Chapter 3
Data Visualization

Solutions:

1.

Salesperson	Total Sales ($)	Average Performance Bonus Previous Years ($)	Customer Accounts	Years with Company
Smith, Michael	325,001	12,499	124	14
Yu, Joe	13,678	240	9	7
Reeves, Bill	452,359	21,987	175	21
Hamilton, Joshua	87,424	7,643	28	3
Harper, Derek	87,654	1,250	21	4
Quinn, Dorothy	234,091	14,568	48	9
Graves, Lorrie	379,402	27,981	121	12
Sun, Yi	31,734	673	7	1
Thompson, Nicole	127,845	13,323	17	3

Some of the changes made in this table include:
Deleting unnecessary gridlines in the table
Removing bolded font except for column titles
Left align text column and right align numerical columns
Adding commas to dollar values to ease readability and removing unnecessary digits to right of decimal place

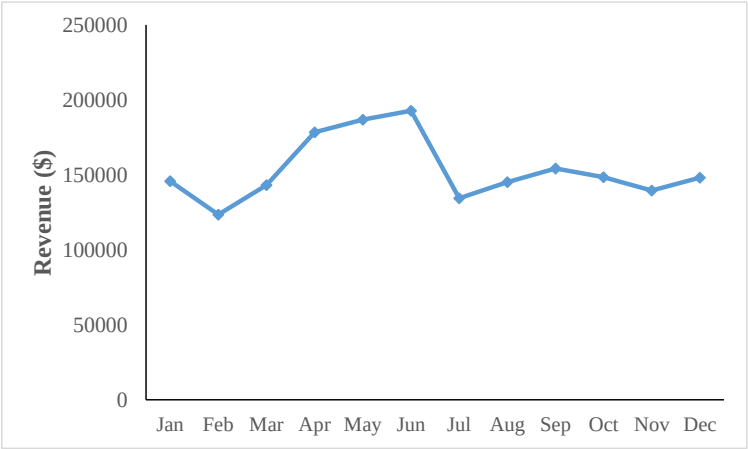
2. a. The readability of the table could be improved by: removing unnecessary gridlines, left-aligning the first column because it contains text entries, right aligning all other columns because they contain numerical values, reducing the number of digits displayed by displaying numerical values in millions or billions of dollars and using shading to differentiate the columns. Note that we could also sort these values by GDP in 2010 if this was the value of most interest.

b.

	Gross Domestic Product (in Billions of US Dollars, $)					
Country	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Albania	7.4	8.1	9.7	11.6	10.8	10.6
Argentina	169.7	198.0	241.0	301.3	285.1	339.6
Australia	704.5	758.3	916.9	983.0	934.2	1178.8
Austria	272.9	290.7	336.8	375.8	344.5	341.4
Belgium	335.6	355.4	408.5	451.7	421.4	416.5
Brazil	756.8	935.5	1175.0	1407.0	1370.8	1782.4
Canada	1056.8	1193.9	1332.1	1404.8	1245.2	1469.9
Costa Rica	18.9	21.2	24.7	28.0	28.0	33.9
Czech Republic	111.7	128.7	156.6	194.6	170.9	172.6
Finland	169.9	180.2	214.8	236.6	206.7	207.9
France	1915.0	2015.0	2312.8	2541.6	2367.9	2301.8
Germany	2516.9	2632.8	2984.7	3258.9	2973.7	2966.1
Greece	217.2	234.3	273.8	307.1	292.6	269.1
Ireland	177.7	195.3	229.6	233.3	199.5	186.2
Israel	122.4	133.2	153.4	185.7	178.7	199.8
Italy	1597.3	1661.9	1892.7	2063.9	1900.0	1836.9
Mexico	823.3	928.5	1011.9	1085.6	858.3	1010.3
Netherlands	567.3	600.9	694.8	775.4	708.0	700.8
New Zealand	108.9	105.1	129.0	125.7	112.9	136.2
Peru	72.3	84.4	98.5	117.8	120.4	144.3
Poland	267.8	300.1	371.9	463.4	382.6	413.4
Portugal	165.3	172.9	200.1	218.7	206.0	200.5
Saudi Arabia	317.4	358.4	386.7	477.3	374.4	436.2
Singapore	119.7	139.1	167.0	179.3	173.8	209.7
South Africa	220.3	232.2	254.4	247.5	256.9	328.8
Spain	1012.0	1100.0	1293.2	1459.0	1361.0	1287.9
Switzerland	350.6	368.2	409.2	474.7	464.9	498.2
Turkey	425.5	467.9	579.0	656.6	557.7	655.8
United Kingdom	2030.3	2178.0	2504.6	2381.9	1959.2	2005.6
United States	12579.7	13336.3	14010.9	14369.5	14113.3	14601.6

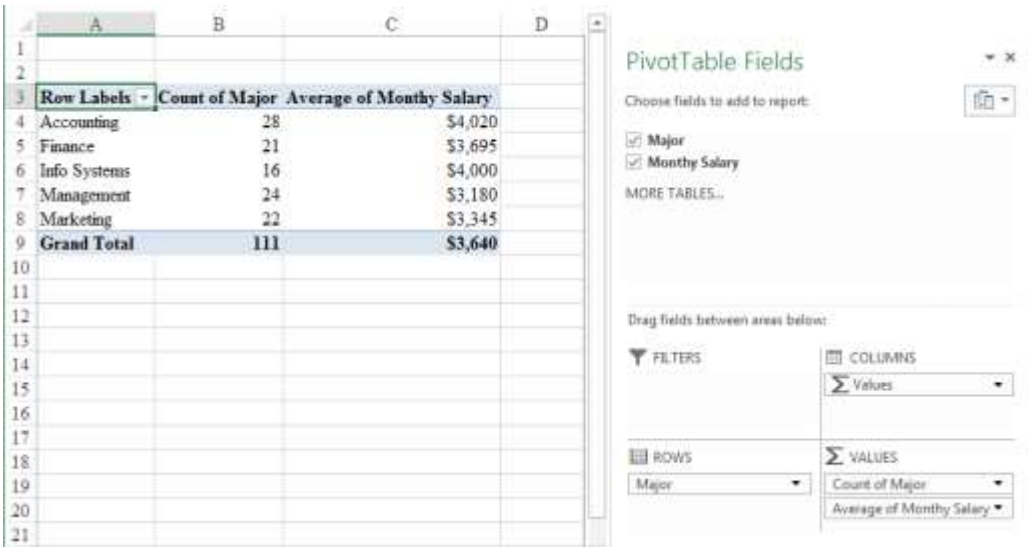
3. a. The chart contains unnecessary gridlines, the y-axis label values are spaced much too close together, the shading of the chart does not add value.

b.



Note that here we have also added small markers on the line chart at each data point to indicate that the data are not continuous.

4.



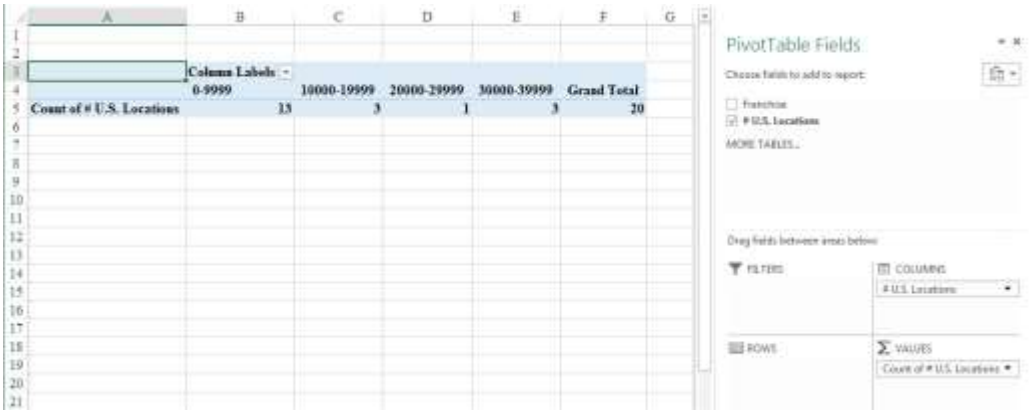
Row Labels	Count of Major	Average of Monthy Salary
Accounting	28	$4,020
Finance	21	$3,695
Info Systems	16	$4,000
Management	24	$3,180
Marketing	22	$3,345
Grand Total	**111**	**$3,640**

a. The PivotTable shows that accounting major has the greatest number of students with 28 students.

b. Accounting has the highest average starting monthly salary at $4020.

c. By changing the Value Field Settings for Monthly Salary from Average to Max, we see that an accounting student has the highest starting salary at $5650.
By changing the Value Field Settings for Monthly Salary to Min, we see that a management student has the lowest starting salary at $2240.

5.

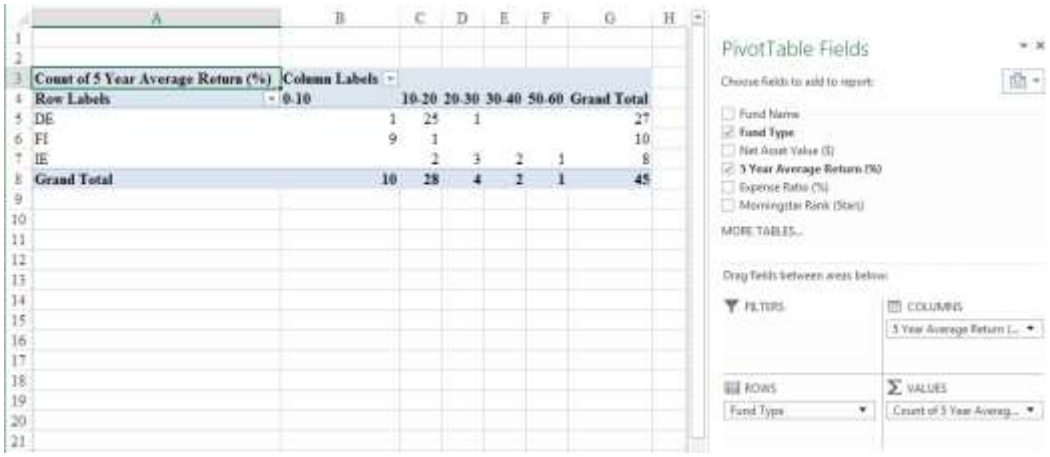


	Column Labels				
	0-9999	10000-19999	20000-29999	30000-39999	Grand Total
Count of # U.S. Locations	13	3	1	3	20

a. 13 franchises have between 0 and 9999 locations.

b. 3 franchises have more than 30,000 locations.

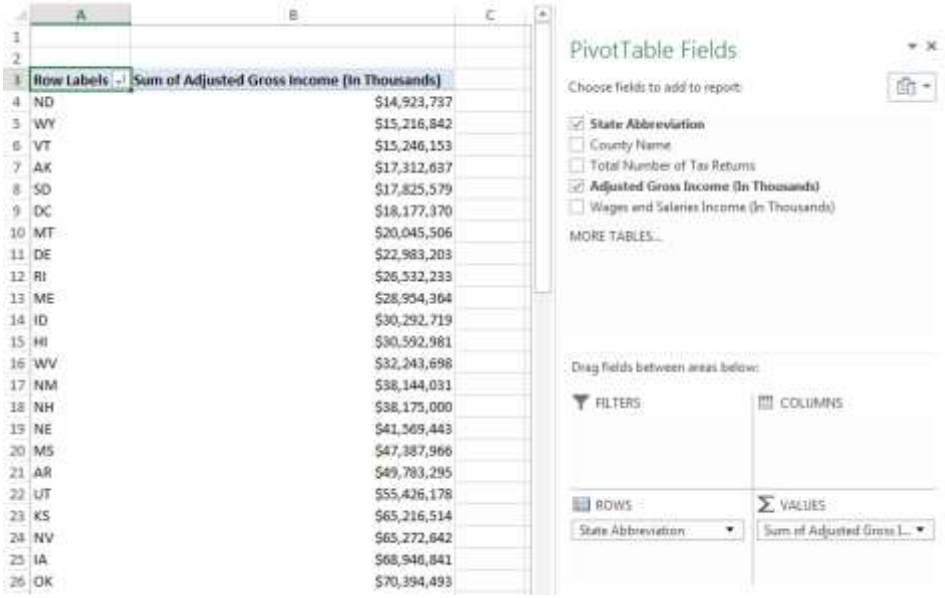
6. a.



Count of 5 Year Average Return (%)	Column Labels					
Row Labels	0-10	10-20	20-30	30-40	50-60	Grand Total
DE	1	25	1			27
FI	9	1				10
IE		2	3	2	1	8
Grand Total	10	28	4	2	1	45

b. Fixed Income (FI) funds have had lower average returns than domestic equity (DE) or international equity (IE) funds; no FI funds has an average return greater than 19.99% and 9 of the 10 have average returns less than 9.99%. IE funds have had greater returns with no IE fund having an average return of less than 10%. IE funds are the only funds to have surpassed a 30% average return.

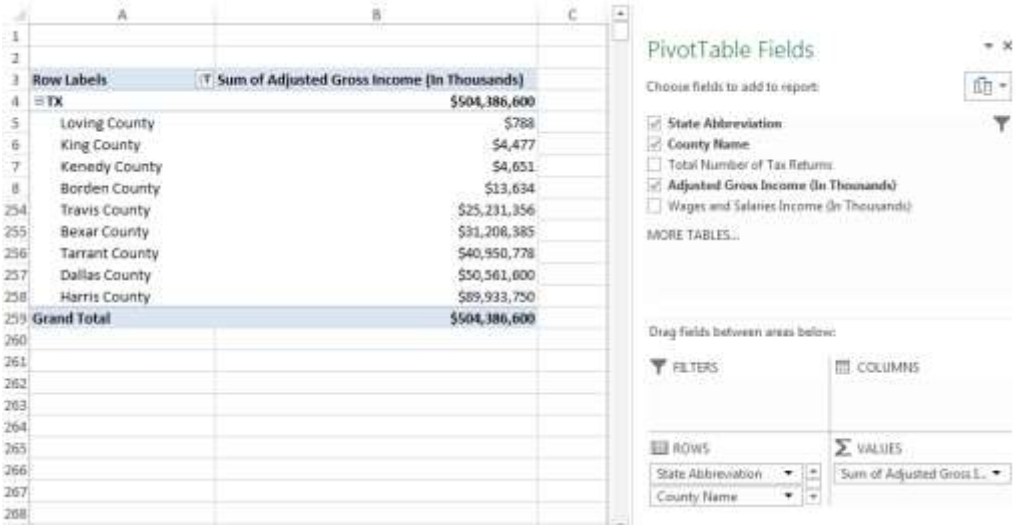
7. a.



Row Labels	Sum of Adjusted Gross Income (In Thousands)
ND	$14,923,737
WY	$15,216,842
VT	$15,246,153
AK	$17,312,637
SD	$17,825,579
DC	$18,177,370
MT	$20,045,506
DE	$22,983,203
RI	$26,532,233
ME	$28,954,364
ID	$30,292,719
HI	$30,592,981
WV	$32,243,698
NM	$38,144,031
NH	$38,175,000
NE	$41,569,443
MS	$47,387,966
AR	$49,783,295
UT	$55,426,178
KS	$65,216,514
NV	$65,272,642
IA	$68,946,841
OK	$70,394,493

North Dakota (ND) has the smallest sum of adjust gross income with $14,923,737,000.

b.

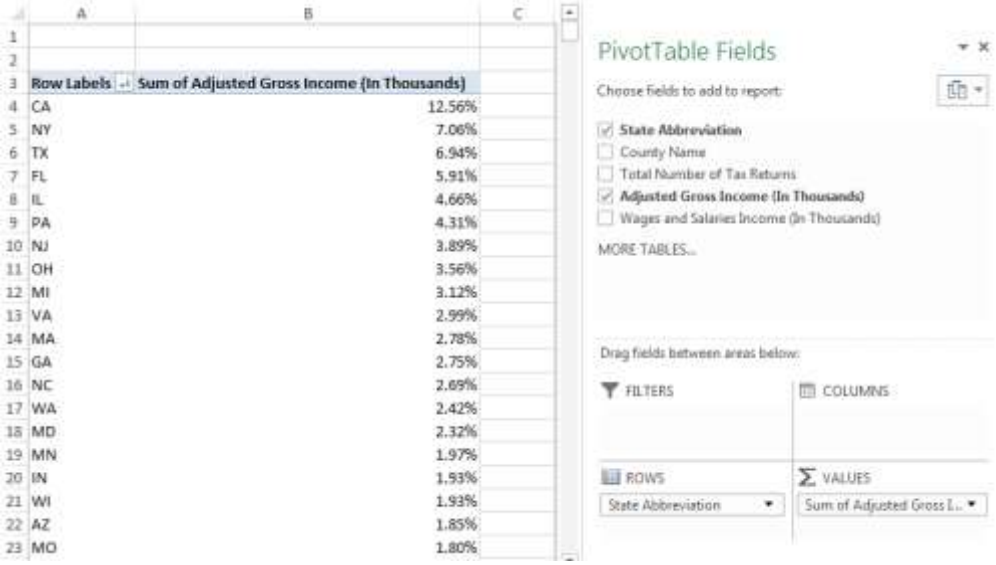


Row Labels	Sum of Adjusted Gross Income (In Thousands)
TX	$504,386,600
Loving County	$788
King County	$4,477
Kenedy County	$4,651
Borden County	$13,634
Travis County	$25,231,356
Bexar County	$31,206,385
Tarrant County	$40,950,778
Dallas County	$50,561,600
Harris County	$89,933,750
Grand Total	$504,386,600

Loving county had the smallest sum of adjusted gross income in Texas; Harris county had the largest sum of adjusted gross income.

c. Harris county has the highest percentage of adjusted gross income in Texas at 17.83%.

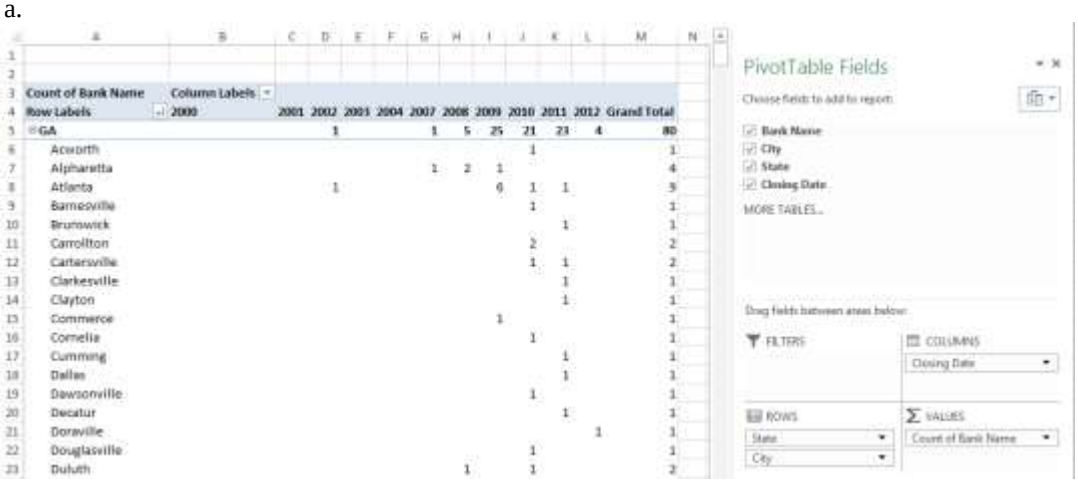
d.



Row Labels	Sum of Adjusted Gross Income (In Thousands)
CA	12.56%
NY	7.06%
TX	6.94%
FL	5.91%
IL	4.66%
PA	4.31%
NJ	3.89%
OH	3.56%
MI	3.12%
VA	2.99%
MA	2.78%
GA	2.75%
NC	2.69%
WA	2.42%
MD	2.32%
MN	1.97%
IN	1.93%
WI	1.93%
AZ	1.85%
MO	1.80%

New York provides 7.06% of the total adjusted gross income in the United States.

8. a.

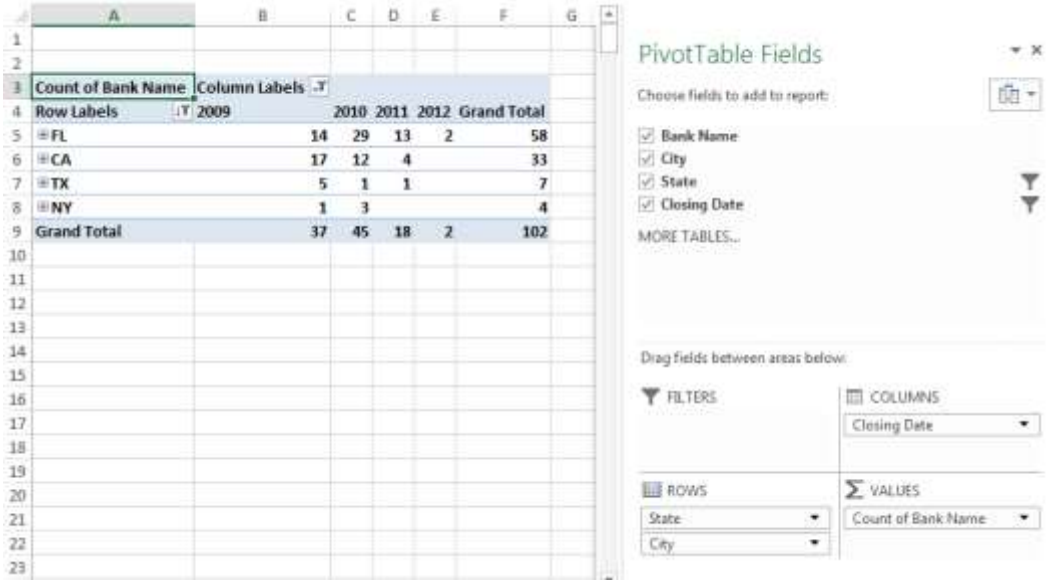


Count of Bank Name	Column Labels										
Row Labels	2000	2001	2002	2003	2004	2007	2008	2009	2010	2011	2012	Grand Total
GA			1			1	5	25	21	23	4	80
Acworth									1			1
Alpharetta						1	2	1				4
Atlanta			1					6	1	1		9
Barnesville									1			1
Brunswick										1		1
Carrollton									2			2
Cartersville									1	1		2
Clarkesville										1		1
Clayton										1		1
Commerce								1				1
Cornelia									1			1
Cumming										1		1
Dallas										1		1
Dawsonville									1			1
Decatur										1		1
Doraville											1	1
Douglasville									1			1
Duluth								1	1			2

Georgia (GA) had the greatest number of bank closures between 2000 and 2012.

b. Nevada experienced 4 bank closures in 2010. These occurred in Carson City, Las Vegas and Reno.

c.

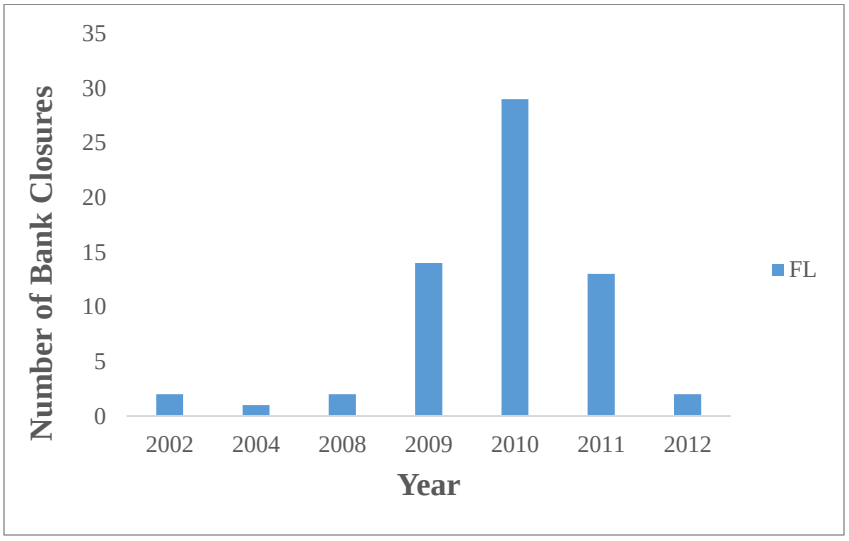


Count of Bank Name	Column Labels				
Row Labels	2009	2010	2011	2012	Grand Total
FL	14	29	13	2	58
CA	17	12	4		33
TX	5	1	1		7
NY	1	3			4
Grand Total	37	45	18	2	102

There were 102 bank closures between 2009 and 2012 in the states of California, Florida, Texas and New York.

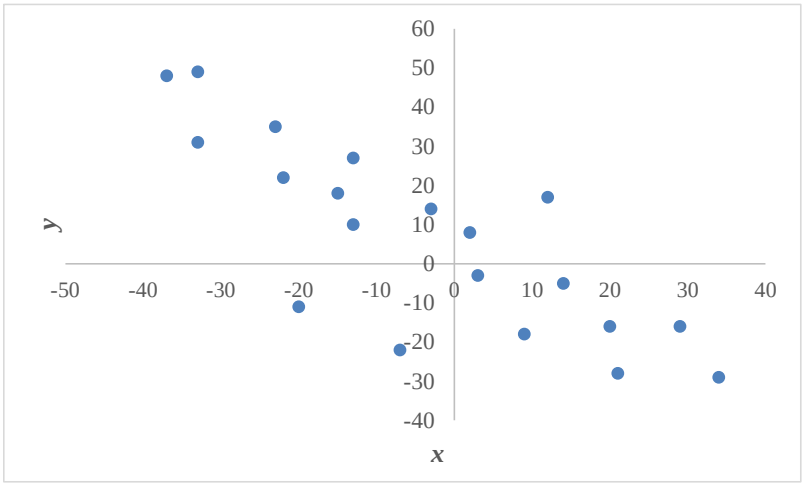
d. Naples had the greatest number of bank closures in Florida between 2009 and 2012 with 4 bank closures.

e.

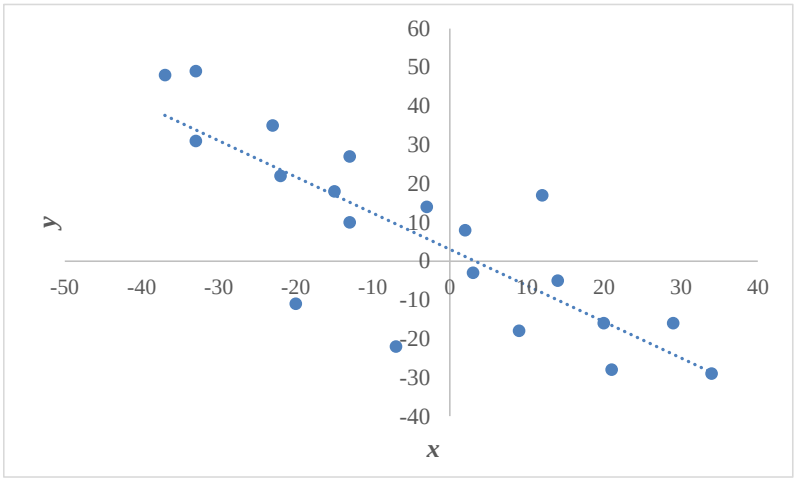


Bank closures peaked in 2010 in Florida and have decreased since then.

9. a.

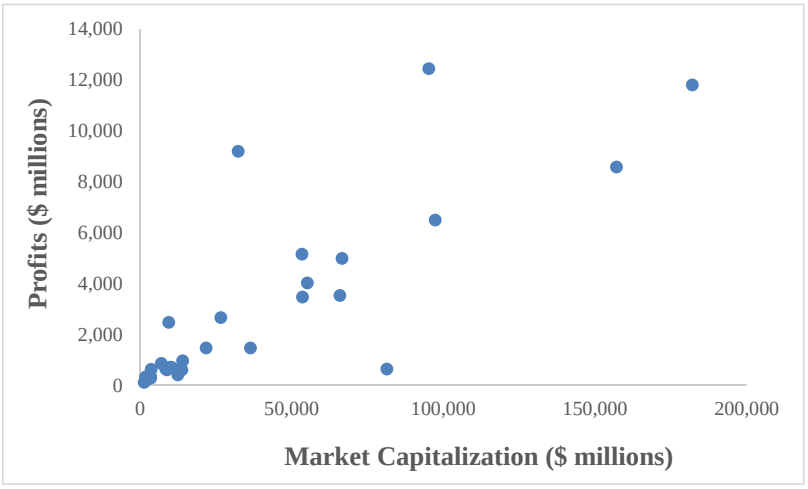


b.



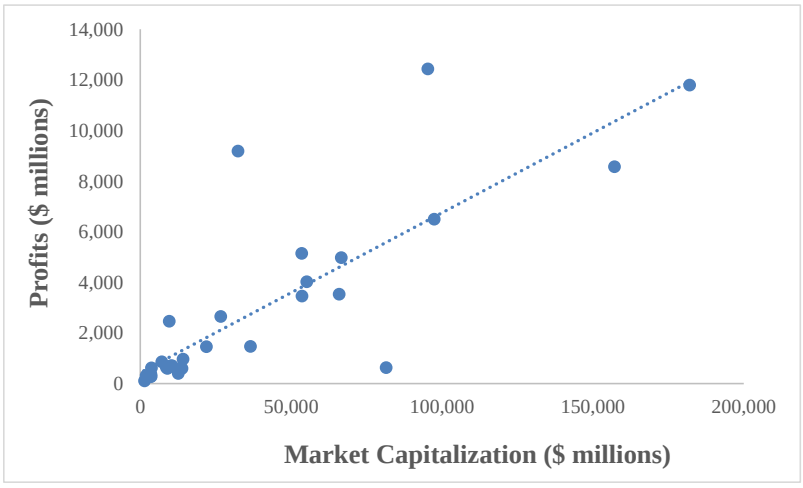
There appears to be a negative linear relationship between the *x* and *y* variables.

10. a.



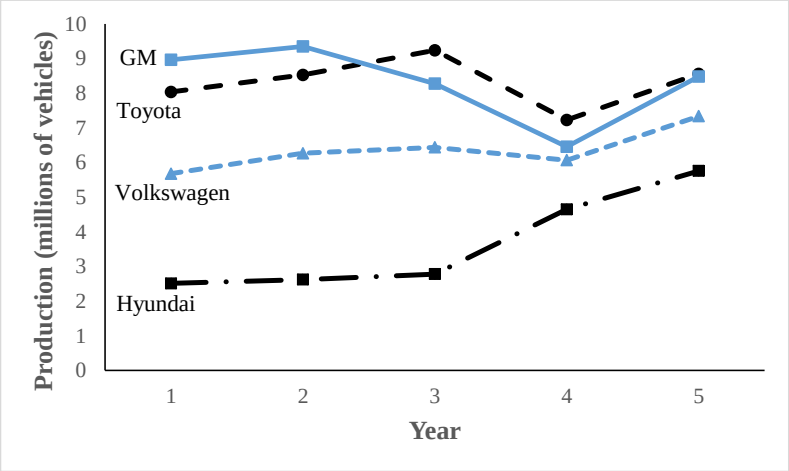
There appears to be a positive linear relationship between profits and market capitalization. As profit increases, market capitalization also increases.

b.



The trendline confirms that there is a positive linear trend between profits and market capitalization.

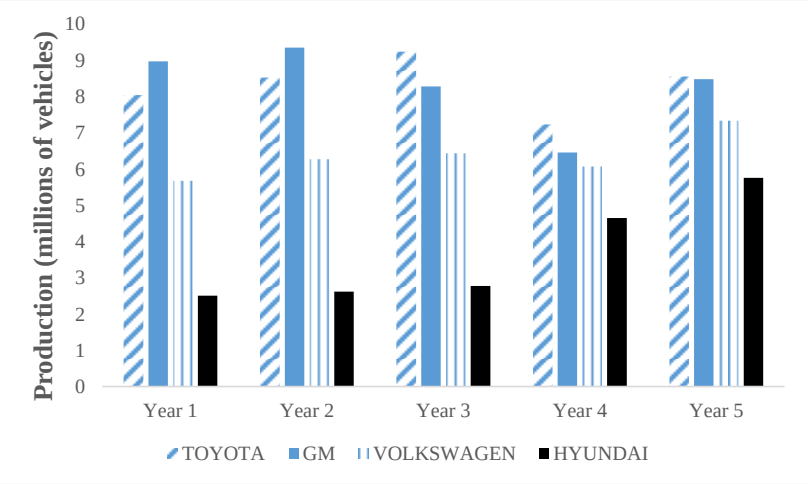
11. a.



Note that we have made several changes to the line chart here to improve readability. We have added axes labels, we have differentiated the lines using different line styles and we have placed labels in the chart for each line.

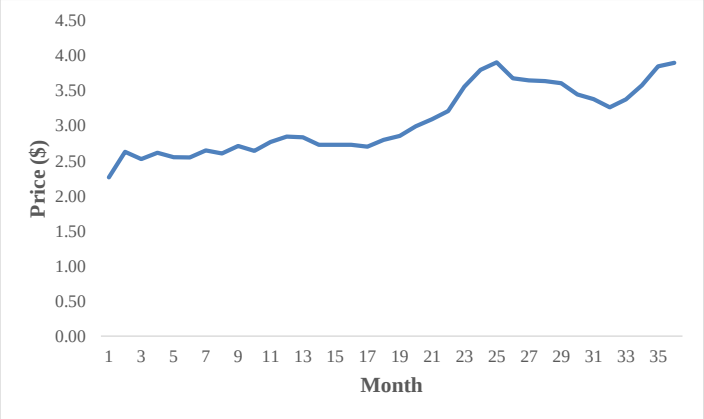
b. GM produced the greatest number of vehicles in Years 1 and 2, but was passed in year 3 by Toyota. Both GM and Toyota produced fewer vehicles in Year 4. By Year 5, Toyota and GM were producing approximately the same number of vehicles. Hyundai has seen significant increases in vehicle production in Years 4 and 5.

c.



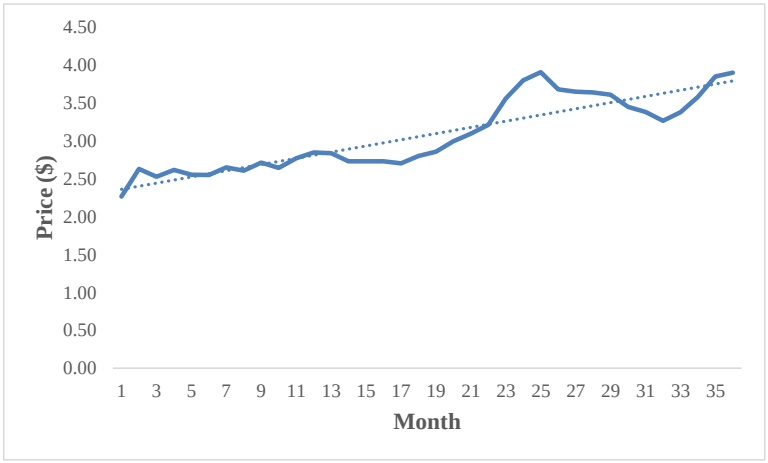
<u>Leading Manufacturers</u>
Year 1: GM
Year 2: GM
Year 3: Toyota
Year 4: Toyota
Year 5: Toyota (although GM and Toyota are producing about the same number of vehicles in Year 5)

12. a.



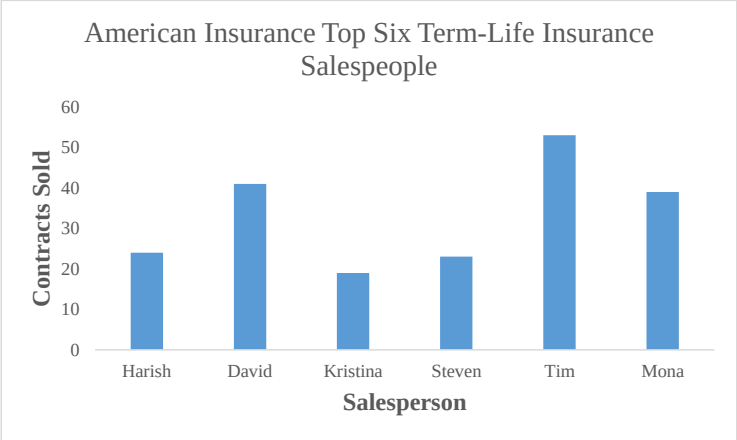
Gasoline prices were relatively steady for about the first 16 to 18 months and then increased rapidly through about month 25 before falling before rising in the last few months. Overall the price of gasoline appears to be increasing over the 36 months, but it is not a constant increase.

b.

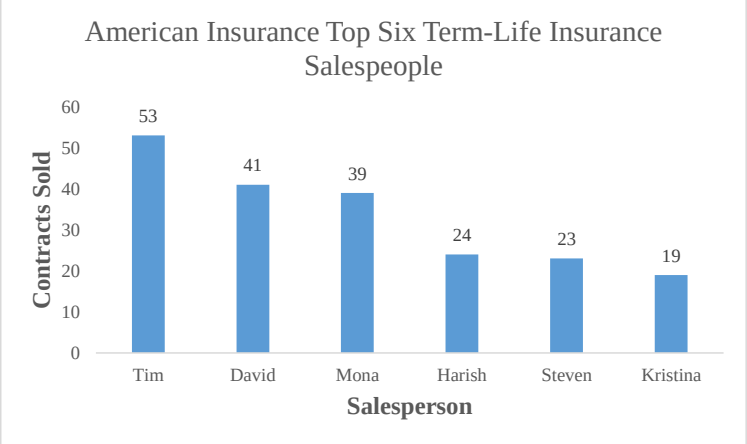


The trendline confirms that there is an overall linear increase in the price of gasoline over the 36 months.

13. a.



b. and c.

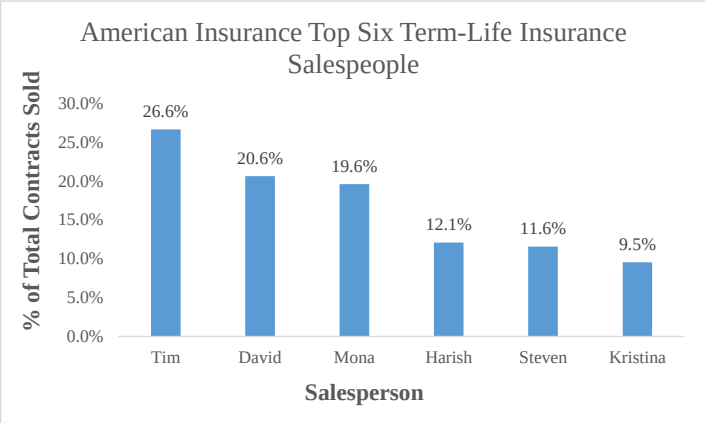


Sorting can be done by selecting the data in Excel and then using the **Sort** function in the **Sort & Filter** group under the **DATA** tab. Data labels can be added by right clicking on one of the columns in the chart and selecting **Add Data Labels**.

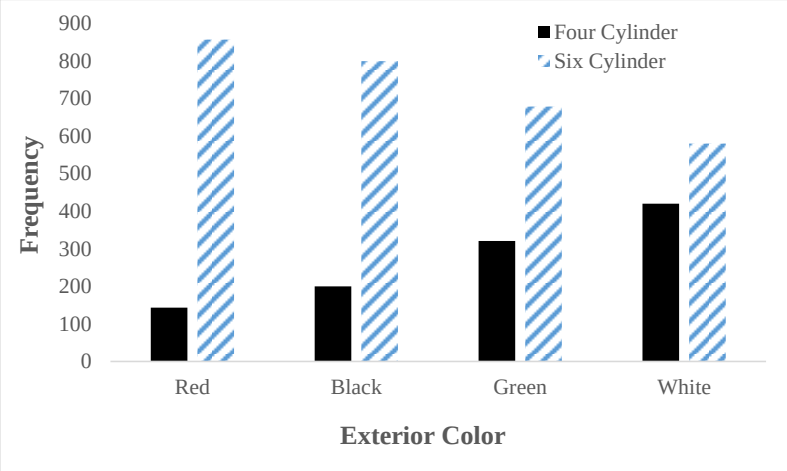
14. a. It is difficult to distinguish the relative sizes of the different pieces of the pie chart. It can also be difficult to distinguish the different colors in the pie chart. Finally, it takes a lot of work for the reader to match the salesperson names to the different pieces of the pie chart.

b. A sorted column or bar chart would be preferable to display these data.

c.

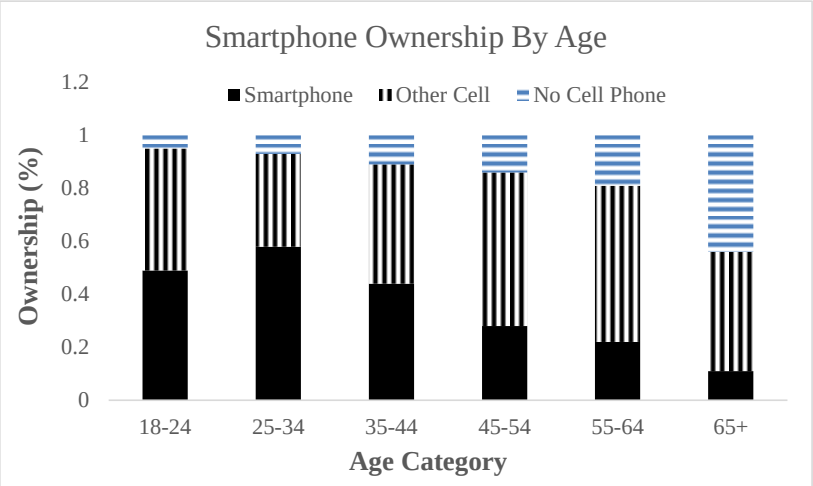


15. a.

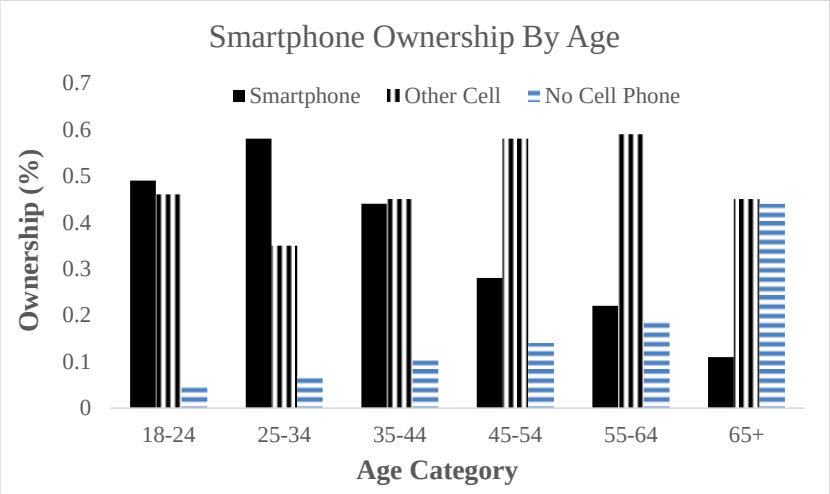


b. All customers preferred the six cylinder engine type, regardless of which exterior color they preferred. However, few customers who preferred red or black exterior colors preferred the four cylinder engine, but customers who preferred the white exterior color were more evenly split between the four and six cylinder engine. If this is a representative sample of customers, it appears that the company will sell very few red models with four cylinder engines, but may sell more white models with four cylinder engines.

16. a.

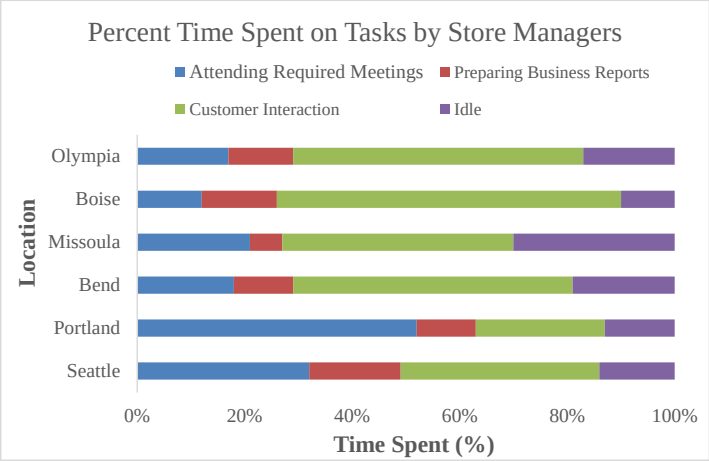


b.

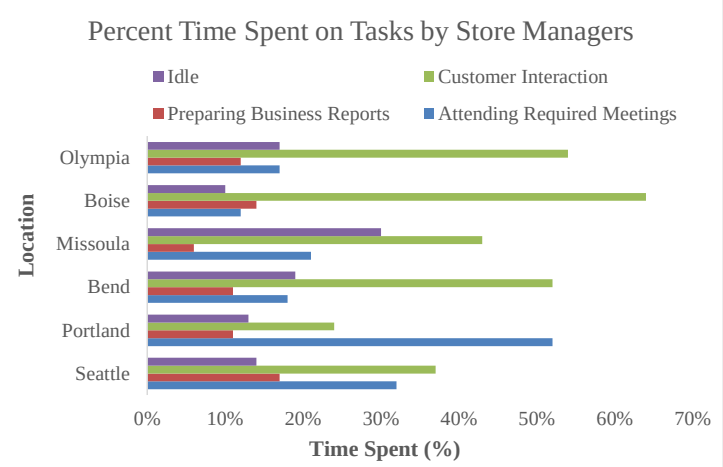


c. Younger respondents are more likely to own smartphones; older respondents are more likely to have other cell phones or to own no cell phone, particularly those in the 65+ age category.
The clustered column chart makes it easier to compare the relative percent ownership values within an age category. It is much easier to interpret from the clustered bar chart that a greater percentage of respondents age 18-24 own smartphones than other cell phones than it is to interpret this from the stacked bar chart.

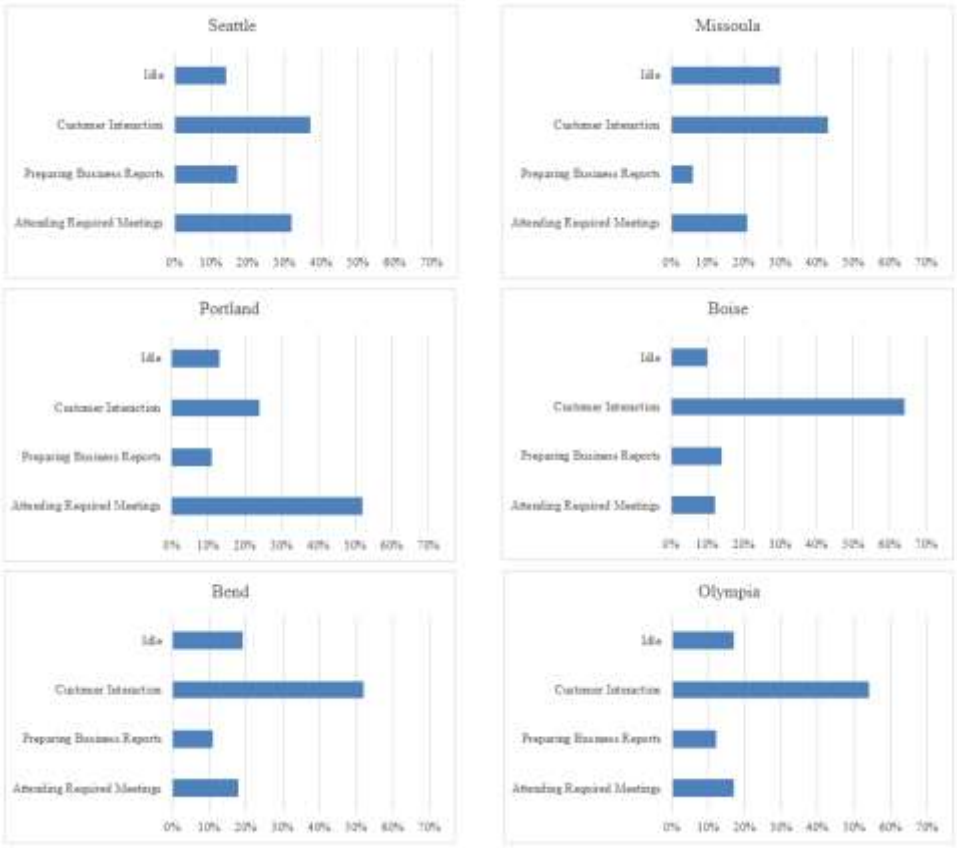
17. a.


Percent Time Spent on Tasks by Store Managers
Attending Required Meetings
Preparing Business Reports
Customer Interaction
Idle
Location
Olympia
Boise
Missoula
Bend
Portland
Seattle
0%
20%
40%
60%
80%
100%
Time Spent (%)

b.


Percent Time Spent on Tasks by Store Managers
Idle
Customer Interaction
Preparing Business Reports
Attending Required Meetings
Location
Olympia
Boise
Missoula
Bend
Portland
Seattle
0%
10%
20%
30%
40%
50%
60%
70%
Time Spent (%)

c.

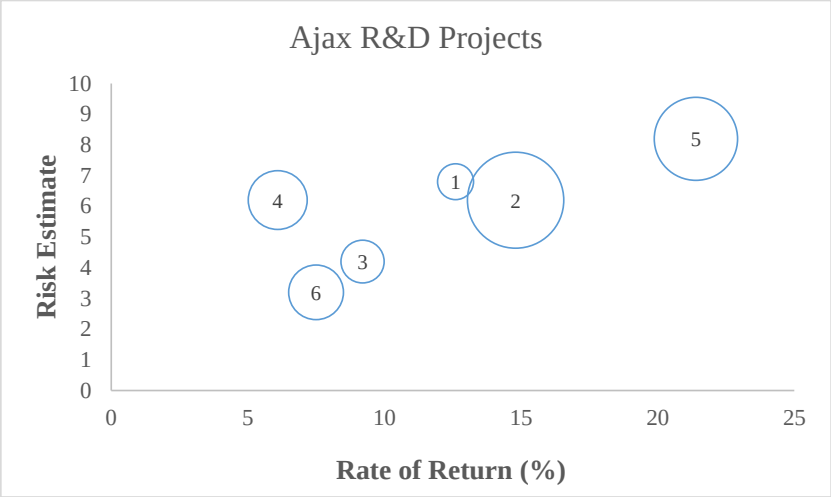


Note that here we have taken care to make sure that the horizontal axes in each bar chart have the same range (0 – 70%) for easy comparisons among locations. We have also retained the vertical gridlines here to ease comparisons, but this is mainly a matter of stylistic preference.

d. Both the stacked and clustered bar charts become very busy for these data, so many readers will prefer the individual bar charts. However, some readers may prefer the clustered bar chart which may make comparisons between locations easier.

e. The managers in Boise, Bend and Olympia spend more time (relatively) in customer interactions than managers in Seattle, Missoula and Portland. The Portland manager in particular appears to spend an excessive time attending required meetings while the manager in Missoula appears to have more idle time.

18. a.



b. Projects 6, 3, 2 and 5 appear to be on the efficient frontier.

19. a. The screen shot below shows the first 15 respondents of the survey results with the blank cells highlighted.

	A	B	C	D	E	F	G	H	I	J	K
1		Survey Question Number									
2	Respondent Number	1	2	3	4	5	6	7	8	9	10
3	1	5	1	2	4	2	4	3	1	1	1
4	2	5	1	1	1	4	3	1	2	2	3
5	3	4	1		1	1	5	5	1	1	4
6	4		2		5	2	4	4	4	3	4
7	5	1	5	1	5	5		3	3	3	3
8	6	2	3	5		1	5	5	1	1	1
9	7	1	5	1	2	3	3	2	2	3	4
10	8	1		3	2	2	3	1	2	5	3
11	9	2	1	4	3	4	4	5	5	2	5
12	10	2	3	3	1	4	3	1	1	2	1
13	11	2	1	2	3	2	2	4	1	1	1
14	12	5	2	5	2	4	4	3	2	5	2
15	13	1	1	1	1	1	5	1	4	1	3
16	14	2	3	2	3	4	3	4	4	4	3
17	15	3	5	3	1	5	4	3	3	3	

b. Question 1: Respondents 4, 18
Question 2: Respondents 8, 74, 87, 100
Question 3: Respondents 3, 4, 78, 101
Question 4: Respondents 6, 15, 23, 76, 82, 106
Question 5: None
Question 6: Respondents 5, 70, 86
Question 7: Respondents 34, 81
Question 8: Respondents 82, 96
Question 9: Respondents 23, 50
Question 10: Respondents 15, 37, 45
Question 4 has the highest non-response rate with six respondents not providing answers.

20. a.

	A	B	C	D	E	F	G	H
1		Revenue ($)						
2	**Company**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	
3	Blue Sky Media	8995	9285	11555	9530	11230	13600	
4	Innovate Technologies	18250	16870	19580	17260	18290	16250	
5	Timmler Company	8480	7650	7023	6540	5700	4930	
6	Accelerate, Inc.	28325	27580	23450	22500	20800	19800	
7	Allen and Davis, LLC	4580	6420	6780	7520	8370	10100	
8	Smith Ventures	17500	16850	20185	18950	17520	18580	

b. Timmler Company and Accelerate, Inc. appear to have generally decreasing revenues over these six months. Allen and Davis, LLC appears to have had the most consistent growth over these six months. Blue Sky Media, Innovate Technologies and Smith Ventures have revenues that have both increased and decreased over the six months.

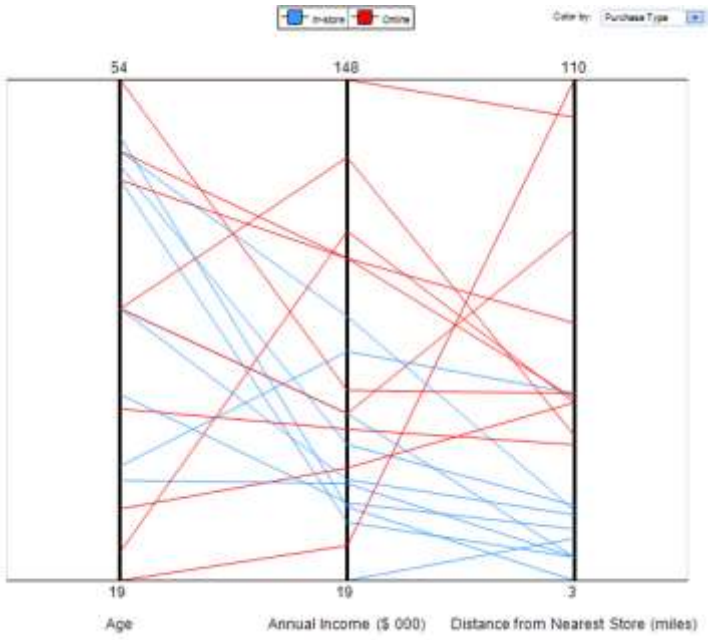
c.

	A	B	C	D	E	F	G
1		Revenue ($)					
2	**Company**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
3	Blue Sky Media	8995	9285	11555	9530	11230	13600
4	Innovate Technologies	18250	16870	19580	17260	18290	16250
5	Timmler Company	8480	7650	7023	6540	5700	4930
6	Accelerate, Inc.	28325	27580	23450	22500	20800	19800
7	Allen and Davis, LLC	4580	6420	6780	7520	8370	10100
8	Smith Ventures	17500	16850	20185	18950	17520	18580

It is difficult to create a heat map that effectively conveys the overall trend of revenues during the six months for each company. The heat map shows the relative magnitude of the revenues which is absent from the sparklines, but the trend for each company is less apparent.

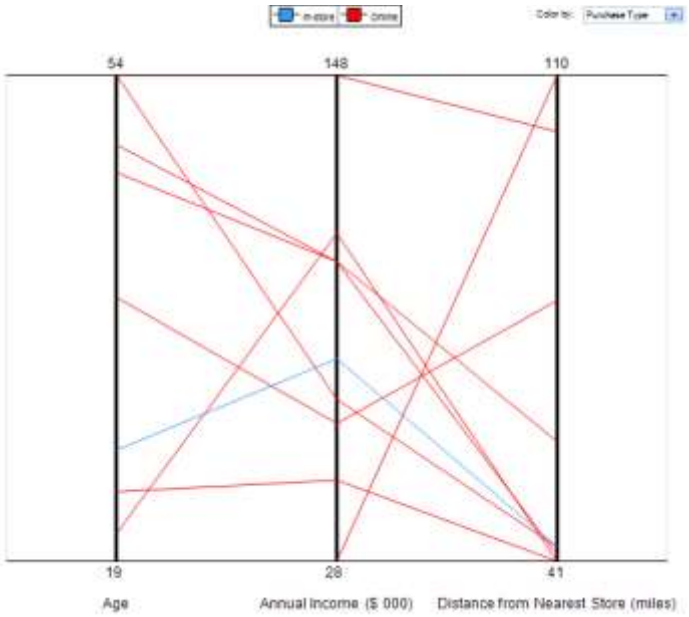
21. Online customers appear to be generally younger, have higher annual income and live further distance away from a store.

22. a.



b. There does not appear to be a clear differentiation between the ages of online versus in-store customers for electronics. However, online customers for electronics still appear to have higher annual incomes and to live further from a store.

c.

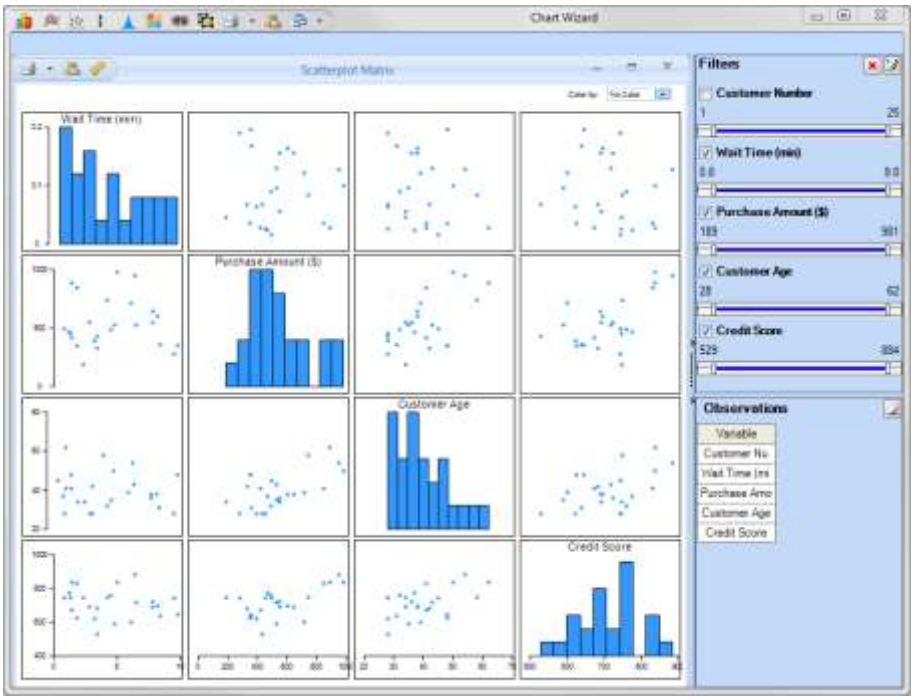


All but one customer who lives more than 40 miles away made their purchase online.

23. a. Some possible key performance indicators include patient wait times, current and projected utilization of the resources available (technicians, physicians, nurses, equipment, etc.). Other information that would be helpful includes number of patients currently waiting to be seen, number of patients expected to arrive today (by procedure type, etc.), number of technicians, physicians, nurses available, etc.

b. The CEO would probably be more interested in key performance indicators such as revenue generated by each clinic, costs at each clinic separated by cost type (salaries for physicians, nurses, operating expenses, etc.). Patient satisfaction scores and/or patient wait times for each clinic could also be very helpful. It would probably be important for the CEO to also see these data plotted over recent history so that she could infer trends and plan for the future.

24. a.



b. Purchase amount appears to have a positive relationship with customer age and credit score. Older customers and customers with higher credit scores appear to place larger purchase amounts. There are no obvious relationships between wait time and the other variables. Customer age and credit score also appears to have a positive relationship. Older customers appear to have higher credit scores.