

Problem 1 (name the Excel file as A2Problem1_yourLastNameFirstName)
→ 20 points total

In a manufacturing process the assembly line speed (feet per minute) was thought to affect the number of defective parts found during the inspection process. To test this theory, managers devised a situation in which the same batch of parts was inspected visually at a variety of line speeds. They collected the following data: **(Data file needed: Problem1_LineSpeed.xlsx)**

Line Speed (ft/min)	No. of Defective Parts Found
20	21
20	19
40	15
30	16
60	14
40	17

- (5 points)** Develop a scatter chart with line speed as the independent variable. What does the scatter chart indicate about the relationship between line speed and the number of defective parts found?
- (10 points)** Use the data to develop an estimated regression equation that could be used to predict the number of defective parts found, given the line speed. What is the estimated regression model?
- (5 points)** How much of the variation in the number of defective parts found for the sample?

**Problem 2 (name the Excel file as A2Problem2_yourLastNameFirstName)→
30 points total**

In 2011, home prices and mortgage rates fell so far that in a few cities the monthly cost of owning a home was less expensive than renting. The following data show the average asking rent for 10 markets and the monthly mortgage on the median priced home (including taxes and insurance) for 10 cities where the average monthly mortgage payment was less than the average asking rent (The Wall Street Journal, November 26–27, 2011).

(Data file needed: Problem2_RentMortgage.xlsx)

City	Rent (\$)	Mortgage (\$)
Atlanta	840	539
Chicago	1,062	1,002
Detroit	823	626
Jacksonville	779	711
Las Vegas	796	655
Miami	1,071	977
Minneapolis	953	776
Orlando	851	695
Phoenix	762	651
St. Louis	723	654

- (5 points) Develop a scatter chart for these data, treating the average asking rent as the independent variable. Does a simple linear regression model appear to be appropriate?
- (10 points) Use a simple linear regression model to develop an estimated regression equation to predict the monthly mortgage on the median-priced home given the average asking rent. Construct a plot of the residuals against the independent variable rent. Based on this residual plot, does a simple linear regression model appear to be appropriate?
- (10 points) Using a quadratic regression model, develop an estimated regression equation to predict the monthly mortgage on the median-priced home, given the average asking rent.
- (5 points) Do you prefer the estimated regression equation developed in part (b) or part (c)? Explain your conclusions.

**Problem 3 (name the Excel file as A2Problem3_yourLastNameFirstName)→
20 points total**

Consider the following time series: **(No Data file needed, create from the table below)**

Quarter	Year 1	Year 2	Year 3
1	71	68	62
2	49	41	51
3	58	60	53
4	78	81	72

- (5 points)** Construct a time series plot. What type of pattern exists in the data? Is there an indication of a seasonal pattern?
- (10 points)** Use a multiple linear regression model with dummy variables as follows to develop an equation to account for seasonal effects in the data: Qtr1=1 if quarter 1, 0 otherwise; Qtr2 =1 if quarter 2, 0 otherwise; Qtr3=1 if quarter 3, 0 otherwise.
- (5 points)** Compute the quarterly forecasts for the next year.

**Problem 4 (name the Excel file as A2Problem4_yourLastNameFirstName)→
30 points total**

Hogs & Dawgs is an ice cream parlor on the border of north-central Louisiana and southern Arkansas that serves 43 flavors of ice creams, sherbets, frozen yogurts, and sorbets. During the summer Hogs & Dawgs is open from 1:00 p.m. to 10:00 p.m. on Monday through Saturday, and the owner believes that sales change systematically from hour to hour throughout the day. She also believes that her sales increase as the outdoor temperature increases. Hourly sales and the outside temperature at the start of each hour for the last week are provided. **(Data file needed: Problem4_IceCreamSales.xlsx)**

- a. (5 points) Construct a time series plot of hourly sales and a scatter plot of outdoor temperature and hourly sales. What types of relationships exist in the data?
- b. (10 points) Use a simple regression model with outside temperature as the causal variable to develop an equation to account for the relationship between outside temperature and hourly sales in the data. Based on this model, compute an estimate of hourly sales for today from 2:00 p.m. to 3:00 p.m. if the temperature at 2:00 p.m. is 93°F.
- c. (10 points) Use a multiple linear regression model with the causal variable outside temperature and dummy variables as follows to develop an equation to account for both seasonal effects and the relationship between outside temperature and hourly sales in the data:

Hour1 = 1 if the sales were recorded between 1:00 p.m. and 2:00 p.m., 0 otherwise
Hour2 = 1 if the sales were recorded between 2:00 p.m. and 3:00 p.m., 0 otherwise
⋮
Hour8 = 1 if the sales were recorded between 8:00 p.m. and 9:00 p.m., 0 otherwise

Note that when the values of the eight dummy variables are equal to 0, the observation corresponds to the 9:00-to-10:00-p.m. hour. Based on this model, compute an estimate of hourly sales for today from 2:00 p.m. to 3:00 p.m. if the temperature at 2:00 p.m. is 93°F.

- d. (5 points) Is the model you developed in part (b) or the model you developed in part (c) more effective? Explain your answer.