.13)/4=0.083

b. MSE = sum of squared error/n **0.010**

(0.0225+0+0.0025+0.0169)/4=0.010

c. MAD = sum of error/n **0.108**

(0.07+0.15+0.08+0.13)/4=0.108

d. MSE = sum of squared error/n **0.013**

(0.0049+0.0225+0.0064+0.0169)/4=0.013

Mean Absolute Deviation (MAD)

$$MAD = \frac{\sum |\text{Actual} - \text{Forecast}|}{n}$$

Mean Squared Error (MSE)

$$MSE = \frac{\sum (\text{Forecast Errors})^2}{n}$$

Problem 4.2a

The following table shows the actual demand observed over the last 11 years:

Year	1	2	3	4	5	6	7	8	9	10	11
Demand	7	8	4	9	11	9	11	13	10	13	8

This exercise contains only parts b, c, and d.

b) Using the 3-year moving average, provide the forecast from periods 4 through 12 *(round your responses to one decimal place)*.

Year	4	5	6	7	8	9	10	11	12
Forecast	6.3	7.0	8.0	9.7	10.3	11.0	11.3	12.0	10.3

c) Using the 3-year weighted moving average with weights 0.10, 0.35, and 0.55, using 0.55 for the most recent period, provide the forecast from periods 4 through 12 *(round your responses to two decimal places)*.

Year	4	5	6	7	8	9	10	11	12
Forecast	5.70	7.15	9.60	9.70	10.30	11.90	11.15	11.95	9.95

d) Mean absolute deviation for the forecast developed using the 3-year moving average is 2.30 and for the 3-year weighted moving average is 2.43. Based on this information, the better forecast is achieved using the 3-year moving average approach.

b. The 3 year moving average forecast is given by

Ft = (F,t-1 + F,t-2 + F,t-3) / 3

Year	4	5	6	7	8	9	10	11	12
Forecast	**6.3**	**7.0**	**8.0**	**9.7**	**10.3**	**11.0**	**11.3**	**12.0**	**10.3**

$$\text{Moving average} = \frac{\sum \text{demand in previous } n \text{ periods}}{n}$$

Year	
4	(7+8+4)/3=6.3
5	(8+4+9)/3=7.0
6	(4+9+11)/3=8.0
7	(9+11+9)/3=9.7
8	(11+9+11)/3=10.3
9	(9+11+13)/3=11.0
10	(11+13+10)/3=11.3
11	(13+10+13)/3=12.0
12	(10+13+8)/3=10.3

$$\text{Weighted moving average} = \frac{\sum (\text{weight for period } n) \times (\text{demand in period } n)}{\sum \text{weights}}$$

Mean Absolute Deviation (MAD)

$$\text{MAD} = \frac{\sum |\text{Actual} - \text{Forecast}|}{n}$$

c. The 3 year moving average forecast is given by

Ft = (F,t-1 + F,t-2 + F,t-3) / 3

Year	4	5	6	7	8	9	10	11	12
Forecast	**5.70**	**7.15**	**9.60**	**9.70**	**10.30**	**11.90**	**11.15**	**11.95**	**9.95**

Year	
4	(0.1*7+0.35*8+0.55*4)=5.70
5	(0.1*8+0.35*4+0.55*9)=7.15
6	(0.1*4+0.35*9+0.55*11)=9.60
7	(0.1*9+0.35*11+0.55*9)=9.70
8	(0.1*11+0.35*9+0.55*11)=10.30
9	(0.1*9+0.35*11+0.55*13)=11.90
10	(0.1*11+0.35*13+0.55*10)=11.15
11	(0.1*13+0.35*10+0.55*13)=11.95
12	(0.1*10+0.35*13+0.55*8)=9.95

d. 3 year moving average because it has lower Mean absolute deviation

Problem 4.30

Question Help

Dr. Lillian Fok, a New Orleans psychologist, specializes in treating patients who are agoraphobic (i.e., afraid to leave their homes). The following table indicates how many patients Dr. Fok has seen each year for the past 10 years. It also indicates what the robbery rate was in New Orleans during the same year:

Year	1	2	3	4	5	6	7	8	9	10
Number of Patients	37	32	40	41	40	55	58	53	59	62
Robbery Rate per 1,000 Population	58.3	60.6	73.4	76.1	78.5	89.5	101.1	94.8	102.2	117.2

The simple linear regression equation that shows the best relationship between the number of patients and year is *(round your responses to three decimal places)*:

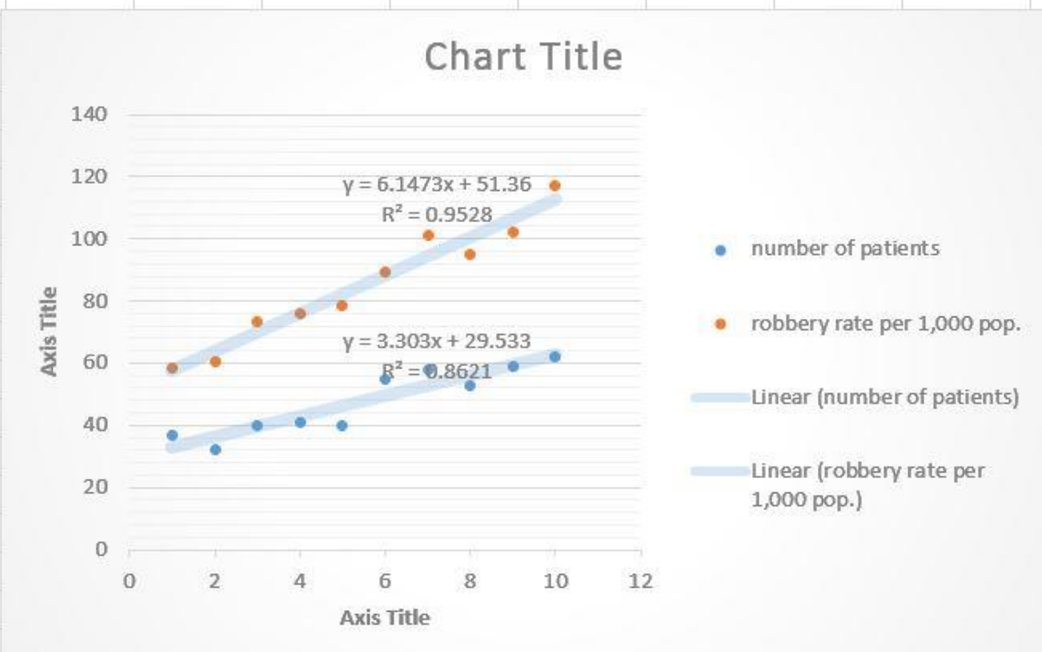
$$\hat{y} = 29.533 + 3.303x$$

where $\hat{y}$ = Dependent Variable and x = Independent Variable.

Using linear regression, the number of patients Dr. Fok will see in year 11 = 65.87 patients *(round your response to two decimal places)*.

Using linear regression, the number of patients Dr. Fok will see in year 12 = 69.17 patients *(round your response to two decimal places)*.

The coefficient of determination for the linear regression model is 0.8621. This shows that there is a strong relationship between the "Number of Patients" and "Year."



65.87	(3.303*11)+29.533=65.87
69.17	(3.303*12)+29.533=69.17

Problem 4.3a

Question Help

The following table shows the actual demand observed over the last 11 years:

Year	1	2	3	4	5	6	7	8	9	10	11
Demand	6	8	6	7	11	7	13	13	9	13	8

Using exponential smoothing with α = 0.50 and a forecast for year 1 of 5.0, provide the forecast from periods 2 through 12 *(round your responses to one decimal place).*

Year	1	2	3	4	5	6	7	8	9	10	11	12
Forecast	5.0	5.5	6.8	6.4	6.7	8.8	7.9	10.5	11.7	10.4	11.7	9.9

Provide the forecast from periods 2 through 12 using the naive approach *(enter your responses as whole numbers).*

Year	2	3	4	5	6	7	8	9	10	11	12
Forecast	6	8	6	7	11	7	13	13	9	13	8

year	demand	forecast		naïve	(equal to last periods demand)
1	6	5.0			
2	8	**5.5**	5+(0.5)*(6-5)=5.5	**6**	
3	6	**6.8**	5.5+(0.5)*(8-5.5)=6.8	**8**	
4	7	**6.4**	6.75+(0.5)*(6-6.75)=6.4	**6**	
5	11	**6.7**	6.375+(0.5)*(7-6.375)=6.7	**7**	
6	7	**8.8**	6.69+(0.5)*(11-6.69)=8.8	**11**	
7	13	**7.9**	8.85+(0.5)*(7-8.85)=7.9	**7**	
8	13	**10.5**	7.93+(0.5)*(13-7.93)=10.5	**13**	
9	9	**11.7**	(10.47)+(0.5)*(13-10.47)=11.7	**13**	
10	13	**10.4**	11.74+(0.5)*(9-11.74)=10.4	**9**	
11	8	**11.7**	10.37+(0.5)*(13-10.37)=11.7	**13**	
12		**9.9**	11.7+(0.5)*(8-11.7)=9.9	**8**	

Problem 4.43bcd

Mark Gershon, owner of a musical instrument distributorship, thinks that demand for guitars may be related to the number of television appearances by the popular group Maroon 5 during the previous month. Gershon has collected the data shown in the following table:

Maroon 5 TV Appearances	4	3	8	7	9	6
Demand for Guitars	4	5	6	5	10	7

This exercise contains only parts b, c, and d.

b) Using the least-squares regression method, the equation for forecasting is *(round your responses to four decimal places)*:

Y = 2.0683 + 0.6646 x

c) The estimate for guitar sales if Maroon 5 performed on TV 9 times = 8.05 sales *(round your response to two decimal places)*.

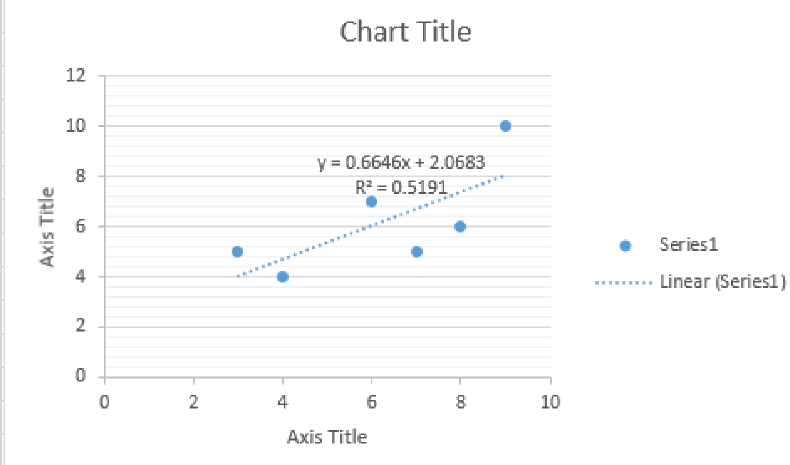
d) The correlation coefficient (r) for this model = 0.7205 *(round your response to four decimal places)*.

The coefficient of determination (r^2) for this model = 0.5191 *(round your response to four decimal places)*.

The percentage of variation in sales that can be explained by TV appearances = 51.91 % *(round your response to two decimal places)*.

Not on exam!

b.	Maroon 5 Appearance (x)	Demand for Guitars (y	x*y	x*x
	4	4	16	16
	3	5	15	9
	8	6	48	64
	7	5	35	49
	9	10	90	81
	6	7	42	36
TOTALS	37	37	246	255
	a=((37*255)-(37*246))/((6*255)-(37*37))= **2.0683**			
	b=((6*246)-(37*37))/((6*255)-(37*37))= **0.6646**			
	y=a+b*x			
	y=2.0683+0.6646x			
c.	2.0683+0.6646*(9)=**8.05**			
d.	r = Σ (xy) / sqrt [(Σ x2) * (Σ y2)]			



$$\hat{y} = a + bx$$

where $\hat{y}$ = computed value of the variable to be predicted (dependent variable)

a = y-axis intercept

b = slope of the regression line

x = the independent variable

$$\hat{y} = a + bx$$

$$b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2}$$

$$a = \bar{y} - b\bar{x}$$

Problem 4.44

Lori Cook has developed the following forecasting model:

$$\hat{y} = 45.0 + 4.30x,$$

where $\hat{y}$ = demand for Kool Air conditioners and
x = the outside temperature (degrees Fahrenheit)

a) When the temperature outside is 70° F, demand forecast = 346 air conditioners *(enter your response as an integer)*.

b) When the temperature outside is 80° F, demand forecast = 389 air conditioners *(enter your response as an integer)*.

c) When the temperature outside is 90° F, demand forecast = 432 air conditioners *(enter your response as an integer)*.

a.	45+(4.3*70)=346
	346
b	45+(4.3*80)=389
	389
c.	45+(4.3*90)=432
	432

$$\hat{y} = a + bx$$

where $\hat{y}$ = computed value of the variable to be predicted (dependent variable)
a = y-axis intercept
b = slope of the regression line
x = the independent variable

$$\hat{y} = a + bx$$

$$b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2}$$

$$a = \bar{y} - b\bar{x}$$

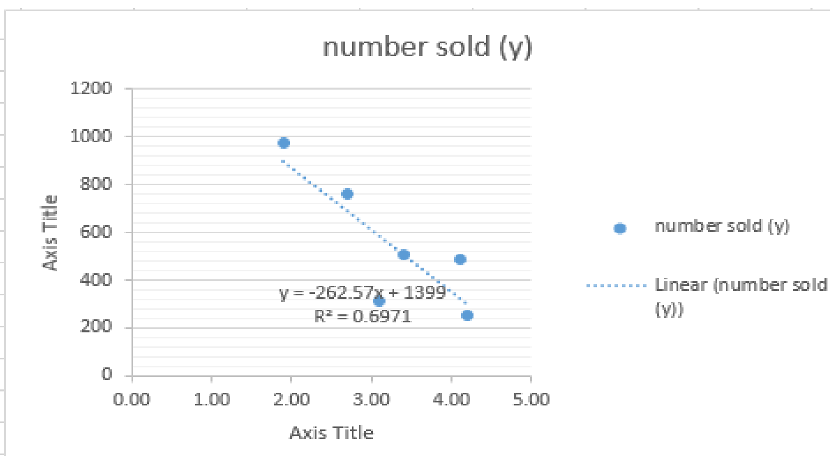
Problem 4.45

Café Michigan's manager, Gary Stark, suspects that demand for mocha latte coffees depends on the price being charged. Based on historical observations, Gary has gathered the following data, which show the numbers of these coffees sold over six different price values:

Price	Number Sold
\$2.70	760
\$3.40	510
\$1.90	975
\$4.20	250
\$3.10	315
\$4.10	490

Using simple linear regression and given that the price per cup is \$1.75, the forecasted demand for mocha latte coffees will be 939.5 cups *(enter your response rounded to one decimal place)*.

	price (x)	number sold (y)	xy	x-squared
	2.70	760	2052	7.29
	3.40	510	1734	11.56
	1.90	975	1852.5	3.61
	4.20	250	1050	17.64
	3.10	315	976.5	9.61
	4.10	490	2009	16.81
TOTALS	19.40	3300.00	9674.00	66.52
means	total/n	number sold/n		x-squared/n
	3.23	550	1612.33	11.09
	-251.109			
			10.4329	
average y value is 550				
average x value is 3.23				
	a=550+(-251.11*3.23)			
	-261.085			
	904.1915			



Problem 4.46

The following data relate the sales figures of the bar in Mark Kaltenbach's small bed-and-breakfast inn in Portland, to the number of guests registered that week:

Week	Guests	Bar Sales
1	16	$330
2	12	$270
3	18	$380
4	14	$320

a) The simple linear regression equation that relates bar sales to number of guests (not to time) is *(round your responses to one decimal place):*

Bar Sales = 70.0 + 17.0 × guests

b) If the forecast is 20 guests next week, the bar sales are expected to be $ 410.0 *(round your response to one decimal place).*

NOT on EXAM!

	week	guests (x)	bar sales (y)	xy	x*x
a.	1	16	330	5280	256
	2	12	270	3240	144
	3	18	380	6840	324
	4	14	320	4480	196
	Total	**60**	**1300**	**19840**	**920**
	Mean	**15**	**325.0**		

b=(19840-(4*15*325))/(920-(4*15*15)=17

17.0

a=325.0-(17.0*15)=70

70

bar sales = 70.0 + 17.0 x guests **y=b+ax**

b. 70+(17*20)=410.0

410.0

$$\hat{y} = a + bx$$

where $\hat{y}$ = computed value of the variable to be predicted (dependent variable)
a = y-axis intercept
b = slope of the regression line
x = the independent variable

$$\hat{y} = a + bx$$

$$b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2}$$

$$a = \bar{y} - b\bar{x}$$

Problem 4.5

Question Help

The Carbondale Hospital is considering the purchase of a new ambulance. The decision will rest partly on the anticipated mileage to be driven next year. The miles driven during the past 5 years are as follows:

Year	1	2	3	4	5
Mileage	3,100	4,000	3,450	3,800	3,700

a) Using a 2-year moving average, the forecast for year 6 = 3,750 miles *(round your response to the nearest whole number).*

b) If a 2-year moving average is used to make the forecast, the MAD based on this = 83.3 miles *(round your response to one decimal place). (Hint: You will have only 3 years of matched data.)*

c) The forecast for year 6 using a weighted 2-year moving average with weights of 0.45 and 0.55 (the weight of 0.55 is for the most recent period) = 3745 miles *(round your response to the nearest whole number).*

The MAD for the forecast developed using a weighted 2-year moving average with weights of 0.45 and 0.55 = 101.7 miles *(round your response to one decimal place). (Hint: You will have only 3 years of matched data.)*

d) Using exponential smoothing with α = 0.50 and the forecast for year 1 being 3,100, the forecast for year 6 = 3675 miles *(round your response to the nearest whole number).*

year	mileage	forecasted	deviation	absoulte	error	.45 and .55				
1	3100	3100	0	0						
2	4000	3100	900	900						
3	3450	3550	-100	100		3595	((0.45*3100)+(0.55*4000))/(0.45+0.55)=3595			
4	3800	3725	75	75		3697.5	((0.45*4000)+(0.55*3450))/(0.45+0.55)=3697.5			
5	3700	3625	75	75		3642.5	((0.45*3450)+(0.55*3800))/(0.45+0.55)=3642.5			
6		3750				3745	((0.45*3800)+(0.55*3700))/(0.45+0.55)=3745			
TOTAL						-145	3450-3595=-145		145	
						102.5	3800-3697.5=102.5		102.5	
a.	**3750**	(3800+3700)/2=3750				57.5	3700-3642.5=57.5		57.5	
b.	**83.33**	(100+75+75)/3=83.33				(145+102.5+57.5)/3=**101.7**			305	
c.	**3745**	((0.45*3800)+(0.55*3700))/(0.45+0.55)=3745							**101.7**	
	101.7									
d	year	mileage	new forecast							
	1	3100	3100							
	2	4000	3100.00							
	3	3450	3550							
	4	3800	3500							
	5	3700	3650							
	6		**3675**	((1-0.5)*3650)+(0.5*3700)=3675						

Mean Absolute Deviation (MAD)

$$MAD = \frac{\sum |Actual - Forecast|}{n}$$

Problem 4.5

The Carbondale Hospital is considering the purchase of a new ambulance. The decision will rest partly on the anticipated mileage to be driven next year. The miles driven during the past 5 years are as follows:

Year	1	2	3	4	5
Mileage	3,050	3,950	3,400	3,850	3,700

a) Using a 2-year moving average, the forecast for year 6 = 3,775 miles *(round your response to the nearest whole number).*

b) If a 2-year moving average is used to make the forecast, the MAD based on this = 116.7 miles *(round your response to one decimal place). (Hint: You will have only 3 years of matched data.)*

c) The forecast for year 6 using a weighted 2-year moving average with weights of 0.35 and 0.65 (the weight of 0.65 is for the most recent period) = 3,753 miles *(round your response to the nearest whole number).*

The MAD for the forecast developed using a weighted 2-year moving average with weights of 0.35 and 0.65 = 166.7 miles *(round your response to one decimal place). (Hint: You will have only 3 years of matched data.)*

d) Using exponential smoothing with α = 0.50 and the forecast for year 1 being 3,050, the forecast for year 6 = 3,675 miles *(round your response to the nearest whole number).*

Year	Mileage	Forecasted	deviation	absolute d	Error x .50	new forecast
1	3050	3050	0	0	0	3050
2	3950	3050	900	900	450	3050
3	3400	3500	-100	100	-50	3500
4	3850	3675	175	175	87.5	3450
5	3700	3625	75	75	37.5	3650
6		3775				**3675**
	total		350			
	year 3 forecast	(3950 + 3050) /2 = 3500				
	year 4 forecast	(3400 + 3950) / 2 =3675				
	year 5 forecast	(3850 + 3400) / 2 =3625				
	year 6 forecast	(3700 + 3850) / 2 = 3775				

a. Moving average = sum demand in 2 yr period/2

(year 4 + year 5)/2 year moving average

(3850 + 3700) / 2 = **3775**

b. (sum of the difference between forcasted and actual milage)/ number of values involved

(sum(| 3500 - 3400 | + | 3675 - 3850 | + | 3625 - 3700 |))/ 3 = **116.7**

Moving average = $\dfrac{\sum \text{demand in previous } n \text{ periods}}{n}$

Mean Absolute Deviation (MAD)

$$MAD = \frac{\sum |\text{Actual} - \text{Forecast}|}{n}$$

Exponential Smoothing

New forecast = Last period's forecast + α (Last period's actual demand – Last period's forecast)

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

where F_t = new forecast

F_{t-1} = previous forecast

α = smoothing (or weighting) constant ($0 \le \alpha \le 1$)

c. Weighted moving average = sum (weight in period n)*(demand in period n)/Sum weights

((0.65*3700)+(0.35*3850))/(0.65 + 0.35)=3752.5==>**3,753**

MEAN ABSOLUTE DEVIATION (MAD) = Sum(|Dt-Ft|)/n where Dt is demand in Period t & Ft is Forecats in period t

d. **Forecast = (((1 - smoothing factor) * newest calculated period forecast) + (Smoothing factor * most recent periods' demand)**

Year	Mileage	new forecast
1	3050	((1-0.5)*3050)+(0.5*3050)=3050
2	3950	((1-0.5)*3050)+(0.5*3050)=3050
3	3400	((1-0.5)*3050)+(0.5*3950)=3500
4	3850	((1-0.5)*3500)+(0.5*3400)=3450
5	3700	((1-0.5)*3450)+(0.5*3850)=3650
6		((1-0.5)*3650)+(0.5*3700)=**3675**

Problem 4.59

Sales of tablet computers at Ted Glickman's electronics store in Washington, D.C., over the past 10 weeks are shown in the table below:

Week	1	2	3	4	5	6	7	8	9	10
Demand	20	20	28	37	25	30	37	20	24	29

a) The forecast for weeks 2 through 10 using exponential smoothing with α = 0.50 and a week 1 initial forecast of 20.0 are *(round your responses to two decimal places)*:

Week	1	2	3	4	5	6	7	8	9	10
Demand	20	20	28	37	25	30	37	20	24	29
Forecast	20.0	20	20.00	24.00	30.50	27.75	28.88	32.94	26.47	25.24

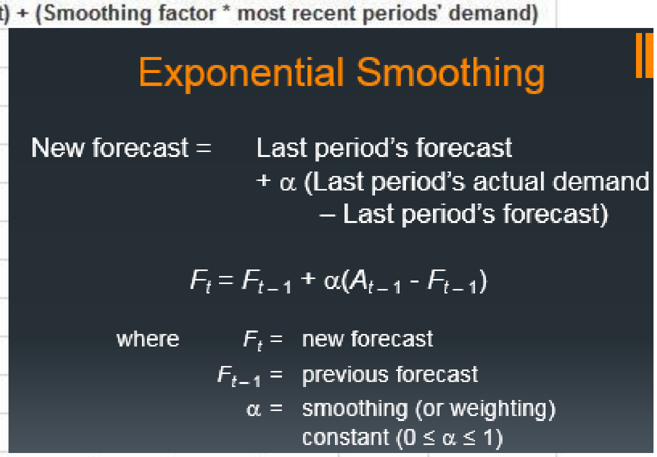
b) For the forecast developed using exponential smoothing (α = 0.50 and initial forecast 20.0), the MAD = 5.60 sales *(round your response to two decimal places)*.

c) For the forecast developed using exponential smoothing (α = 0.50 and initial forecast 20.0), the tracking signal = 2.54 *(round your response to two decimal places)*.

Week	1	2	3	4	5	6	7	8	9	10	
Demand	20	20	28	37	25	30	37	20	24	29	270
Forecast	20.00	**20.00**	**20.00**	**24.00**	**30.50**	**27.75**	**28.88**	**32.94**	**26.47**	**25.24**	255.78
Difference	0.00	0.00	8.00	13.00	5.50	2.25	8.12	12.94	2.47	3.76	**5.60**

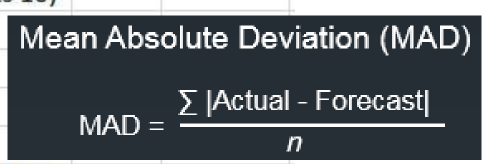
1. Forecast = (((1 - smoothing factor) * Most recent period forecast) + (Smoothing factor * most recent periods' demand)

Week	Forecast
1	((1-0.50)*20)+(0.50*20)=20
2	((1-0.50)*20)+(0.50*20)=20
3	((1-0.50)*20)+(0.50*20)=20
4	((1-0.50)*20)+(0.50*28)=24
5	((1-0.50)*24)+(0.50*37)=30.50
6	((1-0.50)*30.5)+(0.50*25)=27.75
7	((1-0.50)*27.75)+(0.50*30)=28.88
8	((1-0.50)*28.88)+(0.50*37)=32.94
9	((1-0.50)*32.94)+(0.50*20)=26.47
10	((1-0.50)*26.47)+(0.50*24)=25.24



2. MAD= sum of |Demand - Forecast| /N; where N = number of periods (here its 10)

Difference b/t demand & forecast (0+0+8+13+5.50+2.25+8.12+12.94+2.47+3.76)/10=**5.60**



3. Tracking Signal = (sum of demand - Forecast)/MAD

Demand- 20+20+28+37+25+30+37+20+24+29=**270**

Forecast- 20+20+20+24+30.50+27.75+28.88+32.94+26.47+25.24=**255.78**

270=255.78=**14.22**

14.22/5.60=**2.54**

Problem 4.6

Question Help

The monthly sales for Yazici Batteries, Inc., were as follows:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Sales	20	23	15	15	11	15	17	18	20	21	23	24

This exercise contains only parts b and c.

b) The forecast for the next month (Jan) using the naive method = 24 sales *(round your response to a whole number).*

The forecast for the next period (Jan) using a 3-month moving average approach = 22.67 sales *(round your response to two decimal places).*

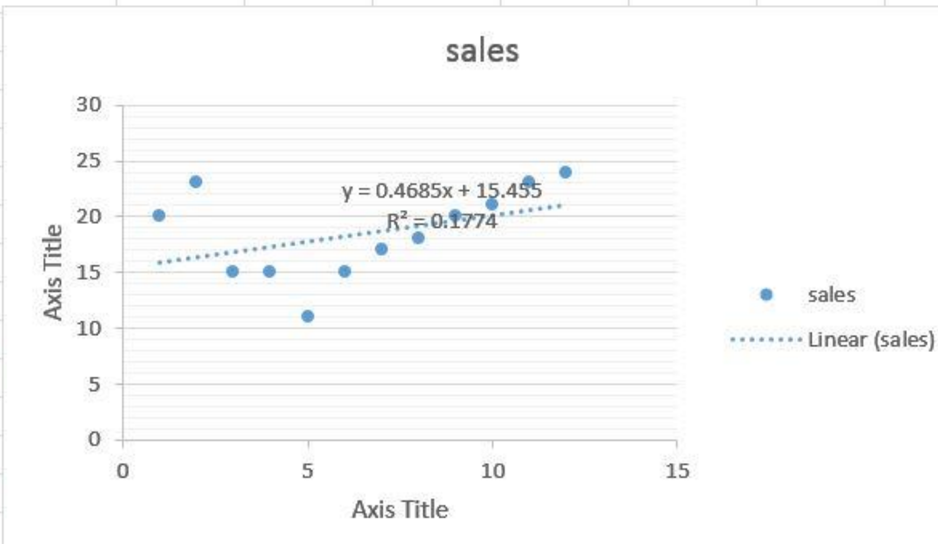
The forecast for the next period (Jan) using a 6-month weighted average with weights of 0.10, 0.10, 0.10, 0.20, 0.20, and 0.30, where the heaviest weights are applied to the most recent month = 21.5 sales *(round your response to one decimal place).*

Using exponential smoothing with $\alpha = 0.30$ and a September forecast of 20.00, the forecast for the next period (Jan) = 21.98 sales *(round your response to two decimal places).*

Using a method of trend projection, the forecast for the next month (Jan) = 21.55 sales *(round your response to two decimal places).*

c) The method that can be used for making a forecast for the month of March is a trend projection .

month	sales	forecast
jan	20	
feb	23	
march	15	
april	15	
may	11	
jun	15	
jul	17	
aug	18	
sept	20	20
oct	21	20
nov	23	20.3
dec	24	21.11
jan		**21.98**



b.	same as dec. = **24**	
	22.67	(21+23+24)/3=22.67
	21.5	(0.1*17)+(0.1*18)+(0.1*20)+(0.2*21)+(0.2*23)+(0.3*24)=21.5
	21.98	21.11+(0.3)*(24-21.11)=21.98
	21.55	0.4685*(13)+15.455=21.55

Problem 4.60

The following are monthly actual and forecast demand levels for May through December for units of a product manufactured by the D. Bishop Company in Des Moines:

Month	Actual Demand	Forecast Demand
May	100	102
June	78	104
July	112	101
August	115	98
September	102	104
October	106	104
November	120	105
December	115	107

For the given forecast, the tracking signal = 2.22 MADs *(round your response to two decimal places)*.

Month	Actual Demand	Forecast Demand	**Difference**
May	100	102	**2**
June	78	104	**26**
July	112	101	**11**
August	115	98	**17**
September	102	104	**2**
October	106	104	**2**
November	120	105	**15**
December	115	107	**8**
TOTAL	848	825	**83**

Mean Absolute Deviation (MAD)

$$MAD = \frac{\sum |\text{Actual - Forecast}|}{n}$$

MAD= sum of |Demand - Forecast| /N; where N = number of periods (here its 8)

(2+26+11+17+2+2+15+8+83)/8=**10.375**

Tracking Signal = (sum of demand - Forecast)/MAD

actual demand 100+78+112+115+102+106+120+115=848

forecast demand 102+104+101+98+104+104+105+107=825

(848-825)/10.375=**2.22**

Problem 4.7

Question Help

The actual number of patients at Omaha Emergency Medical Clinic for the first six weeks of this year follows:

Week	Actual No. of Patients
1	67
2	68
3	77
4	60
5	64
6	73

Clinic administrator Marc Schniederjans wants you to forecast patient numbers at the clinic for week 7 by using this data. You decide to use a weighted moving average method to find this forecast. Your method uses four actual demand levels, with weights of 0.333 on the present period, 0.250 one period ago, 0.250 two periods ago, and 0.167 three periods ago.

a) What is the value of your forecast?

The value of the forecast is 68.17 patients *(round your response to two decimal places).*

b) If instead the weights were 20, 15, 15, and 10, respectively, how would the forecast change?

- A. The value of the forecast will decrease.
- B. The value of the forecast will increase.
- C. The value of the forecast will remain the same.

c) What if the weights were 0.60, 0.20, 0.10, and 0.10, respectively? Now what is the forecast for week 7?

The value of the forecast is 70.30 patients *(round your response to two decimal places).*

Problem 4.8

Question Help

Daily high temperatures in St. Louis for the last week were as follows: 93, 94, 94, 92, 96, 88, 95 (yesterday).

a) The high temperature for today using a 3-day moving average = 93.0 degrees *(round your response to one decimal place).*

b) The high temperature for today using a 2-day moving average = 91.5 degrees *(round your response to one decimal place).*

c) The mean absolute deviation based on a 2-day moving average = 2.9 degrees *(round your response to one decimal place).*

d) The mean squared error for the 2-day moving average = 11.7 degrees^2 *(round your response to one decimal place).*

e) The mean absolute percent error (MAPE) for the 2-day moving average = 3.5 % *(round your response to one decimal place).*

actual	2-day moving average	absolute deviation		absolute dev. Squared	
93					
94					
94	93.5	0.5	0.5	0.3	
92	94	-2	2	4.0	
96	93	3	3	9.0	
88	94	-6	6	36.0	
95	92	3	3	9.0	**11.7**
	91.5		14.5	2.9	
a.	**93.0**	(96+88+95)/3=**93.0**			
b.	**91.5**	(88+95)/2=**91.5**			
c.	**2.9**	(0.5+2+3+6+3)/5=**2.9**			
d	**11.7**	(0.3+4.0+9.0+36.0+9.0)/5=**11.7**			
e	**0.035**	(2.9/11.7)=0.248==>0.248/7=0.035==>**3.5%**			

Mean Absolute Deviation (MAD)

$$MAD = \frac{\sum |Actual - Forecast|}{n}$$

Mean Squared Error (MSE)

$$MSE = \frac{\sum (Forecast\ Errors)^2}{n}$$

Problem 4.9d

Question Help

Lenovo uses the ZX-81 chip in some of its laptop computers. The prices for the chip during the last 12 months were as follows:

Month	Price Per Chip	Month	Price Per Chip
January	$1.85	July	$1.80
February	$1.61	August	$1.82
March	$1.60	September	$1.60
April	$1.85	October	$1.57
May	$1.90	November	$1.62
June	$1.95	December	$1.75

This exercise contains only part d.

With α = 0.1 and the initial forecast for October of $1.81, using exponential smoothing, the forecast for periods 11 and 12 is *(round your responses to two decimal places)*:

Month	Oct	Nov	Dec
Forecast	$1.81	1.79	1.77

With α = 0.3 and the initial forecast for October of $1.76, using exponential smoothing, the forecast for periods 11 and 12 is *(round your responses to two decimal places)*:

Month	Oct	Nov	Dec
Forecast	$1.76	1.70	1.68

With α = 0.5 and the initial forecast for October of $1.72, using exponential smoothing, the forecast for periods 11 and 12 is *(round your responses to two decimal places)*:

Month	Oct	Nov	Dec
Forecast	$1.72	1.65	1.63

Based on the months of October, November, and December, the mean absolute deviation using exponential smoothing where α = 0.1 and the initial forecast for October = $1.81 is $ .142 *(round your response to three decimal places).*

Based on the months of October, November, and December, the mean absolute deviation using exponential smoothing where α = 0.3 and the initial forecast for October = $1.76 is $ .116 *(round your response to three decimal places).*

Based on the months of October, November, and December, the mean absolute deviation using exponential smoothing where α = 0.5 and the initial forecast for October = $1.72 is $ .098 *(round your response to three decimal places).*

Based on the mean absolute deviation, the better forecast is achieved using α = 0.5 .

month	price per chip	0.1	0.3	0.5			
jan	1.85						
feb	1.61				1.81+(0.1)*(1.57-1.81)=**1.79**		
march	1.6				1.786+(0.1)*(1.62-1.786)=**1.77**		
april	1.85				1.76+(0.3)*(1.57-1.76)=**1.70**		
may	1.9				1.7+(0.3)*(1.62-1.7)=**1.68**		
june	1.95				1.72+(0.5)*(1.57-1.72)=**1.65**		
july	1.8				1.645+(0.5)*(1.62-1.645)=**1.63**		
aug	1.82						
sept	1.6						
oct	1.57	1.81	1.76	1.72			
nov	1.62	**1.79**	**1.70**	**1.65**			
dec	1.75	**1.77**	**1.68**	**1.63**			
		Differences					
		-0.24	0.19	0.15			
		-0.166	0.083	0.025			
		-0.0194	0.074	0.1175			
		-0.4254	0.347	0.2925			
sum of differences		**-0.142**	**0.116**	**0.098**			