Appendix B
Data Analytics

Road Map

Learning Objectives		Page	eLecture	Assignments
1	Identify and define the four types of data analytics.	519	eB.1	1, 6, 7, 8,
2	Describe the use of data analytics within the accounting profession.	520	eB.2	1, 6, 7, 8, 13, 18,
3	Describe the analytics mindset.	521	eB.3	2, 3, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
4	Describe data visualization best practices.	523	eB.4	4, 5, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 24

2. Use the forecasts to determine:
   a. Expected unit sales in October 2021
   b. Expected sales revenue in June 2021
   c. Expected net operating income in December 2021
3. Open the Describe Forecast screen. Use the Summary tab to determine:
   a. What percent of the forecast was attributed to seasonality for net operating income?
   b. What was the range given for number of units sold for January 2021?
4. Duplicate the worksheet as a cross-tab and swap the axes. Filter out details for net operating income and units sold. For December 2021, what is Tableau's:
   a. estimate?
   b. lower prediction interval?
   c. upper prediction interval?
5. How could Melton use forecasts to manage or expand the business?

A video demonstrating the use of Microsoft Excel to use Benford's Law in the detection of fraud is available on the textbook's website to assist in solving problem PB-18.

LO2, 3

PB-18. Using Excel for Fraud Detection

Benford's Law represents a powerful tool in the forensic accountant's toolkit to aid in the detection of fraud. Benford's Law is a mathematical law that recognizes the leading (first) digit in many real-life number sets is distributed in a certain manner, and often not in the manner that a fraudster would expect. Specifically the number 1 occurs as the first digit approximately 30 percent of the time, with each succeeding digit appearing less often as follows: 1–30%, 2–18%, 3–12%, 4–10%, 5–8%, 6–7%, 7–6%, 8–5%, and 9–5%. Fraudsters who are unaware of this natural ordering will often arrange digits in a random order that deviates from Benford's Law.

In Part A of this problem you will use Microsoft Excel to show how a natural data set of GDP by country conforms to Benford's Law and how a random set of numbers does not. In Part B you will use the same data used in an actual court case to convict a fraudster of embezzlement. Finally, in Part C you will use Benford's Law to test a new reimbursement procedure for possible fraud. A video demonstrating the Excel tools used in this problem is available on the textbook's website.

Part A Use Microsoft Excel to show how a natural data set of GDP by country conforms to Benford's Law and how a random set of numbers does not.

- Download the file **GDP.xlsx** from the textbook website. The file contains World Bank GDP data by country for 2018.
- In order to use Benford's Law you need to first extract the leading digit from each country's GDP amount. To do this, place the cursor in cell C2 and input the formula `=Left(B2,1)`. Copy this formula down column C for each country.
- Next in cells F2 through F10 input the numbers 1 through 9. In cell G2 input the formula `=COUNTIF($c$2:$C$205,F2)` and copy the formula down for each number 1 through 9. This formula goes through the entire range of extracted first digits in column C and records the count of these digits in the cell if it matches the number in column F.
- Sum the column total in cell G11.
- Next determine the percentage that each leading digit appears by dividing the amount in column G by the total of these amounts in cell G11 and place this figure in column H.
- In column I, compute the predicted occurrences of each digit (given above) by placing the formula `=Log10(1/F2+1)` in cell I2 and copying the formula down the column.
- Finally create a Combo chart to visualize these results by highlighting cells H1:I10 and selecting Combo chart.

a. Do the naturally occurring GDP amounts appear to follow Benford's Law?

- Next replace the GDP amounts with random numbers to see if random numbers also obey Benford's Law.
- Input the formula `=Rand()*1000` in cell B2 and copy this formula down the column.
- Observe the results in the table and the chart. Try to recalculate the spreadsheet several times to obtain different sets of random numbers.

b. Do random numbers appear to follow Benford's Law?

PB-22. Forecasting Using Excel (Predictive Analytics) LO3, 4

Melton Manufacturing opened in January 2019. Sales have increased significantly in the first two years of operations, and management is now looking to expand production capacity. To finance the purchase of a new factory, they would need to either raise capital or borrow funds.

They have asked you to make some projections for the next year of operations. They intend to share these with potential investors and lenders.

Information about unit sales, sales revenues, and net profits for the past two years is included in the **Forecasting Data Set.xlsx** file available on the textbook's website. A video demonstrating Excel tools used to answer the questions in this problem is also available on the website.

1. Create three line graphs in Excel (one for units sold, one for sales revenue, and one for net operating income). Add trendlines to all graphs.
   a. Extend the trendline out for 12 months.
   b. Use the Polynomial (Order 2) trendline option for all charts
   c. To see how closely the trendline matches the data, check the *Display R-squared value on chart* box. The closer the R-square value is to 1, the better the match.
2. Create the same three graphs using the Forecast Sheet tool (line charts) in Excel.
   a. Set the *Forecast End* to 12/1/2021.
   b. Use an 85% *Confidence Interval.*
   c. Check the *Include forecast statistics* box.
   d. Leave remaining defaults as is.
3. Use the trendline graphs to determine: (*HINT:* To help identify the answers, display gridlines. Consider changing vertical axis bounds.)
   a. Expected unit sales in October 2021
   b. Expected sales revenue in June 2021
   c. Expected net profits in December 2021
4. Use the Forecast sheets to determine:
   a. Range of expected unit sales in October 2021 (Upper to lower Confidence bounds)
   b. Expected sales revenue in June 2021 (Upper to lower Confidence bounds)
   c. Range of expected net profits in December 2021 (Upper to lower Confidence bounds)
5. To evaluate the Forecast sheets, rerun the forecasts. This time change the *Forecast Start* date to 1/1/2020 to see what the model would have predicted for 2020. (Leave all other options the same as 2 above.) Were the predictions higher or lower than the actual results? What could have caused the differences?

PB-23. Utilization of Constrained Resources Using Excel (Prescriptive analytics) LO3

Backyard Helpers, Inc. is a small manufacturing company with 18 different gardening tools in its product line. All of the products are fabricated using the same equipment.

Recently, sales demand has increased. Unfortunately, Backyard Helpers cannot produce enough products with existing equipment to meet that demand. Facilities can be expanded, and new equipment purchased, but it will be at least two years before that happens. The production manager needs to make production scheduling decisions now.

The **Constrained Resource Data Set.xlsx** file available on the textbook's website includes information about demand, sales price, cost, and fabrication time on the shared equipment for each of Backyard Helpers' products. A video demonstrating Excel tools used to answer the questions in this problem is also available at cambridgepub.com.

Maximum machine time is 40,500 minutes per month. The demand for all products is spread equally throughout the month. Fixed costs (manufacturing, selling, and administrative) total $755,750 per month. Backyard Helpers maintains no inventory of finished goods. (All units produced are sold during the month.)

1. Ignore machine time limits in answering the following:
   a. Which product has the highest contribution margin per unit? How many units of that product should be produced each month?
   b. If Backyard could meet demand, what would be the total net operating income per month?
2. If demand was unlimited for all products, which products should Backyard Helpers produce?
3. Given the maximum number of machine minutes per month, use Solver in Excel to answer the following:
   a. How many of the following products should be produced each month?
      i. R25
      ii. JK369