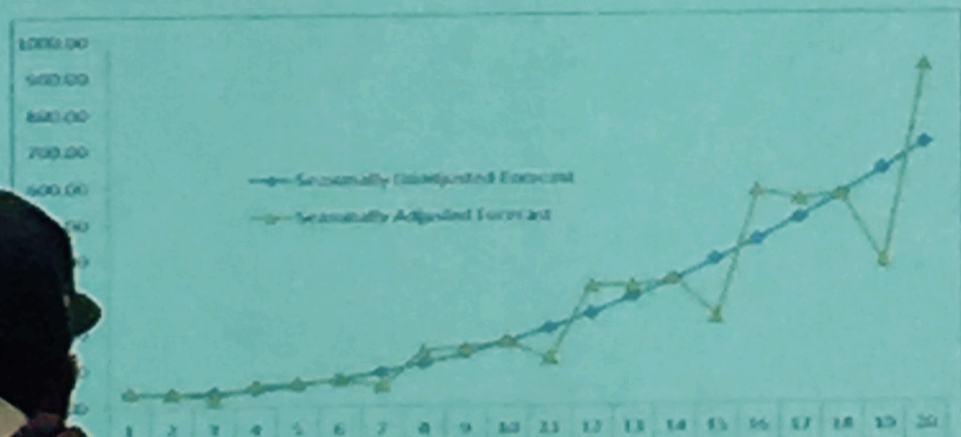


$$F_t = 40 - 6.5t + 2t^2$$

Where: F_t = Unit sales (in 000 units) $t = 1$ at the first quarter of 2010

Quarter	Relative
1	110.0
2	100.0
3	60.0
4	130.0

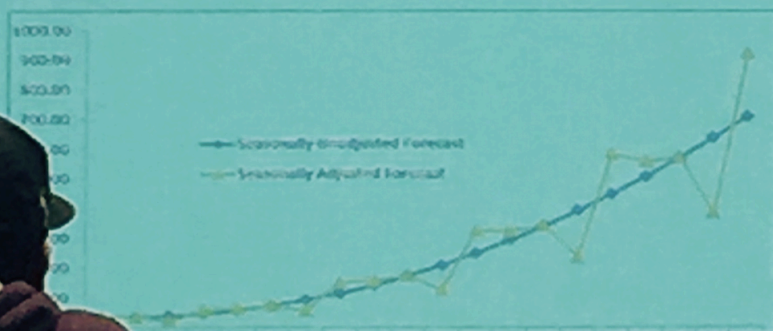


The following equation summarizes the trend portion of quarterly sales of automatic dishwashers over a long cycle. Sales also exhibit seasonal variations.

$$F_t = 40 - 6.5t + 2t^2$$

Where: F_t = Unit sales (in 000 units) $t = 1$ at the first quarter of 2010

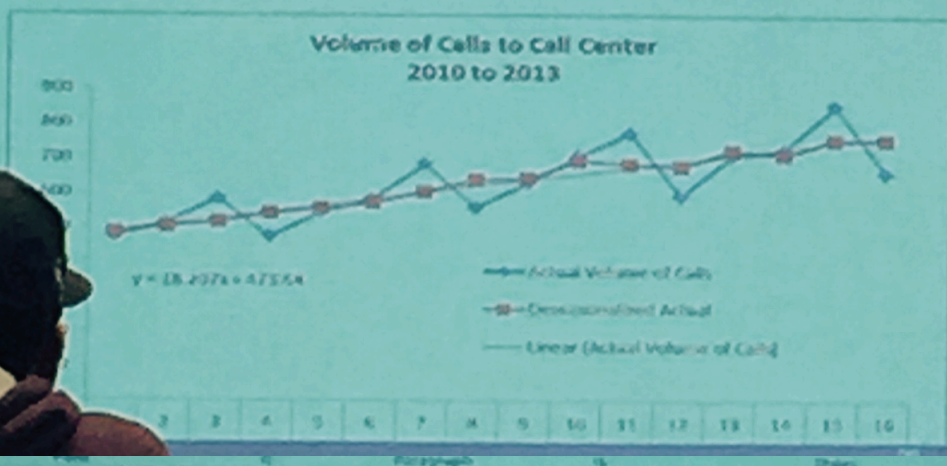
Quarter	Relative
1	110.0
2	100.0
3	60.0
4	130.0



Problem 2

The data below represent the call volumes over 20 quarters from a call center at a major financial institution. Develop a forecasting model for the volume of calls (in 000 units).

	2010	2011	2012	2013
Q1	473	544	624	709
Q2	513	582	707	728
Q3	502	671	772	854
Q4	474	537	592	591



- d. Seasonalized actual sales of dishwashers
- Refer to the time series graph. Which of the following is represented by the 'seasonal' line?
 - Seasonalized forecast of sales of dishwashers
 - Seasonalized actual sales of dishwashers
 - Seasonally adjusted forecast of dishwasher sales
 - Seasonally adjusted actual sales of dishwashers
 - Using the given trend equation, give your seasonally unadjusted forecast for the fourth quarter of 2013. _____
 - Using the given trend equation, give your seasonally adjusted forecast for the fourth quarter of 2013. _____
 - During the fourth quarter of 2013, the actual number of dishwashers sold was 470 (000 units). Compared to the seasonally adjusted forecast (refer to your assignment) for the fourth quarter of 2013, what is (how much) is the forecast error for this quarter? _____
 - If you were going to develop a forecast for the first quarter of 2016 using the trend equation given above, what will be the time code (i.e. value of t) for this period? _____
 - Assume you were the marketing manager of this outfit that is selling the dishwashers. What is the likely consequence if for the fourth quarter of 2014 you fail to consider (i.e. you think that the sales of the product does not differ from quarter to quarter) the seasonal differences in generating the forecast for the quarter?
 - Nothing
 - You will have excess inventory (higher inventory costs)
 - You will have shortages (lost sales or profits)
 - None of the above - all quarters are similar

11. Which of the following best depicts the expected behavior of sales of automatic dishwashers beyond 2014 assuming the time series trend as expressed in the equation above continues?
 - a. increasing, linear trend
 - b. decreasing, linear trend
 - c. increasing, non-linear trend
 - d. decreasing, non-linear trend
 - e. none of the above
 12. For each year, in which quarter is the sales of automatic dishwashers typically the best in terms of expected number of units to be sold?
 - a. Q1
 - b. Q2
 - c. Q3
 - d. Q4
 13. Refer to the time series graph above. Which of the following is represented by the smoothed sales?
 - a. Seasonally adjusted forecast of sales of dishwashers
 - b. Actual sales of dishwashers
 - c. Seasonally unadjusted forecast of dishwasher sales
 - d. ~~Disseasonalized~~ actual sales of dishwashers
- Refer to the time series graph. Which of the following is represented by the jagged line?
- a. ~~Disseasonalized~~ forecast of sales of dishwashers
 - b. ~~Disseasonalized~~ actual sales of dishwashers
 - c. Seasonally adjusted forecast of dishwasher sales
 - d. Seasonally adjusted actual sales of dishwashers

Problem 3

A product engineer has developed the following equation for the cost of a system component: $C = 1000 + 1500P$ where C is the cost in dollars and P is the probability that the component will operate as expected. The system is composed of two identical components, both of which must operate for the system to operate. The engineer can spend \$4,000 on the two components (note: the numbers above are different from the original problem discussed in class).

46. To the nearest two decimal places, what is the largest **COMPONENT** reliability (express your answer as a percent) that can be purchased with the given budget? _____
47. To the nearest two decimal places, what is the largest **SYSTEM** reliability (express your answer as a percent) that can be purchased with the given budget? _____
48. If the product engineer needs to have a 99 percent **SYSTEM** reliability, what is the minimum **COMPONENT** reliability that is needed? _____
49. If the product engineer needs to have a 99 percent **SYSTEM** reliability, how much should be spent on reliability for **EACH** component? _____
50. If the product engineer needs to have a 99 percent **SYSTEM** reliability, how much should be spent on reliability for the two components combined? _____

Problem 2

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Problem 8

An office manager has received a report from a consultant that includes a section on equipment replacement. The report indicates that scanners have a service life that is normally distributed with a mean of 41 months and a standard deviation of 4 months.

39. What percentage of the scanners in the office would you expect to last fail within the warranty period of 3 years? _____
40. If there are 20 of this scanner in the office, how many of them are expected to fail within the warranty period? _____
41. If the scanner manufacturer makes and sells 1,000 units of this scanner each year, assuming a replacement cost of \$200 per scanner, what is the expected total cost of replacement for the scanners that fail within the warranty period? _____

new process of manufacturing the scanners is made and the new process reduces the

27. a. PMI
b. Sales
c. Both PMI and Sales
28. Refer to the regression equation expressing the relationship between PMI and Sales. By how much on average is Sales changing per unit increase in PMI?
a. Sales is increasing by \$78,421
b. Sales is decreasing by \$78,421
c. Sales is increasing by \$1.053
d. Sales is decreasing by \$1.053
e. None of the above (Write the correct answer)
29. Use the linear regression equation to obtain an estimate of Sales for November 2024 if PMI is projected to be 54 _____
30. How much does the predictor variable PMI explain for the variation in Sales?
a. 0.8056
b. 64.74%
c. 1.0529
d. 78,421
e. None of the above (Write the correct answer)

Problem 1

An electrical contractor's records during the last 5 weeks indicate the number of job requests:

Week	Actual Requests
1	20
2	22
3	18
4	21
5	22

- Forecast Week 6 sales volume using a linear trend equation.
- Forecast Week 6 sales volume using a 3-month moving average.
- Forecast Week 6 sales volume using the Naïve approach.
- Forecast Week 6 sales volume using a weighted average using 0.50 for Week 5, 0.30 for Week 4, and 0.20 for Week 3.

Refer to your solution to the assignment problem. Using the MAD, MSE, or MAPE as a measure of forecast accuracy, which of the following statements is the most accurate?

- The Naïve method is more accurate than the MA2 by all (MAD, MSE, MAPE) measures.
- The MA2 is more accurate than the Naïve by all (MAD, MSE, MAPE) measures.
- The MAD is more accurate than the MSE or MAPE.
- The MAPE is more accurate than the MA2.

d. De-seasonalized actual sales of dishwashers

- Refer to the time series graph. Which of the following is represented by the 'seasonal' line?
 - De-seasonalized forecast of sales of dishwashers
 - De-seasonalized actual sales of dishwashers
 - Seasonally adjusted forecast of dishwasher sales
 - Seasonally adjusted actual sales of dishwashers
- Using the given trend equation, give your seasonally unadjusted forecast for the fourth quarter of 2015.
- Using the given trend equation, give your seasonally adjusted forecast for the fourth quarter of 2015.
- During the fourth quarter of 2013, the actual number of dishwashers sold was 470 (000 units). Compared to the seasonally adjusted forecast (refer to your assignment) for the fourth quarter of 2013, what is (how much) is the forecast error for this quarter?
- If you were going to develop a forecast for the first quarter of 2016 using the trend equation given above, what will be the time code (i.e. value of t) for this period?
- Assume you were the marketing manager of this outfit that is selling the dishwashers. What is the likely consequence if for the fourth quarter of 2014 you fail to consider (i.e. you think that the sales of the product does not differ from quarter to quarter) the seasonal differences in generating the forecast for the quarter?
 - Nothing
 - You will have excess inventory (higher inventory costs)
 - You will have shortages (lost sales or profits)
 - None of the above - all quarters are similar