

## Chapter 2

2.1 Nominal: Occupation, undergraduate major. Ordinal: Rating of university professor, Taste test ratings.  
Interval: age, income

2.2 a Interval

b Nominal

c. Nominal

d Interval

e Interval

f Ordinal

2.3 a Interval

b Ordinal

c Nominal

d Ordinal

2.4 a Interval

b Nominal

c Nominal

2.5 a Ordinal

b Ordinal

c Ordinal

2.6 a Interval

b Interval

c Nominal

d Ordinal

2.7 a Interval

b Nominal

c Ordinal

d Interval

e Interval

2.8 a Interval

- b Nominal
- c Nominal
- d Interval
- e Ordinal

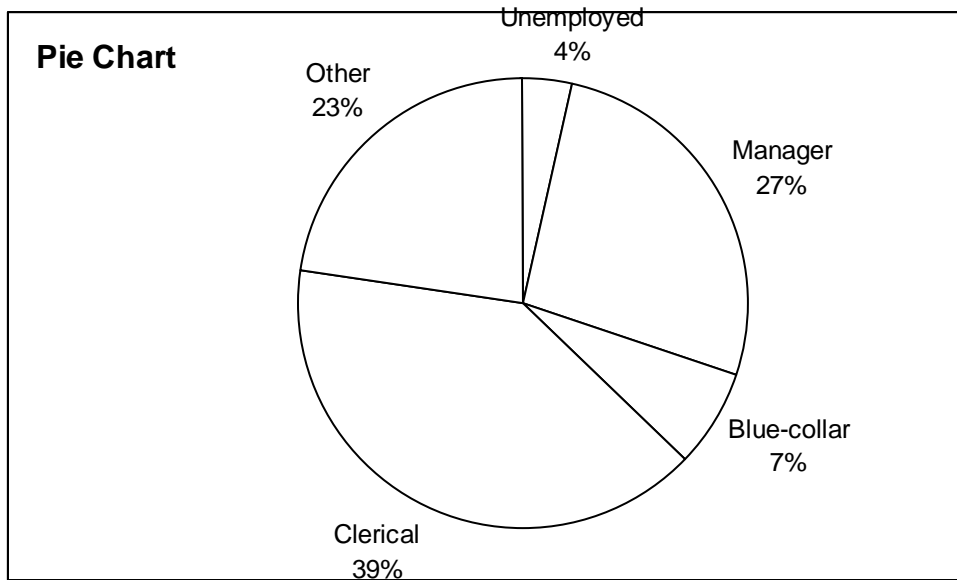
2.9 a Interval

- b Interval
- c Nominal
- d Interval
- e Nominal

2.10 a Interval

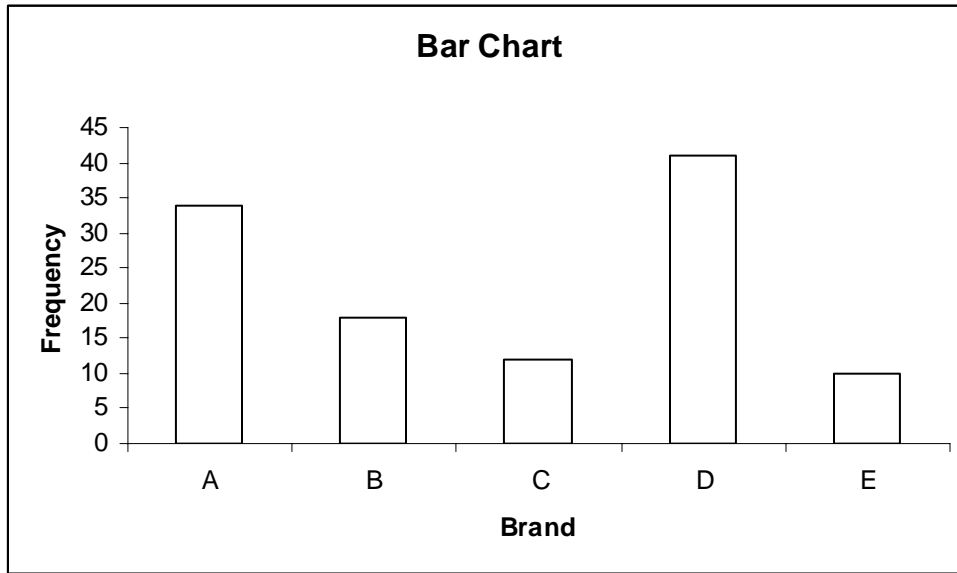
- b Interval
- c Nominal
- d Ordinal
- e Interval

2.11 a

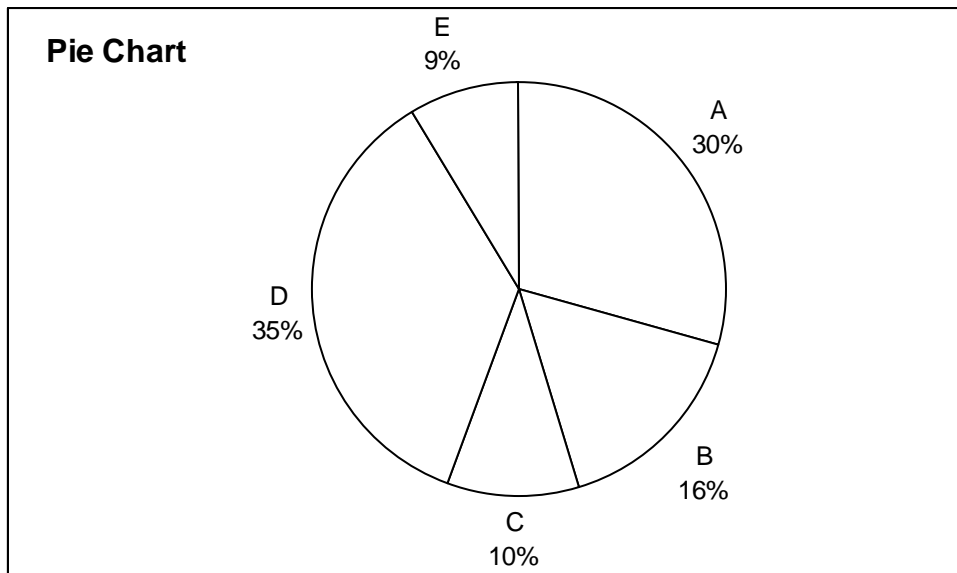


Most graduates are managers or are doing clerical work.

2.12a

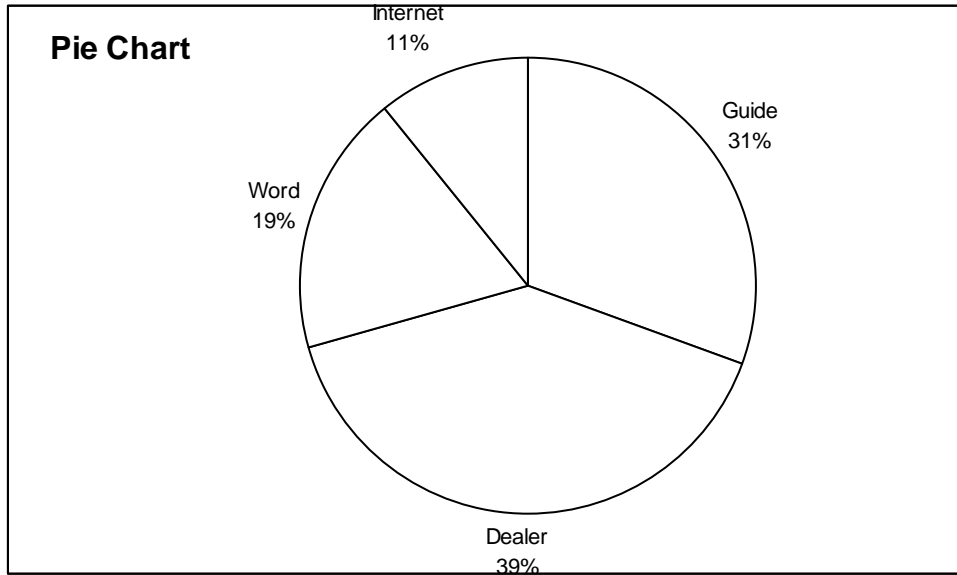


b



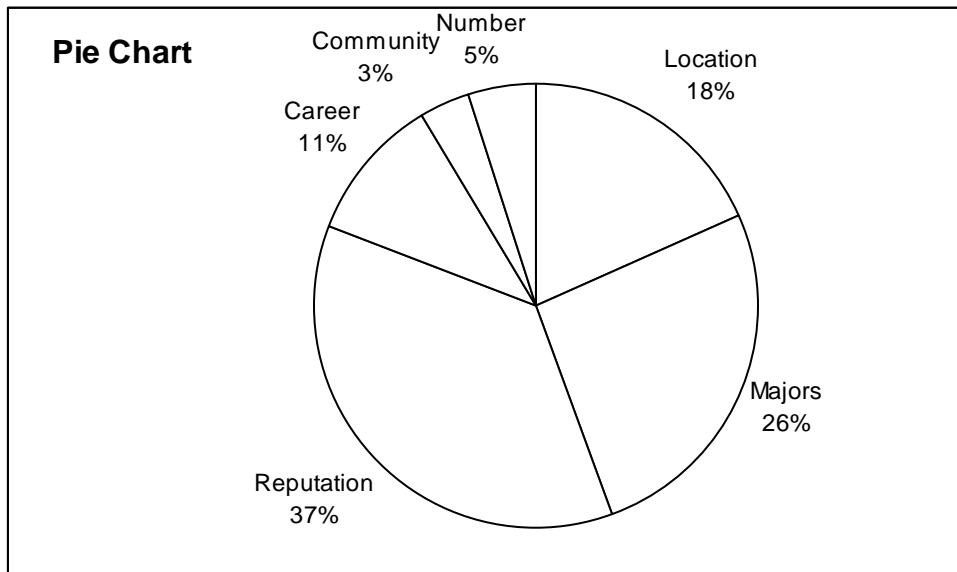
c Brands A and D are most popular, but no one brand dominates the market.

2.13



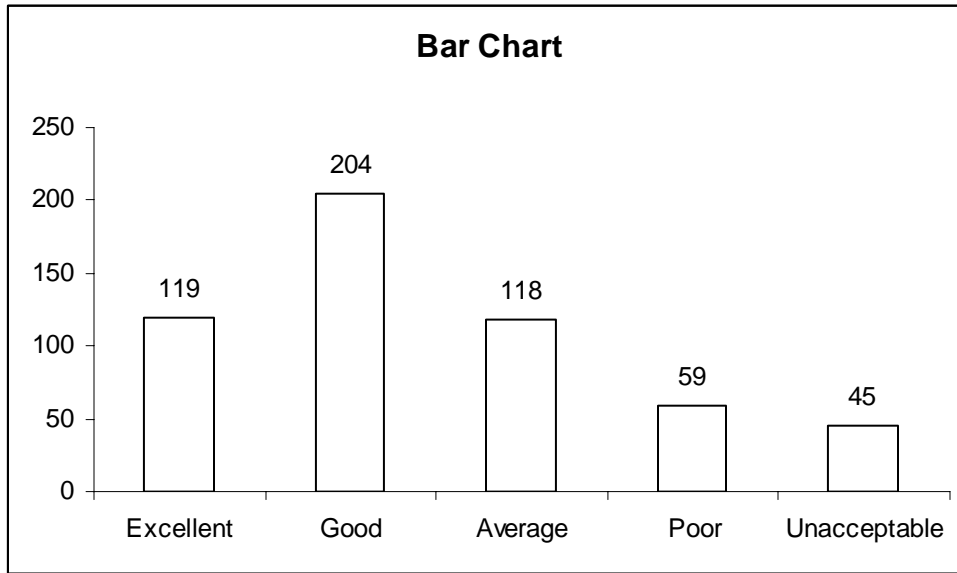
Most consumers get their information from a dealer.

2.14



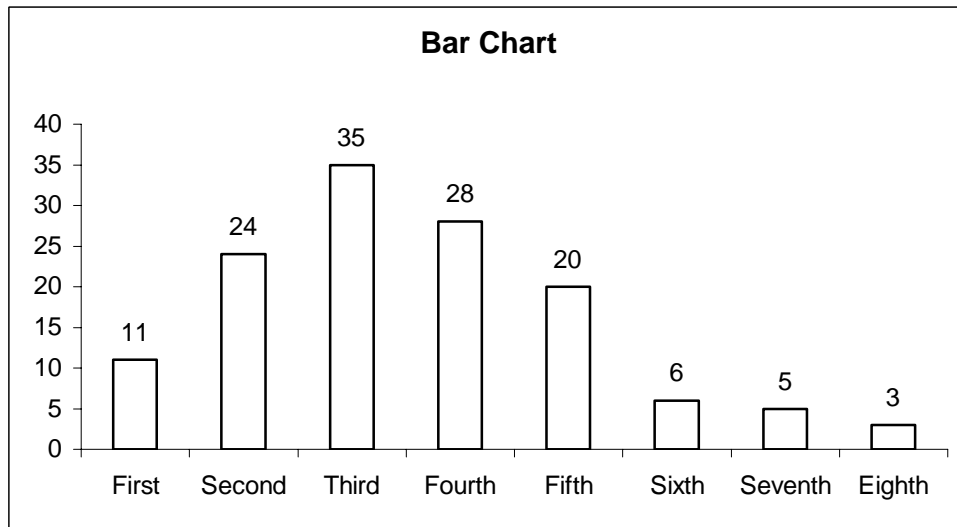
Reputation and choice of majors dominate the responses.

2.15



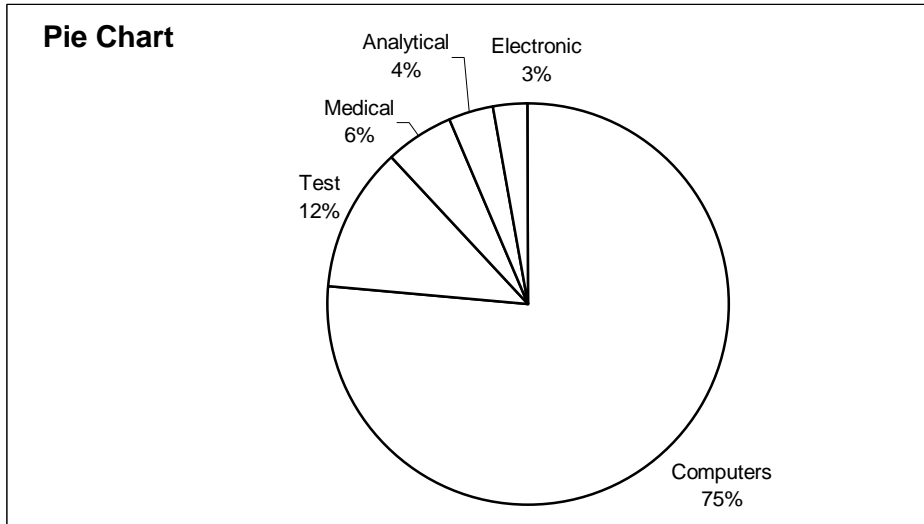
A large proportion of customers rate the facilities as average or better.

2.16



The horse has had a satisfactory career, but not outstanding one.

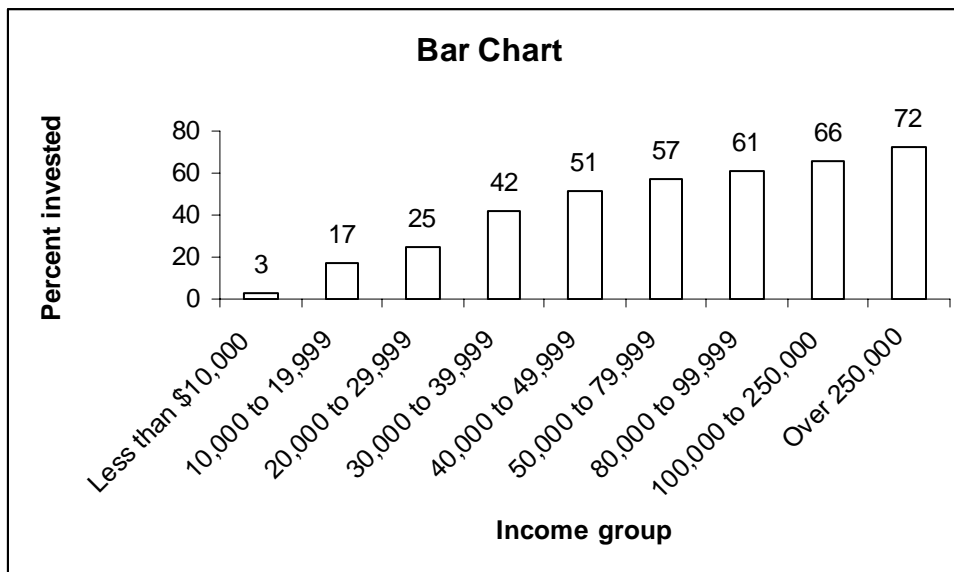
2.17



Most of HP's revenue comes from the sale of computers.

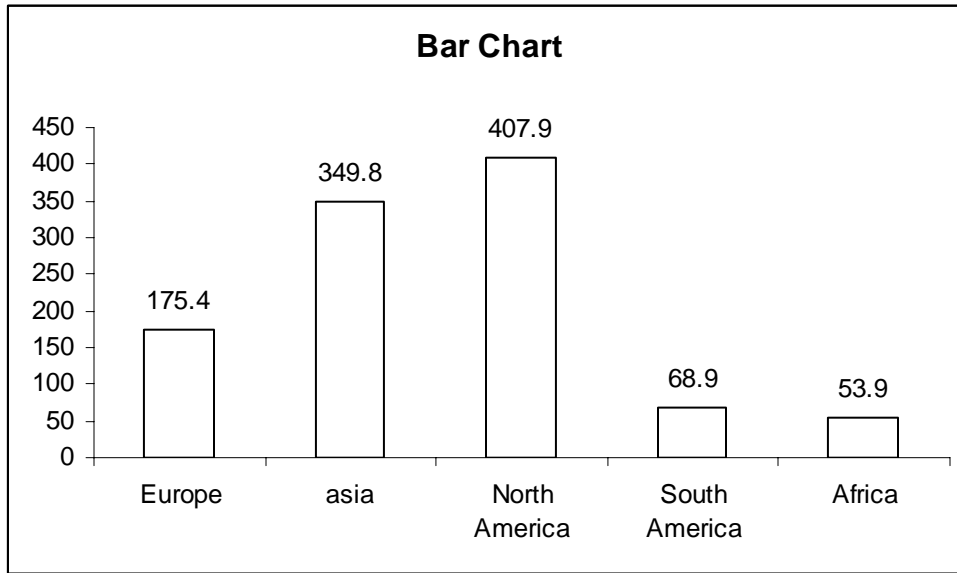
2.18a A bar chart is suitable for these results. A pie chart is incorrect.

b

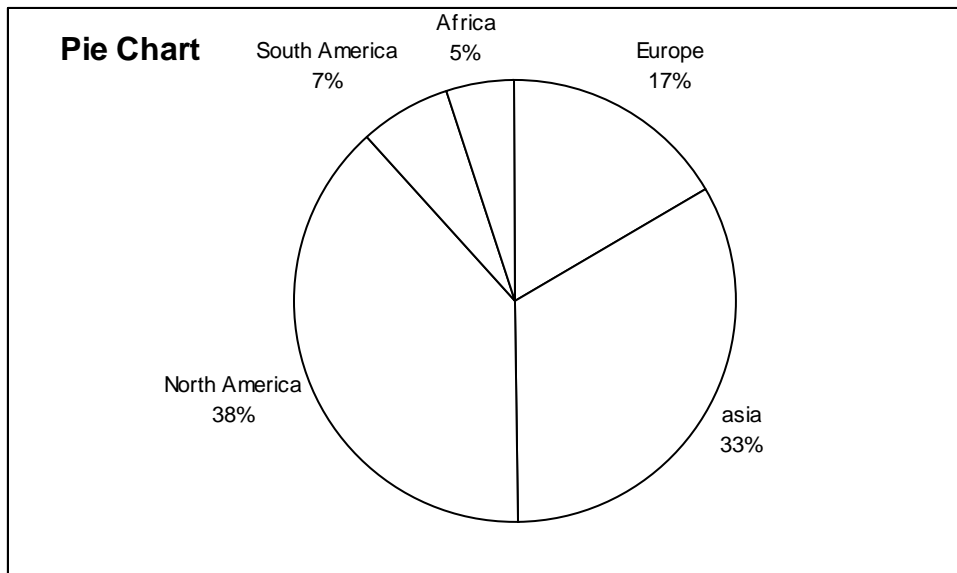


As income increases so does ownership of retirement savings plans.

2.19a



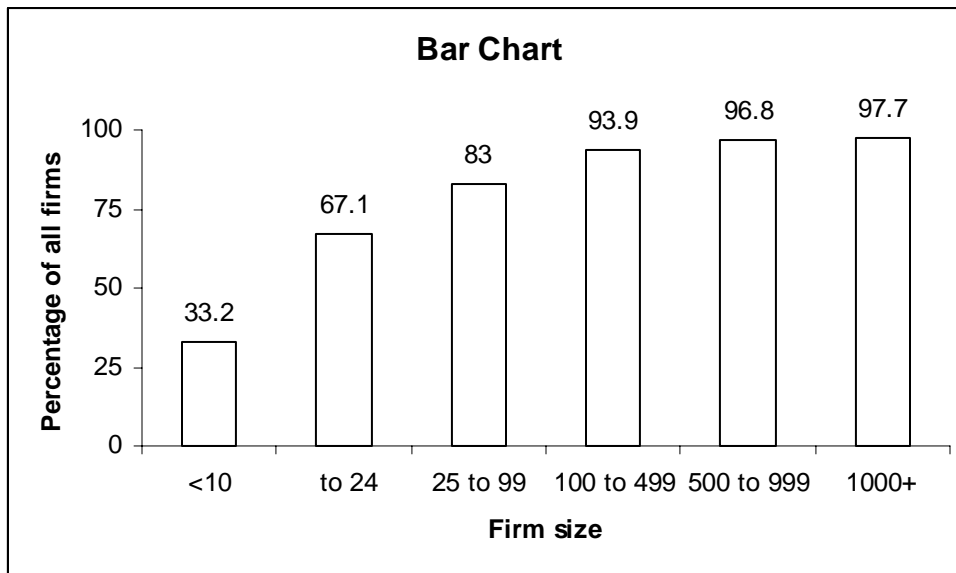
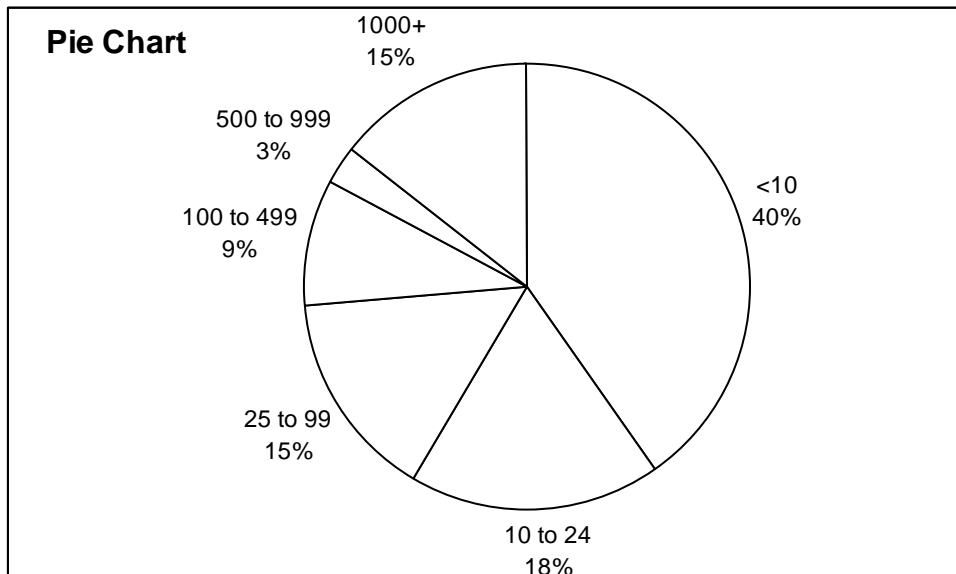
b



Most immigrants come from North America (and Central America) and Asia.

2.20

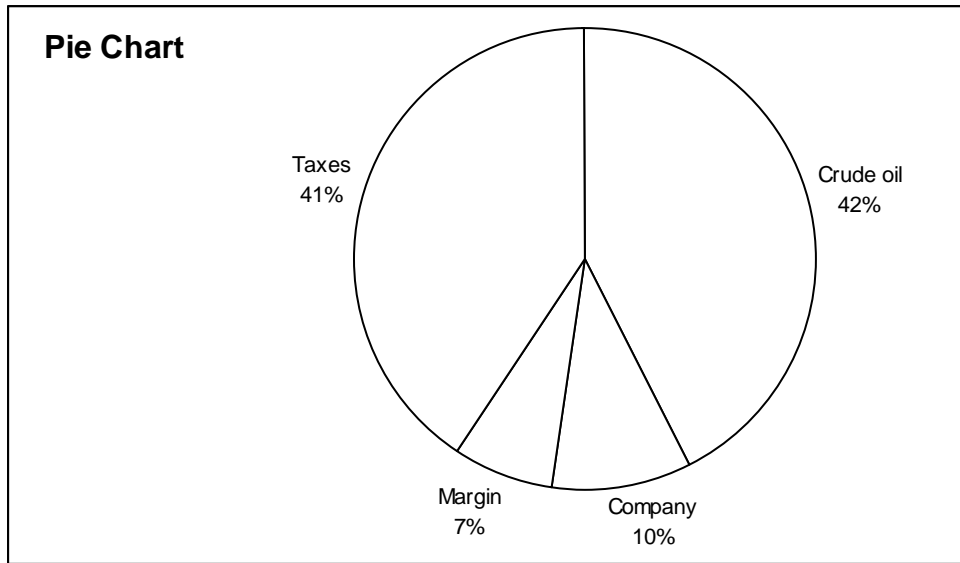
We use a pie chart to depict the proportion of all firms with health insurance categorized by the size of the firm. Thus, 40% of all firms with health insurance have fewer than 10 employees.



We use a bar chart to depict the proportion of firms in each size category that has health insurance. For example, 97.7% of firms with 1,000 or more employees have health insurance.

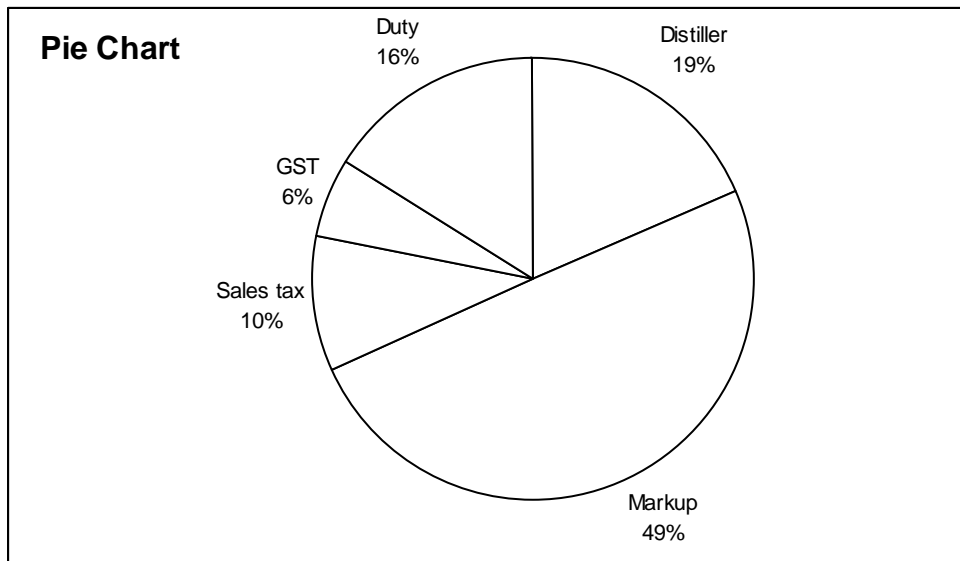


2.21



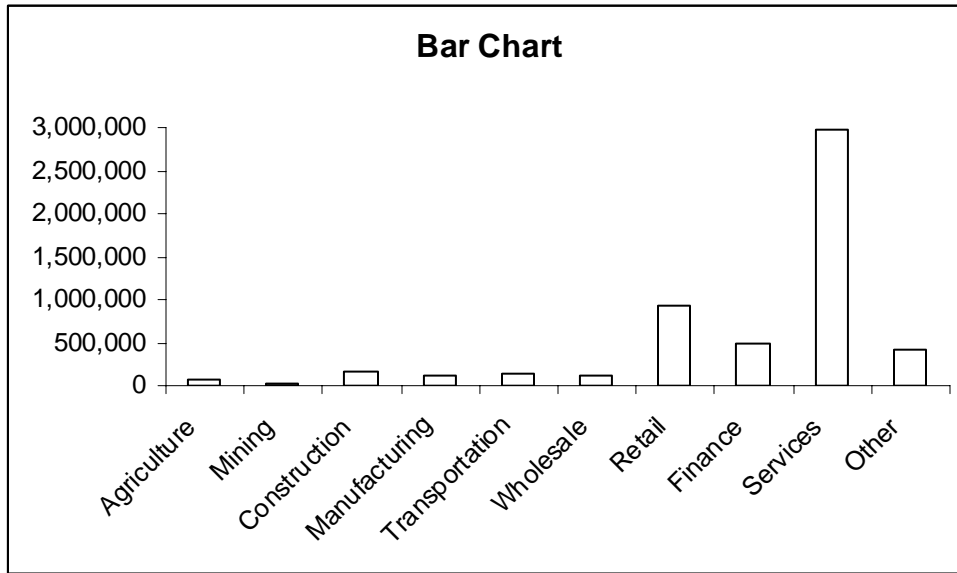
Canadians pay too much tax.

2.22

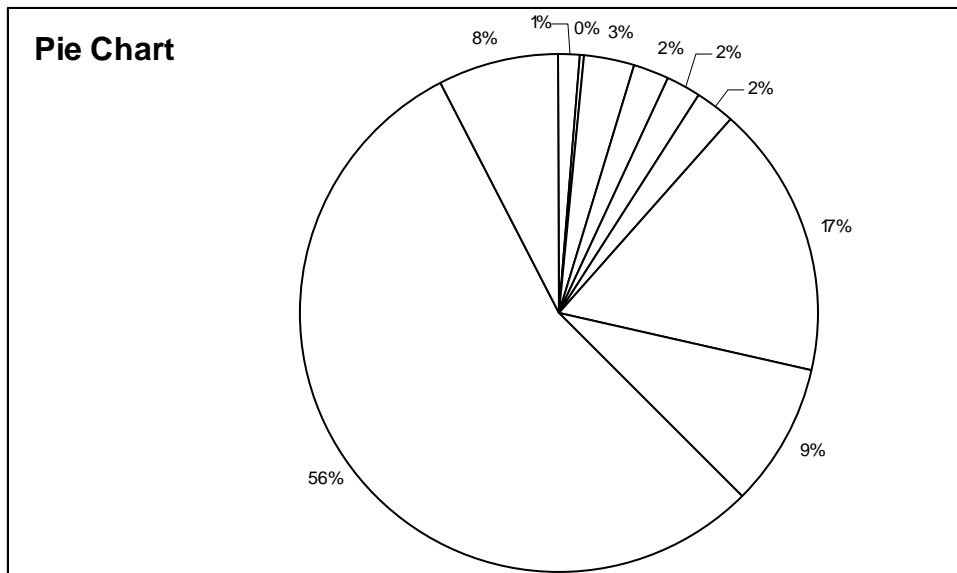


Canadians pay too much tax.

2.23a



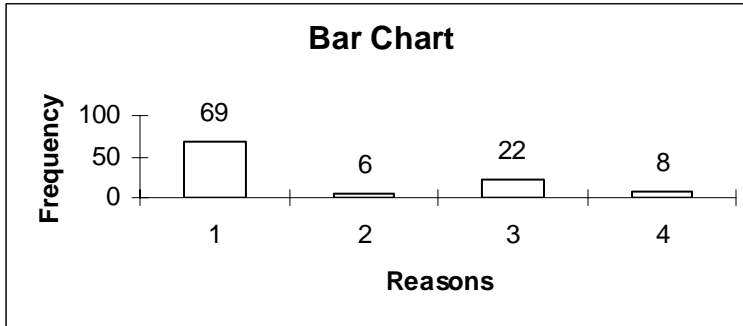
b



c Both charts indicate that the service and retail industry dominate.

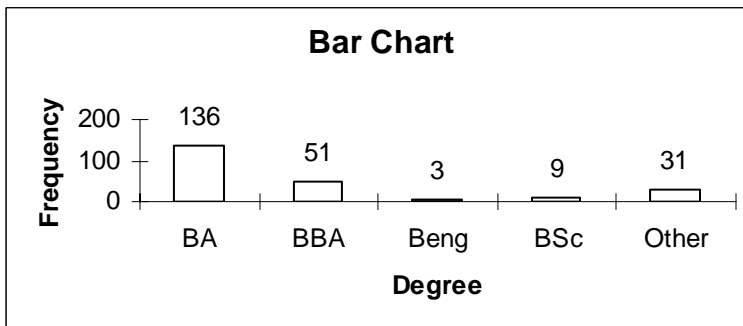
Reason	Frequency	Relative Frequency
Sickness	69	.66
Death in family	6	.06
Team	22	.21
Forgot	8	.08

b

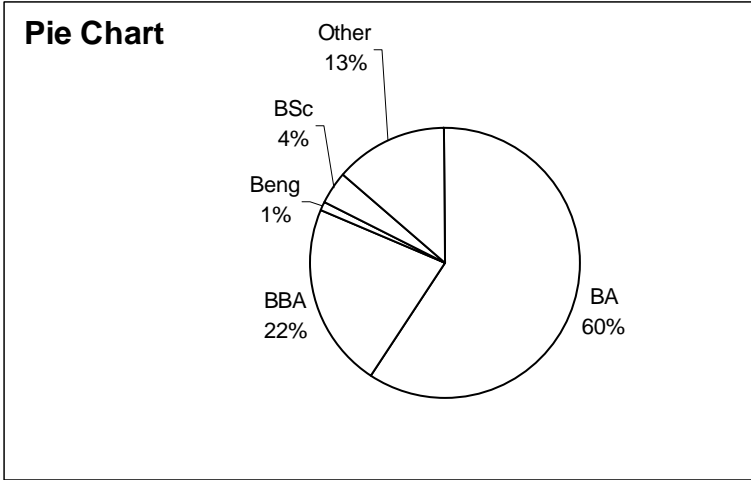


Degree	Frequency
BA	136
BBA	51
B Eng	3
B Sc	9
Other	31

b

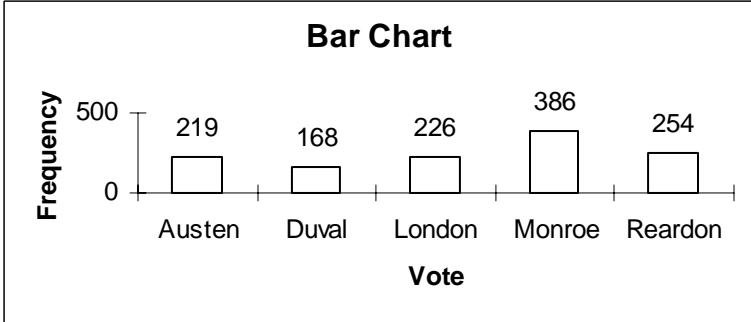


c



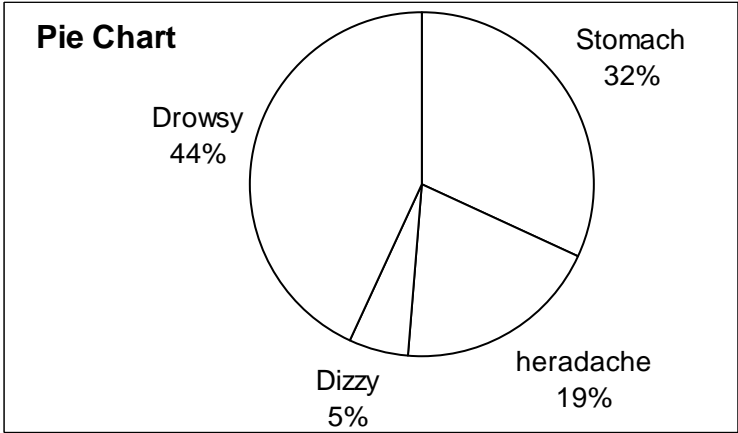
c Most applicants have the BA degree and about one-fifth have a BBA.

2.26



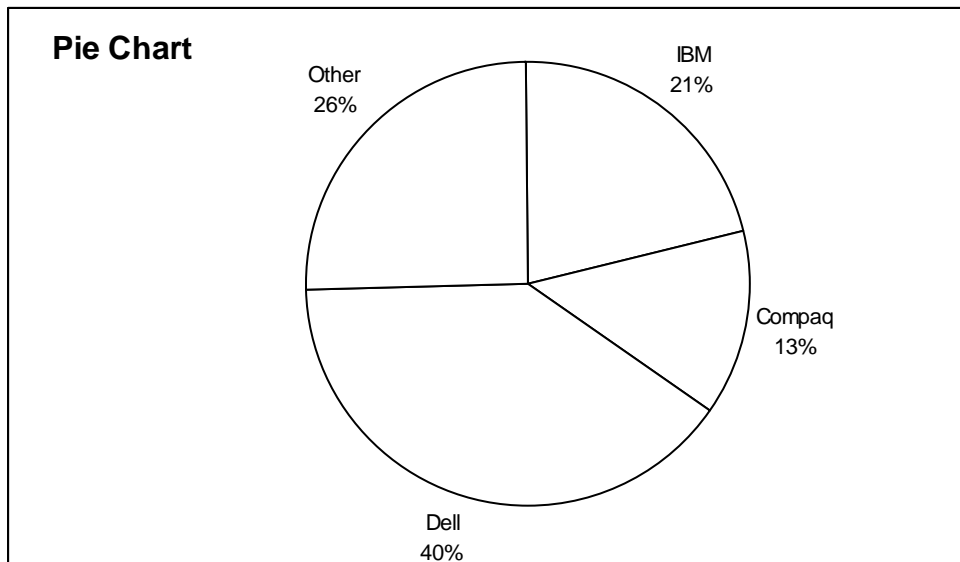
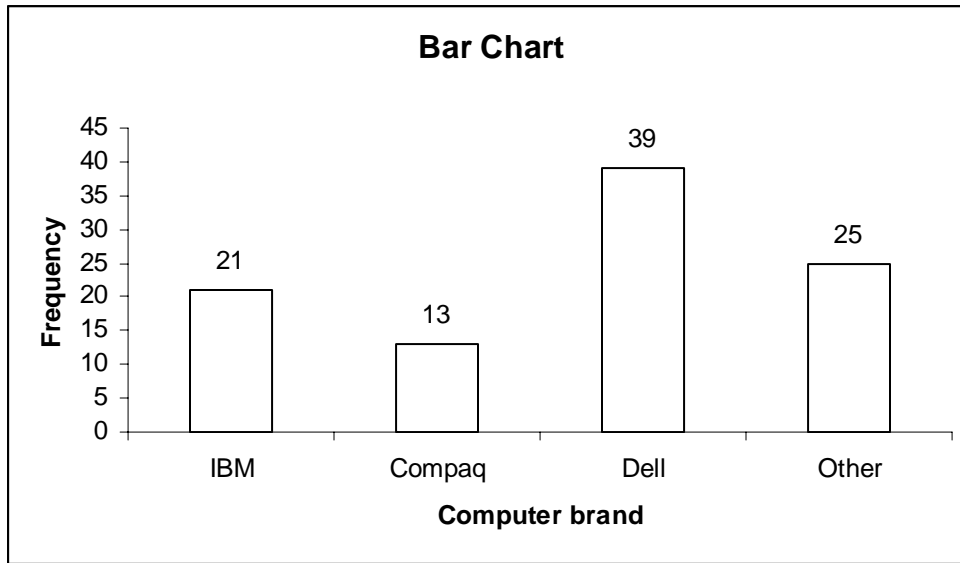
Monroe is the predicted winner in a tight race.

2.27



Drowsiness and stomach upset are the two most common symptoms.

2.28 a

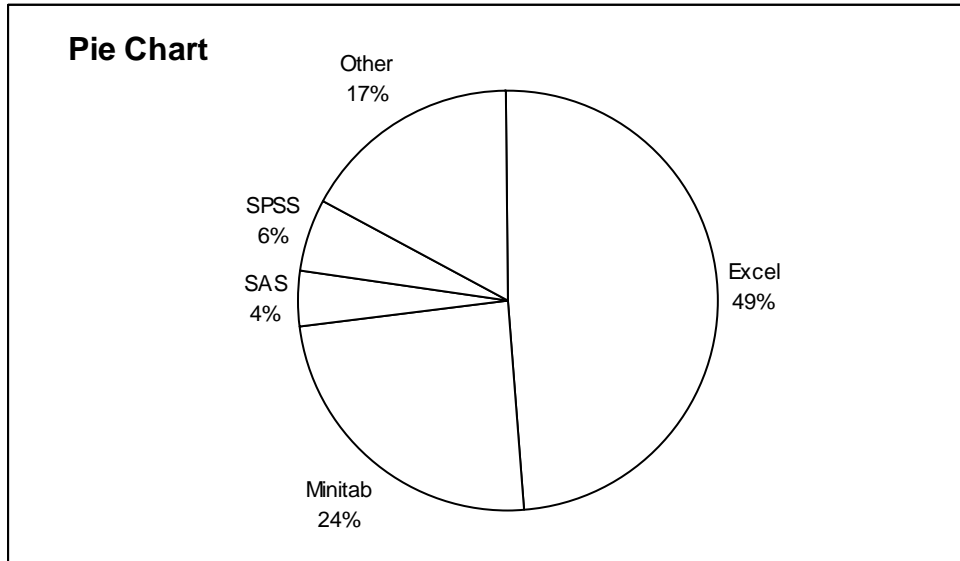


b

c Dell is most popular with 40% proportion, followed by other, 26%, IBM, 21% and Compaq, 13%.

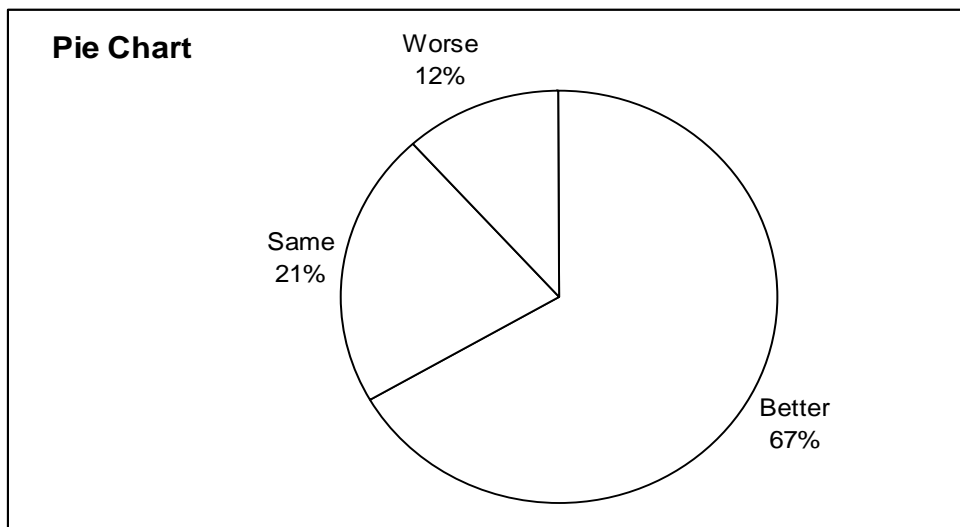
2.29 a	Software	Frequency
	Excel	34
	Minitab	17
	SAS	3
	SPSS	4
	Other	12

b



c Excel is the choice of about half the sample, one-quarter have opted for Minitab, and a small fraction chose SAS and SPSS.

2.30



67% said the economy would get better, 21% said the same, and the rest stated that the economy would worsen.

2.31 11, 12, or 13

2.32 5, 6, or 7

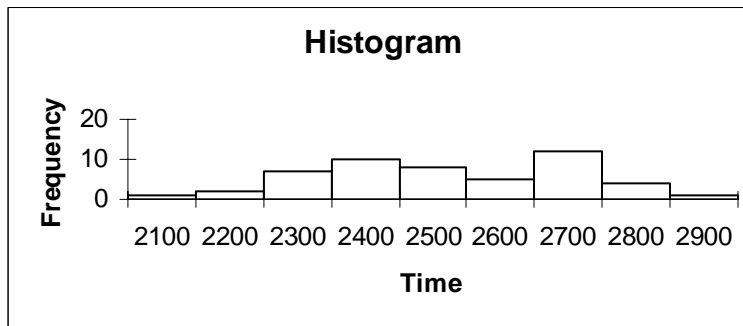
2.33 a 7 to 10

b Interval width  $\approx \frac{107-88}{9} = 2.11$  (rounded to 2); upper limits: 90, 92, 94, 96, 98, 100, 102, 104, 106, 108

2.34 a 7 to 9

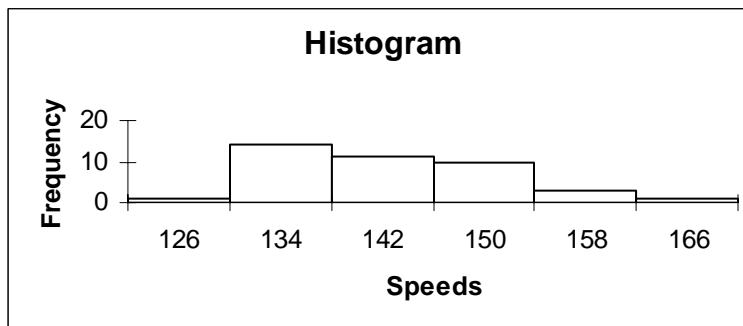
b Interval width  $\approx \frac{560-240}{8} = 40$ ; upper limits: 280, 320, 360, 400, 440, 480, 520, 560

2.35a



b The histogram is bimodal and negatively skewed.

2.36 a

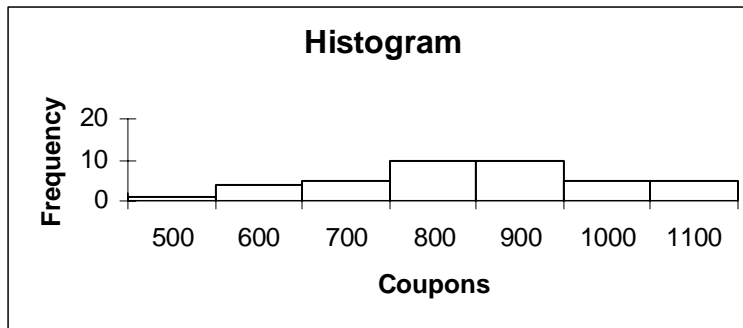


b The histogram is positively skewed.

2.37 a

	A	B	C
1	<b>Stem &amp; Leaf Display</b>		
2			
3	<b>Stems</b>	<b>Leaves</b>	
4	4	->4	
5	5	->345	
6	6	->002233	
7	7	->1133556799	
8	8	->2223456899	
9	9	->01347	
10	10	->01145	

b



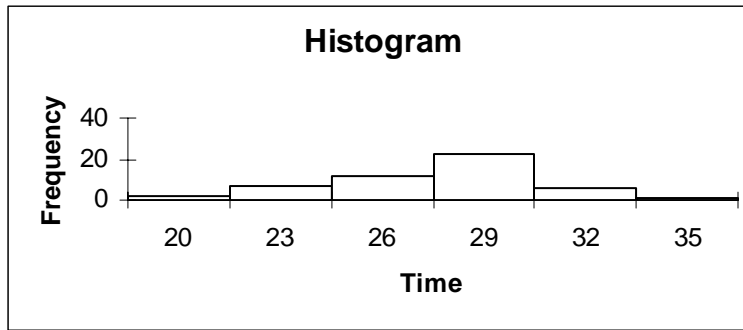
c The distribution is approximately bell shaped and symmetric.

2.38 a



	A	B	C
1	<b>Stem &amp; Leaf Display</b>		
2			
3	<b>Stems</b>	<b>Leaves</b>	
4	19	->18	
5	20		
6	21	->178	
7	22	->1125	
8	23	->277	
9	24	->78	
10	25	->033557	
11	26	->0123333568	
12	27	->01222788	
13	28	->25578	
14	29	->3	
15	30	->12357	
16	31		
17	32		
18	33	->2	

b

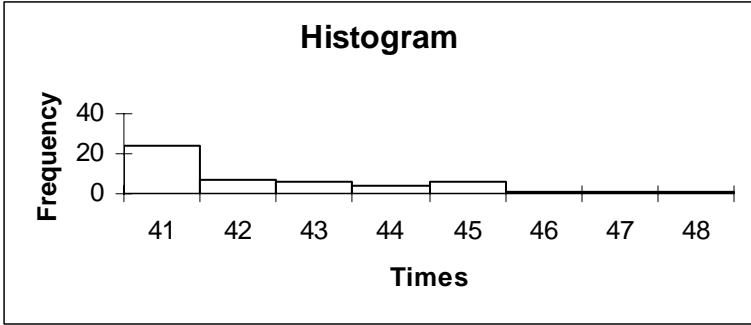


c The distribution is approximately bell shaped and slightly negatively skewed.

2.39 a

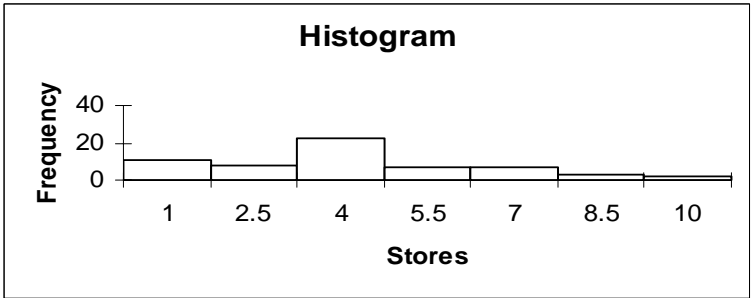
	A	B	C	D
1	<b>Stem &amp; Leaf Display</b>			
2				
3	<b>Stems</b>	<b>Leaves</b>		
4	40	->000222222245555777799		
5	41	->000004559		
6	42	->024777		
7	43	->0047		
8	44	->024455		
9	45	->7		
10	46	->7		
11	47	->9		

b

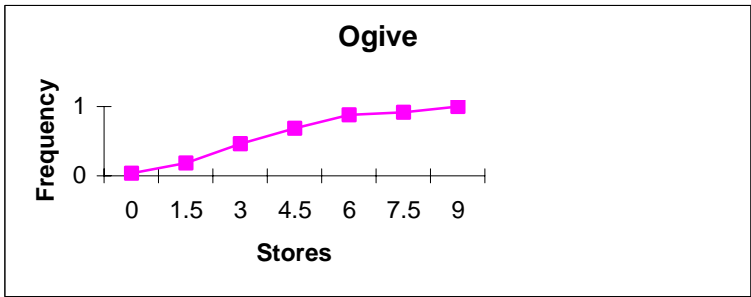


c The histogram is positively skewed.

2.40 a

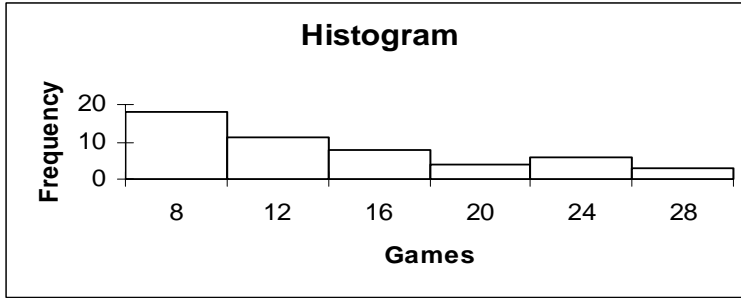


b



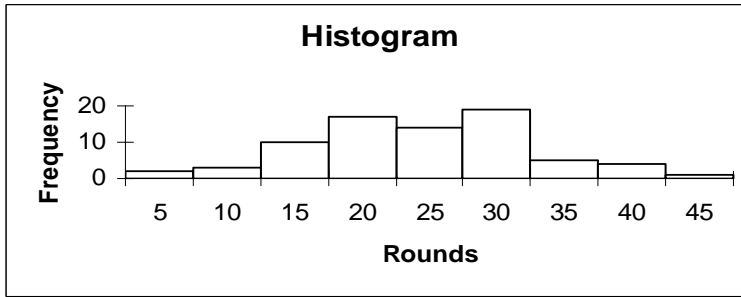
c The number of stores is bimodal and positively skewed.

2.41



The histogram is positively skewed.

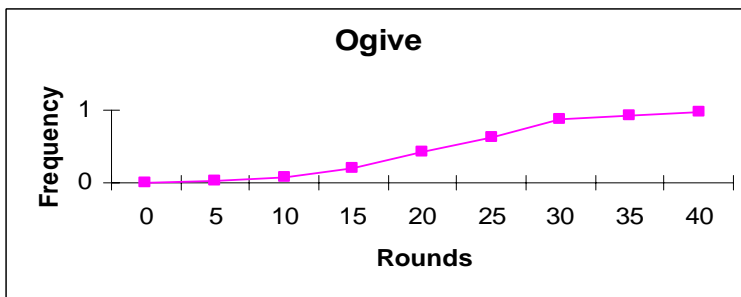
2.42 a



b

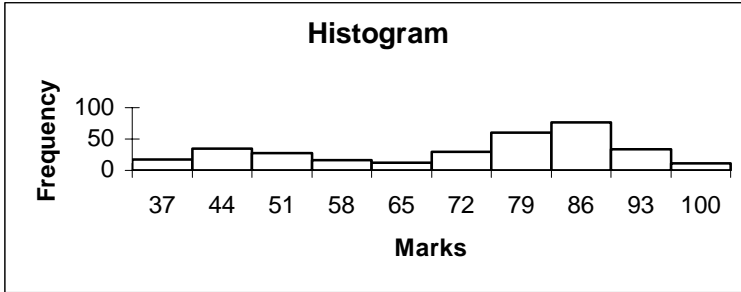
Stem & Leaf Display				
Stems	Leaves			
0	->359			
1	->0023334445556677888888899			
2	->00001223334444455566667888889999			
3	->00000112556668			
4	->2			

c



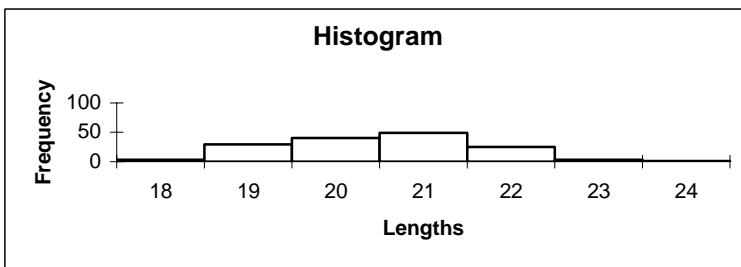
d The histogram is symmetric (approximately) and bimodal.

2.43



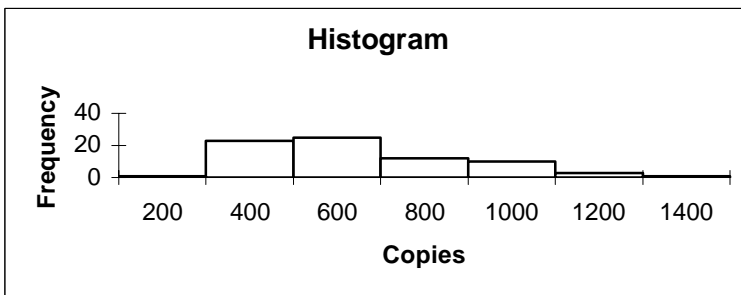
c The histogram is negatively skewed, bimodal, and not bell shaped.

2.44



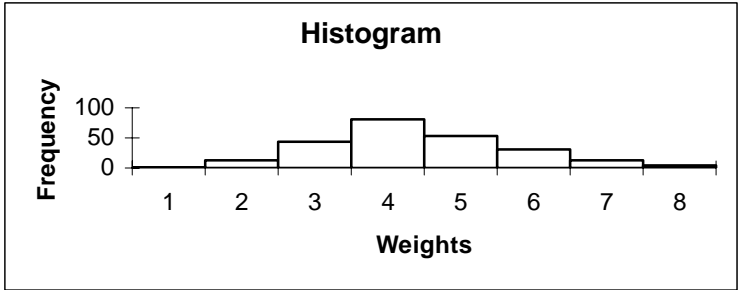
The histogram is unimodal, bell-shaped and roughly symmetric. Most of the lengths lie between 18 and 23 inches.

2.45



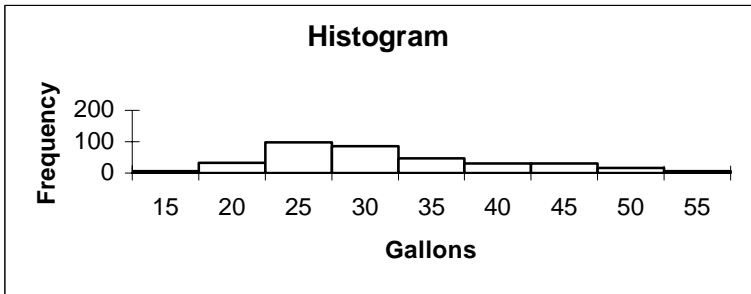
The histogram is unimodal and positively skewed. On most days the number of copies made is between 200 and 1000. On a small percentage of days more than 1000 copies are made.

2.46



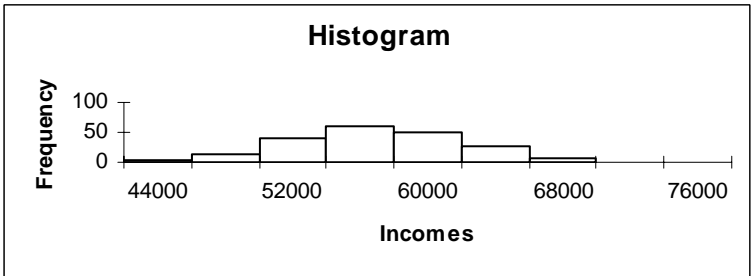
The histogram is unimodal, symmetric and bell-shaped. Most tomatoes weigh between 2 and 7 ounces with a small fraction weighing less than 2 ounces or more than 7 ounces.

2.47



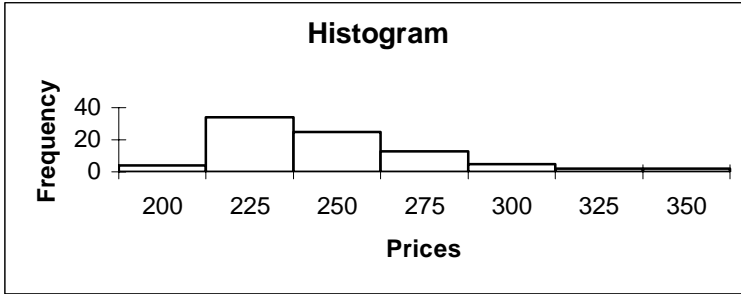
The histogram is positively skewed and unimodal. Most households use between 20 and 45 gallons per day. The center of the distributions appears to be around 25 to 30 gallons.

2.48

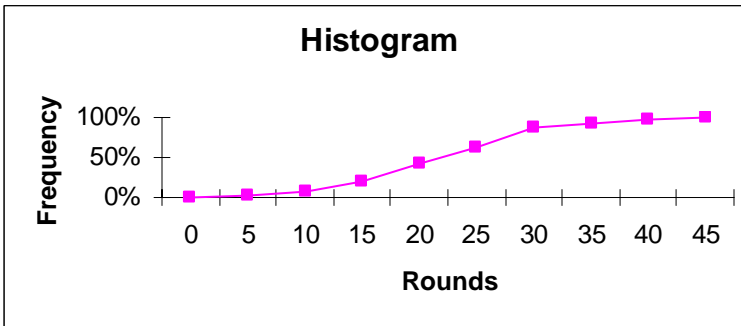


The histogram is symmetric, unimodal, and bell shaped.

2.49a



b

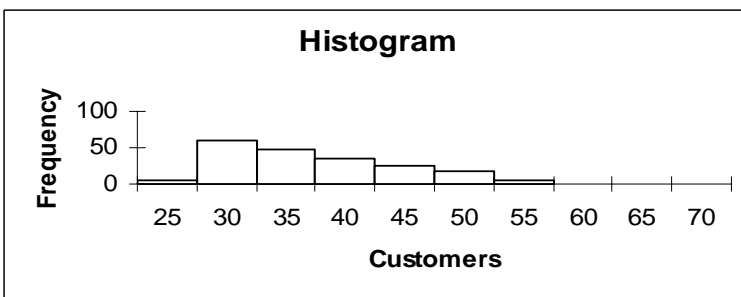


c

	A	B	C	D	E
1	<b>Stem &amp; Leaf Display</b>				
2					
3	<b>Stems</b>	<b>Leaves</b>			
4	0	->359			
5	1	->00233344445556667788888899			
6	2	->00001223334444455566667888889999			
7	3	->00000112556668			
8	4	->2			

d The histogram is positively skewed, unimodal, and not bell-shaped. We learn that most prices lie between 200 and 275 thousand dollars with a small number of houses selling for more than \$275,000.

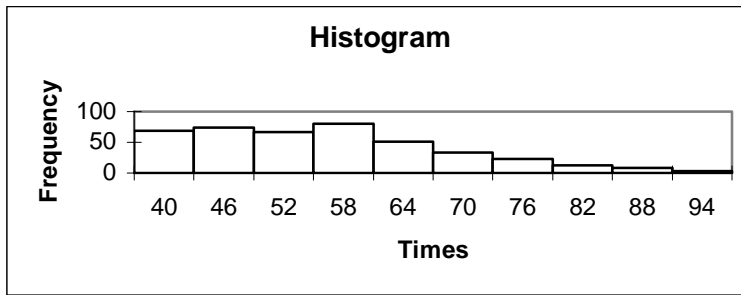
2.50



The histogram is unimodal and positively skewed.

2.51 The histogram should contain 9 or 10 bins. We chose 10.

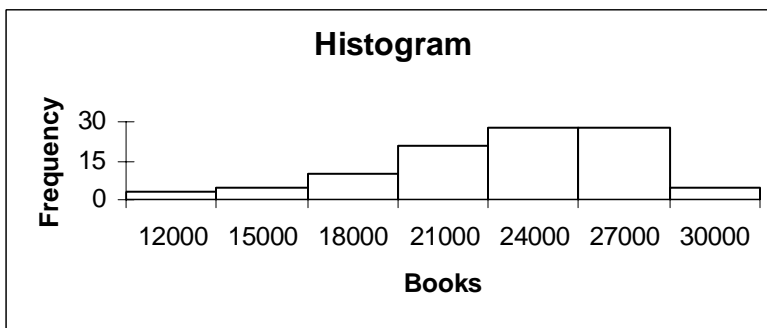
b



c The histogram is positively skewed.

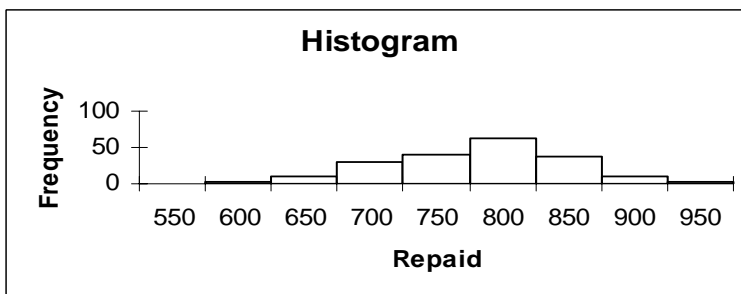
d The histogram is not bell-shaped.

2.52

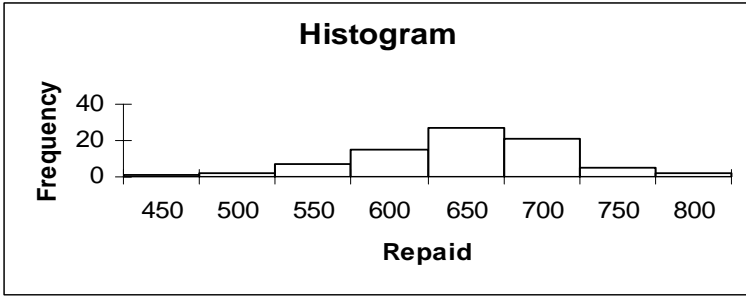


The histogram of the number of books shipped daily is negatively skewed, It appears that there is a maximum number that the company can ship.

2.53 a

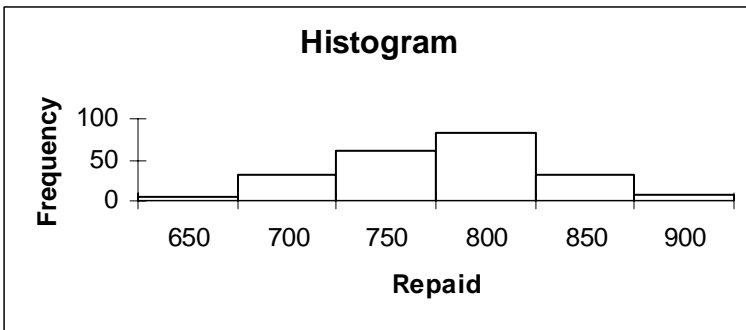


b

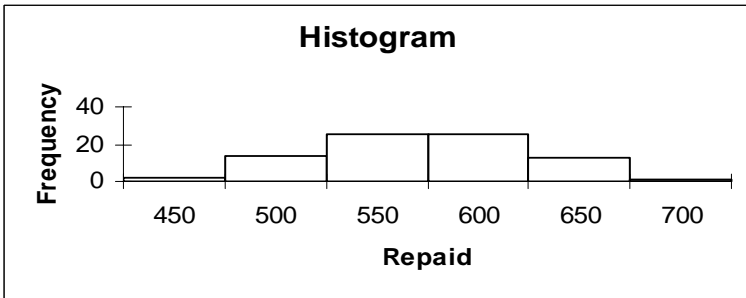


c The scorecards appear to be relatively poor predictors.

2.54 a



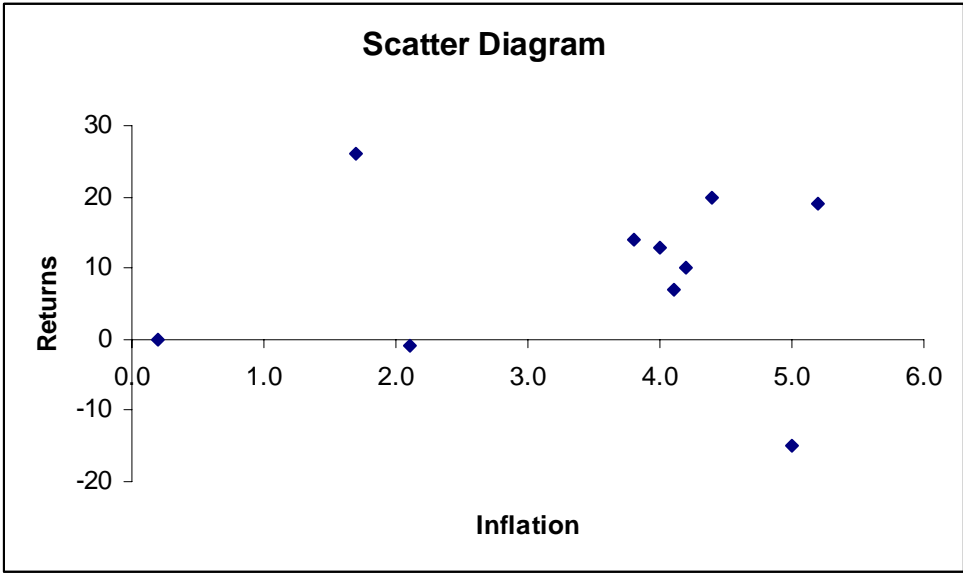
b



d This scorecard is a much better predictor.

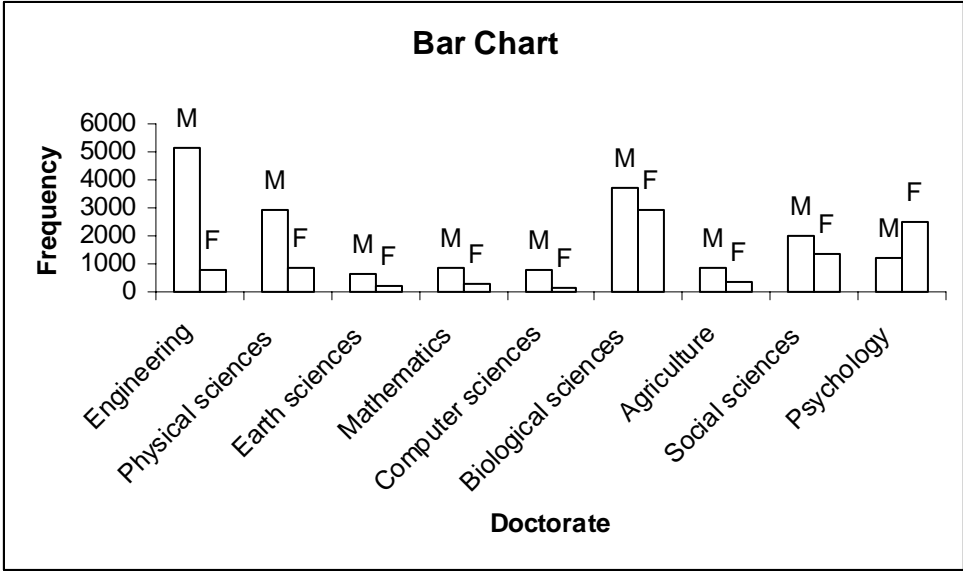
2.55a





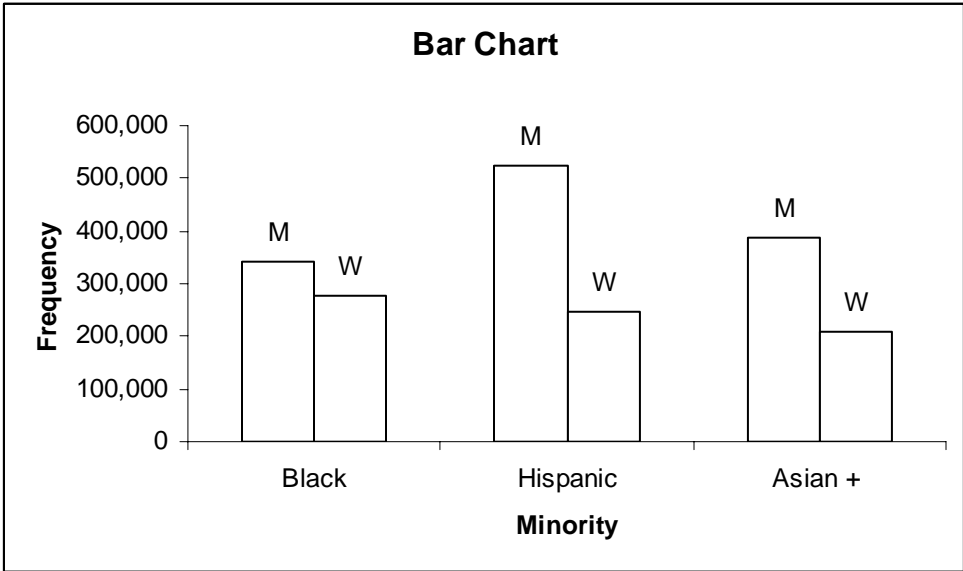
b There is no sign of a linear relationship between inflation (the independent variable) and returns (the dependent variable). Common stocks do not provide a hedge against inflation.

2.56



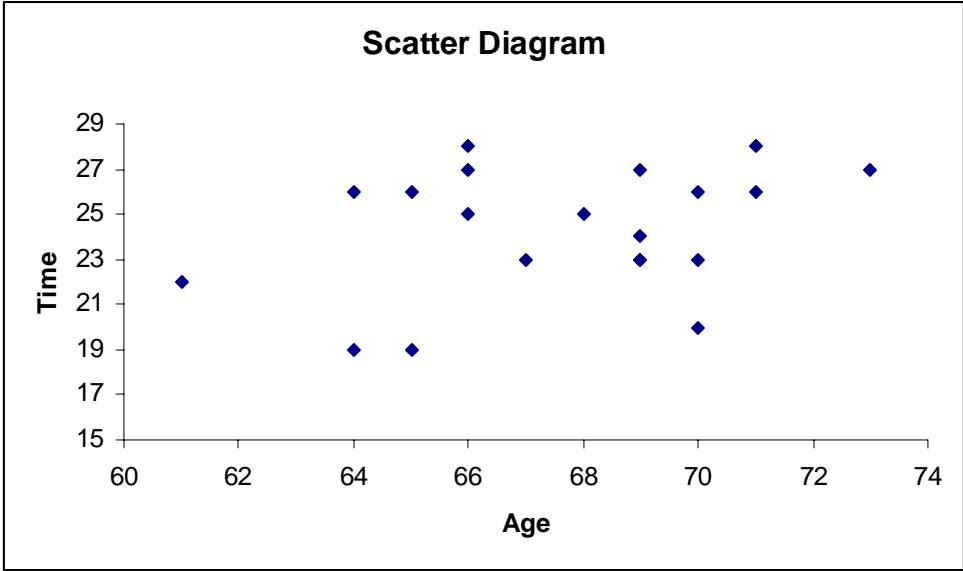
The two bar charts are somewhat dissimilar. There is a weak relationship.

2.57



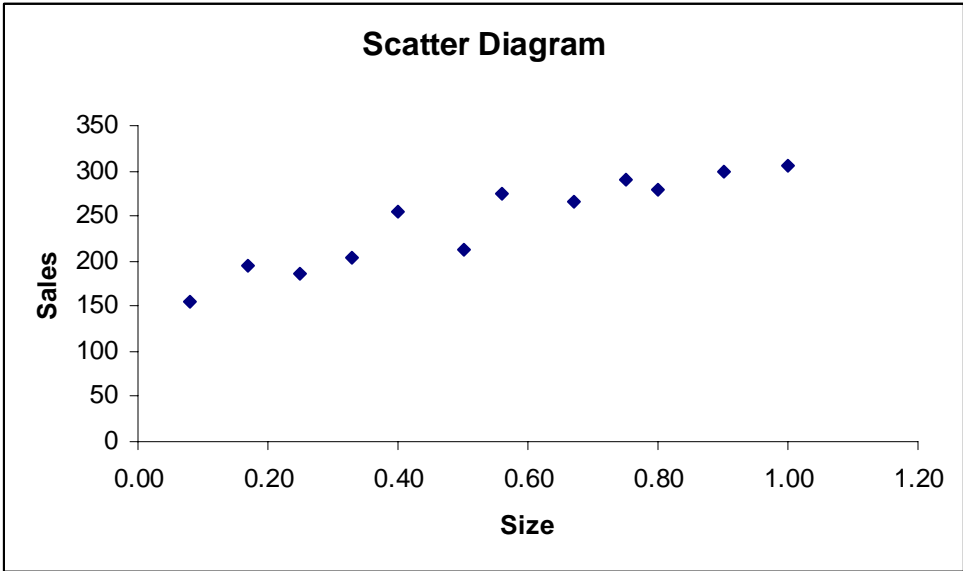
The variables race and gender are only slightly related.

2.58 a



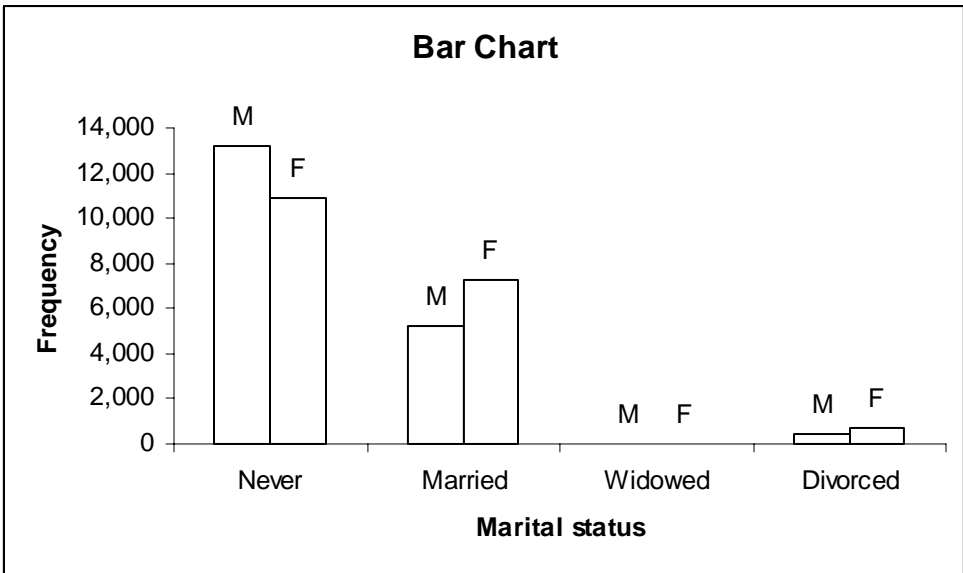
b There is a weak positive linear relationship between age and time.

2.59



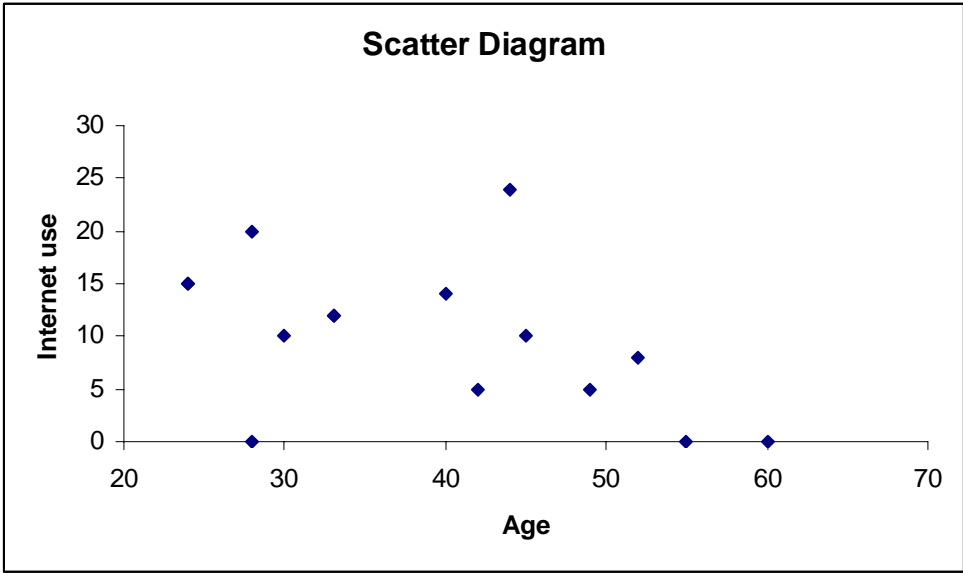
There is a strong positive linear relationship.

2.60



Gender and marital status are unrelated.

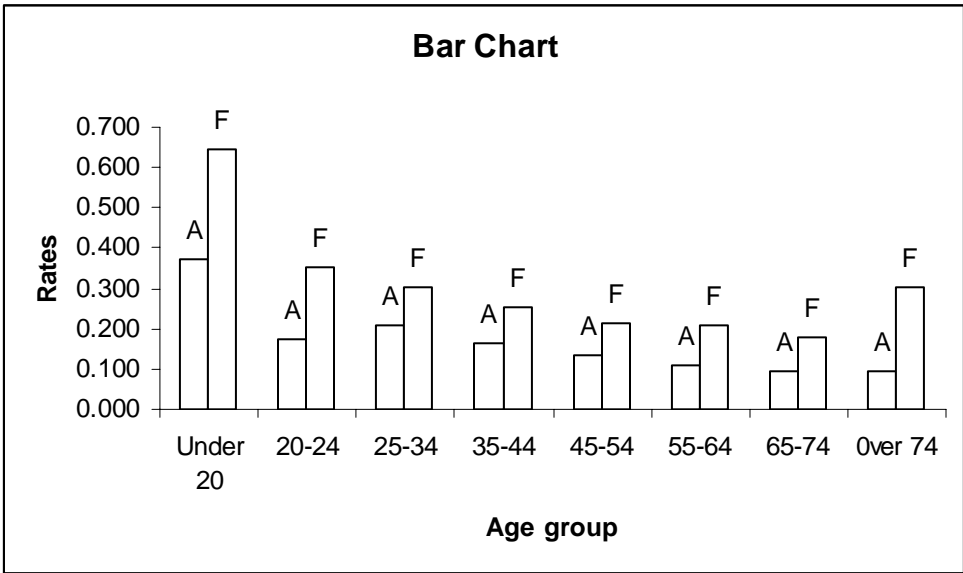
2.61a



b There does not appear to be a linear relationship.

2.62	Age Group	Accident rate (per driver)	Fatal accident rate (per 1,000 drivers)
	Under 20	.373	.643
	20 – 24	.173	.352
	25 – 34	.209	.305
	35- 44	.162	.251
	45 – 54	.133	.214
	55 – 64	.108	.208
	65 – 74	.095	.177
	Over 74	.093	.304

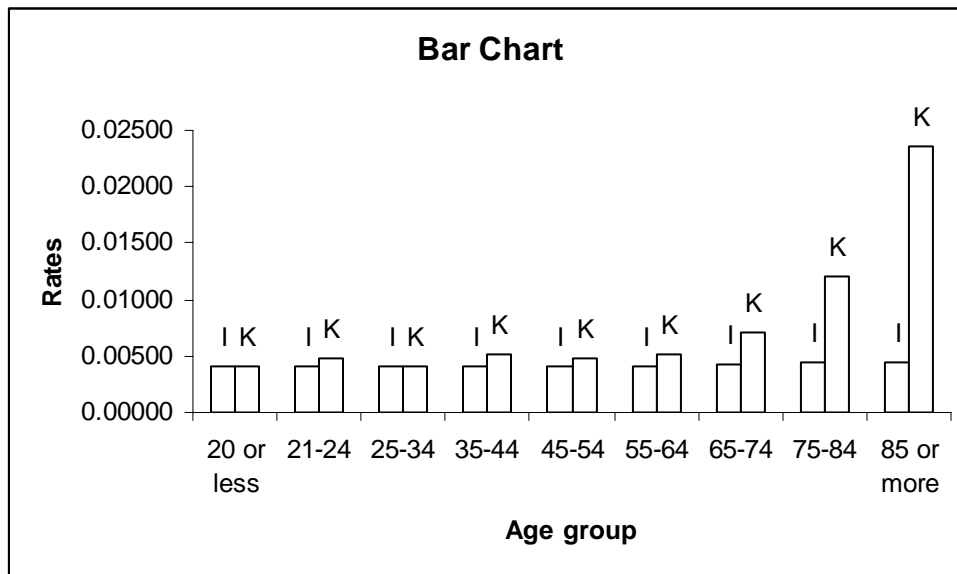
b



c The accident rate generally decreases as the ages increase. The fatal accident rate decreases until the over 74 age category where there is an increase. As drivers age they become less likely to be involved in an accident. As a result the fatal accident rate also decreases except for the over 74 age group. Perhaps because of other health issues older drivers are more likely than other drivers to die as a result of the accident.

2.63 a	Age Group	Injury Rate (per 100 accidents)	Fatal injury rate (per accident)
	20 or less	.00416	.00415
	21- 24	.00417	.00481
	25 – 34	.00400	.00412
	35 – 44	.00401	.00511
	45 – 54	.00414	.00475
	55 – 64	.00413	.00522
	65 – 74	.00418	.00704
	75 – 84	.00443	.01197
	85 or more	.00445	.02363

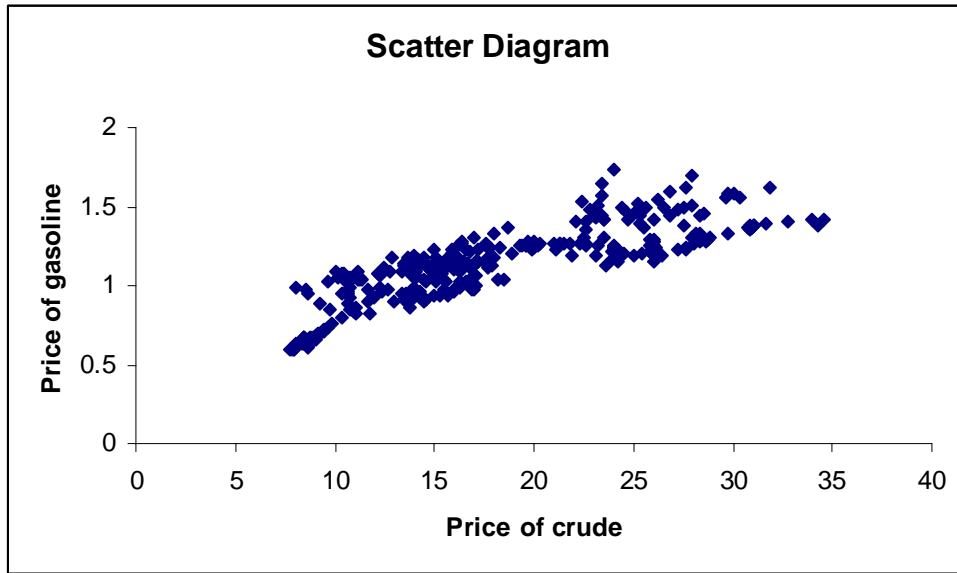
b



c Older drivers who are in accidents are more likely to be injured or killed.

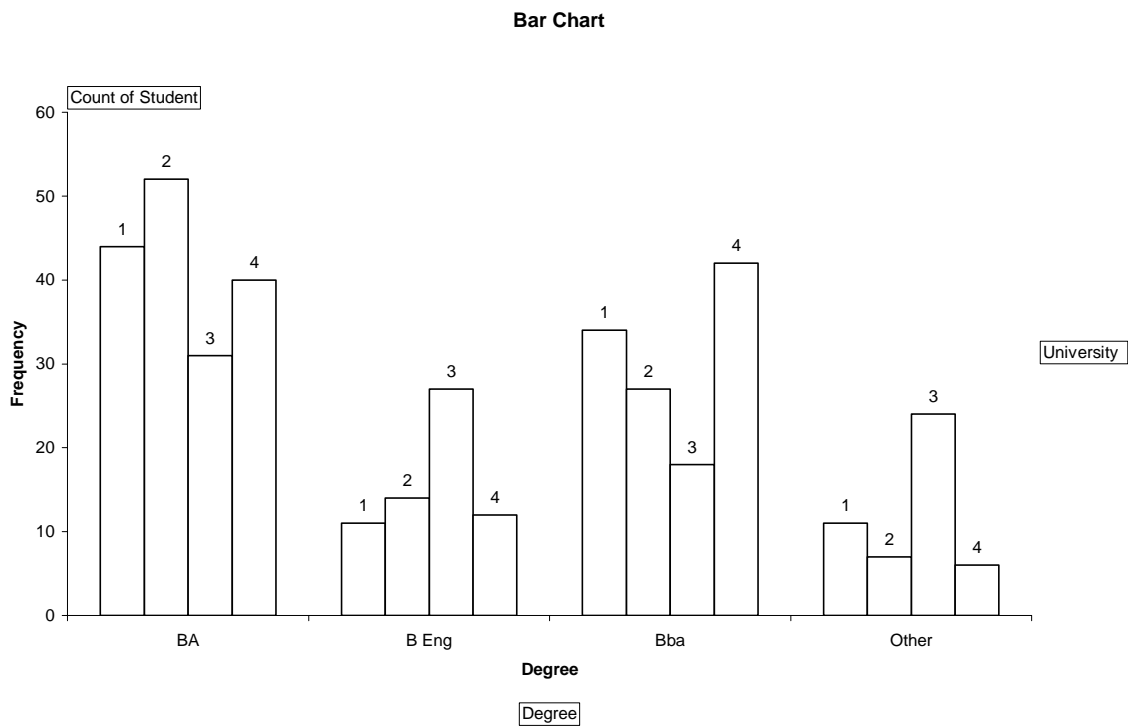
d Exercise 2.62 addressed the issue of accident rates, where in this exercise we consider the severity of accidents.

2.64



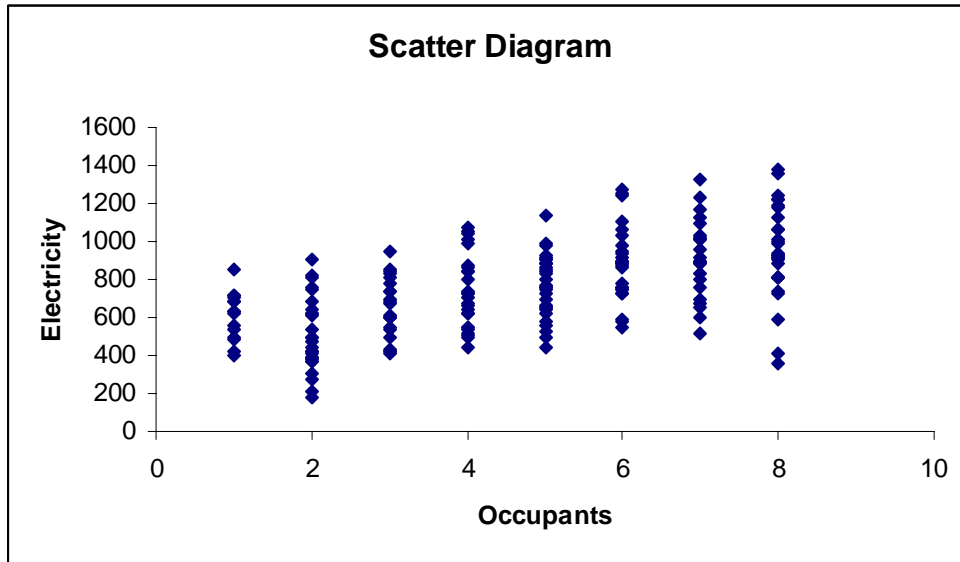
There is a strong positive linear relationship between the prices of crude oil and gasoline.

2.65



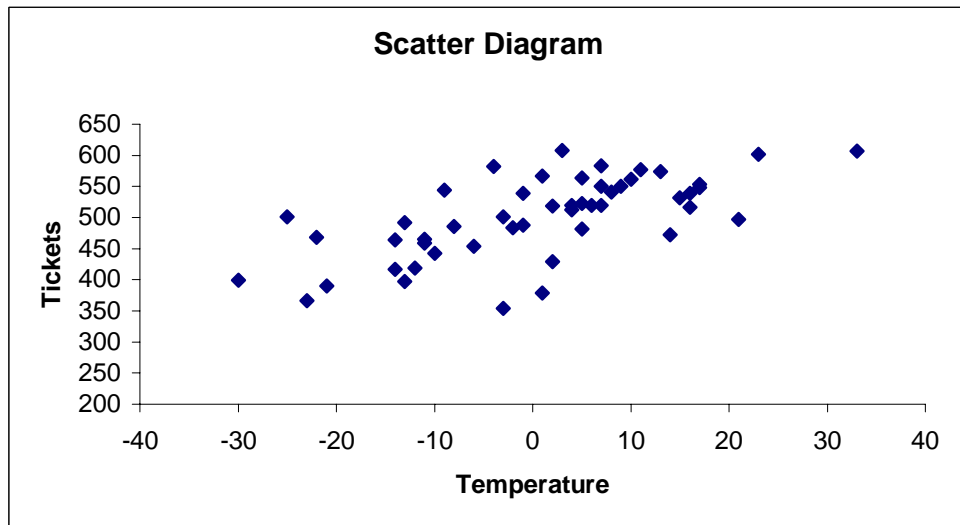
There is a relationship between degree and university.

2.66a



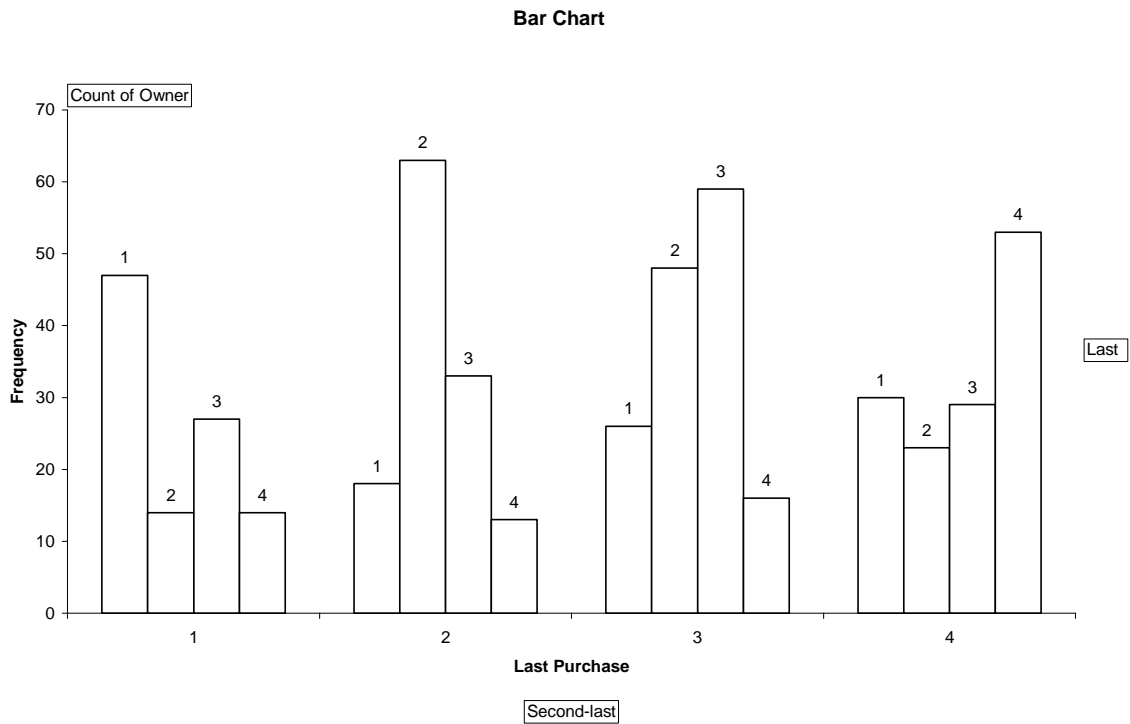
b There is moderately strong positive linear relationship between the number of occupants and electricity use.

2.67



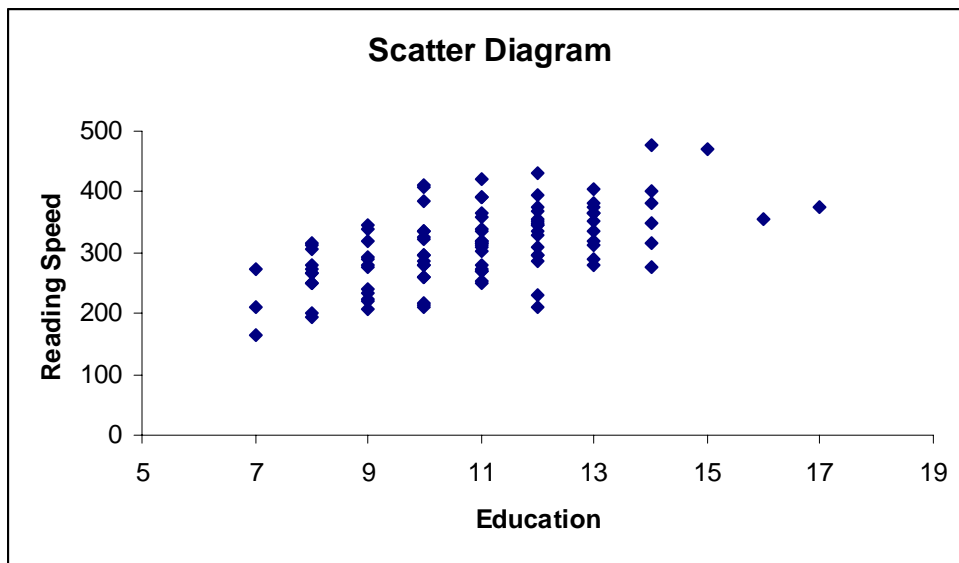
There is a moderately strong positive linear relationship between temperature and the number of tickets.

2.68



There is a relationship between the last two purchases. There is some brand loyalty.

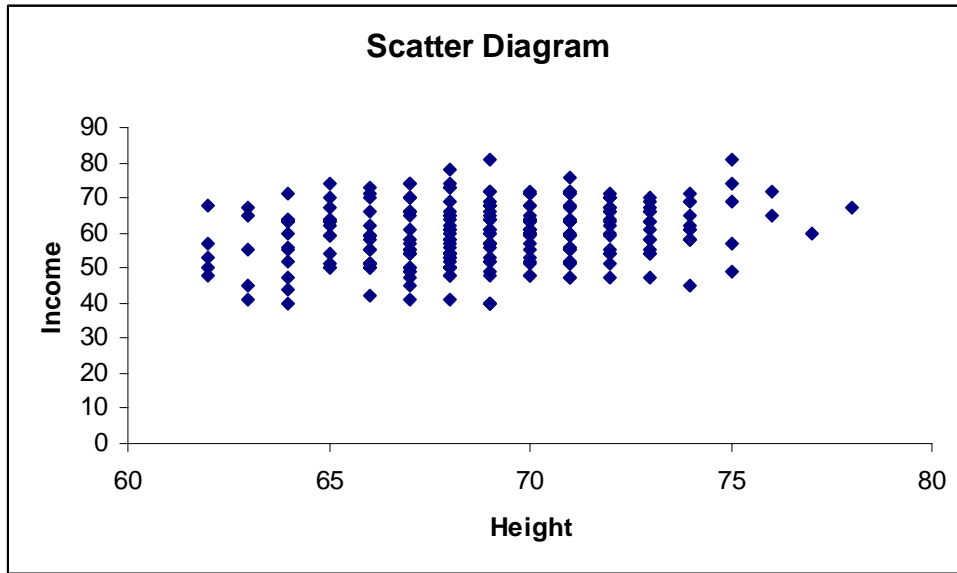
2.69



There is a moderately strong linear relationship between years of education and reading speed.

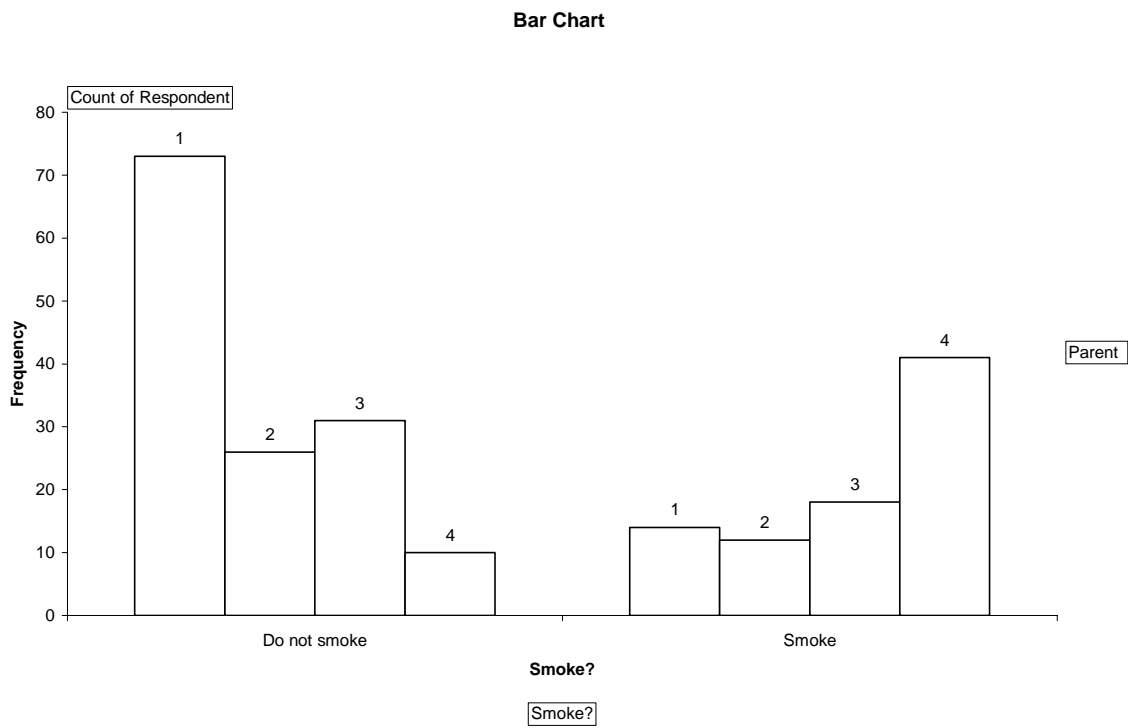


2.70 a



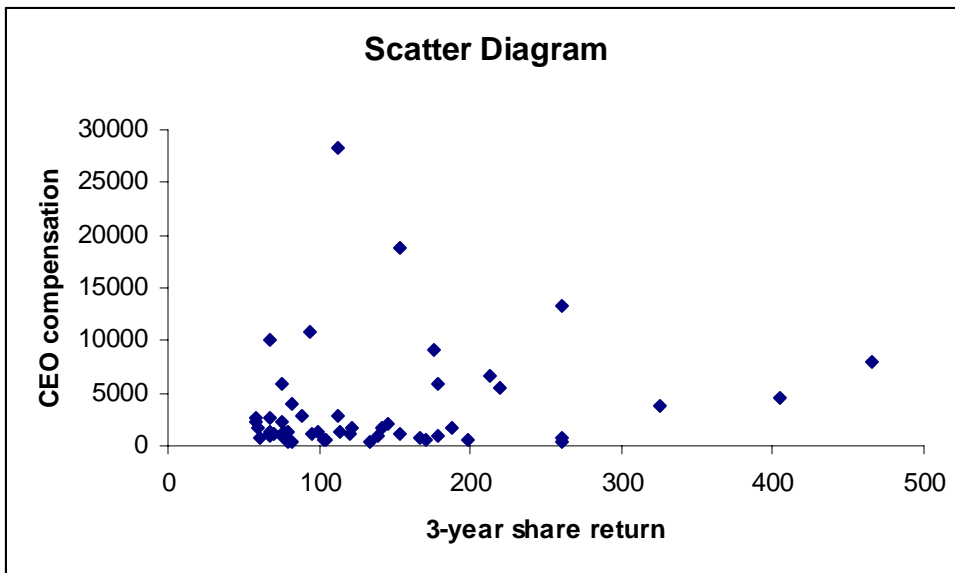
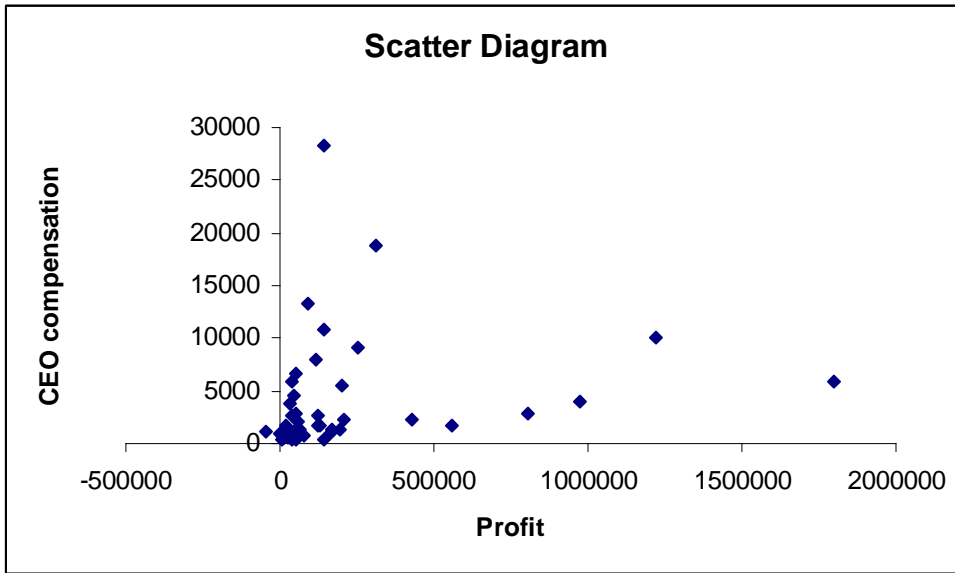
b There is a no linear relationship between the two variables.

2.71



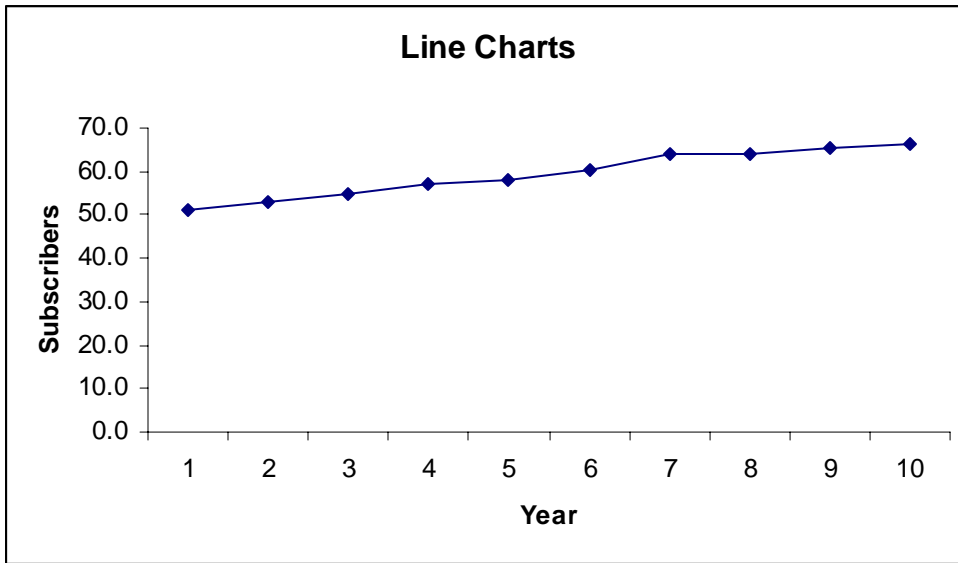
The two nominal variables are strongly correlated.

2.72



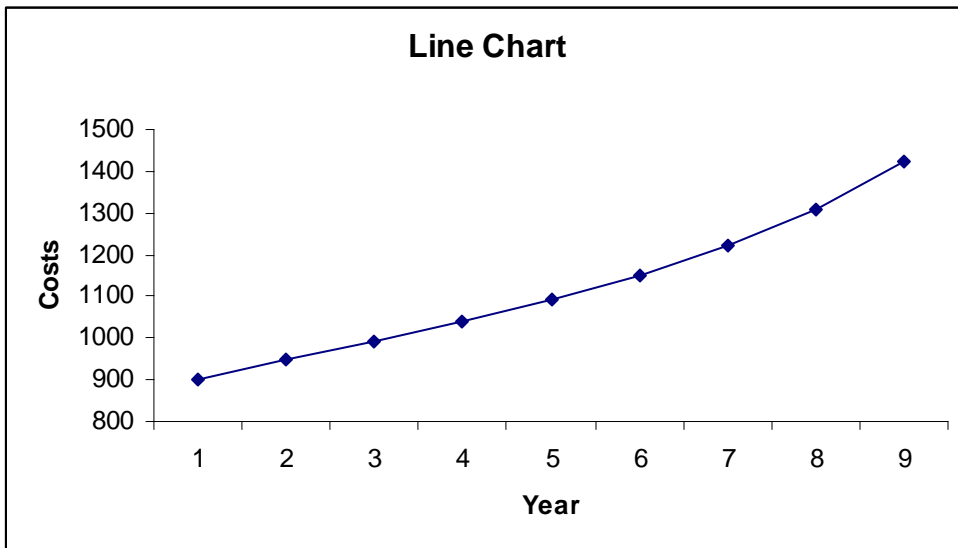
There does not appear to be a linear relationship between profit and CEO compensation or between 3-year share return and CEO compensation.

2.73



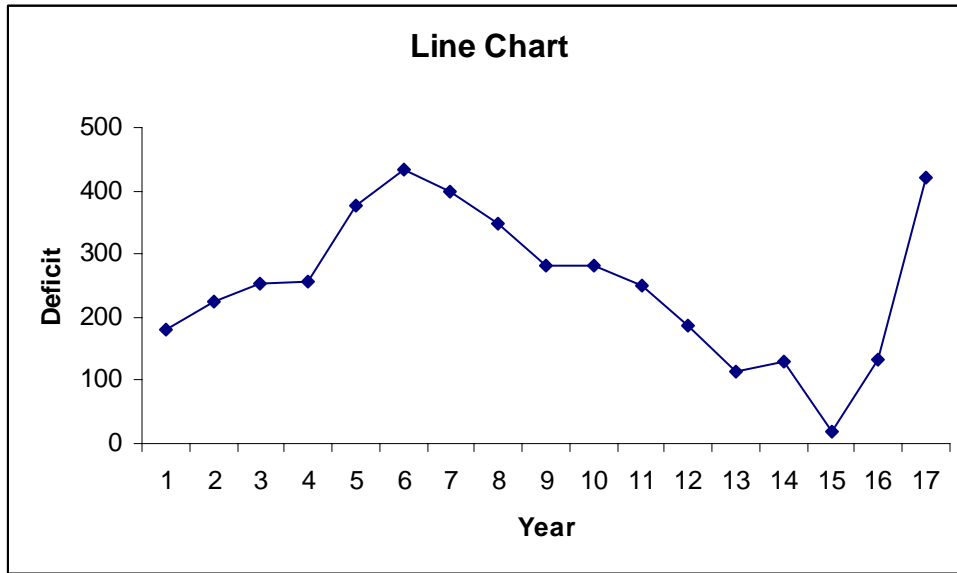
There has been a steady growth in subscribers over the ten-year period.

2.74



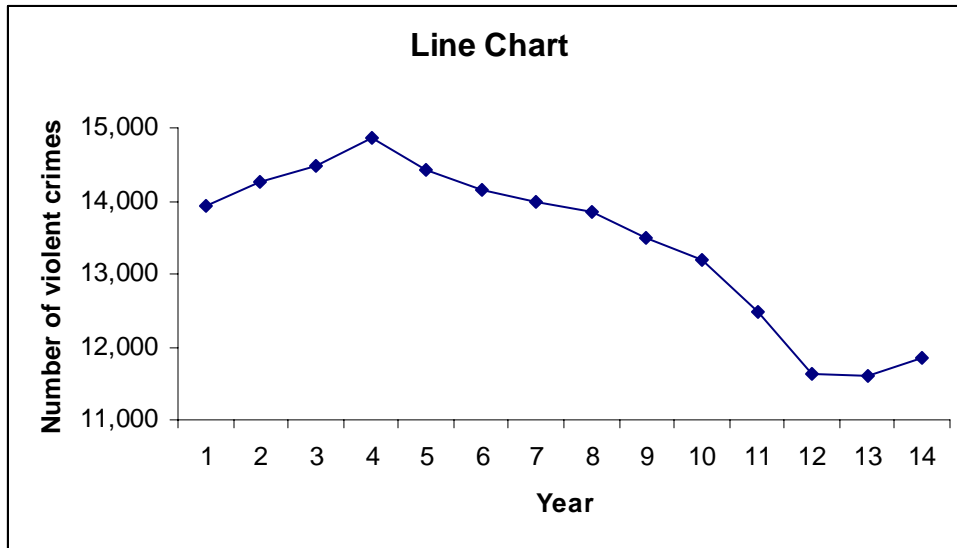
Costs have increased dramatically and appear to be accelerating.

2.75a



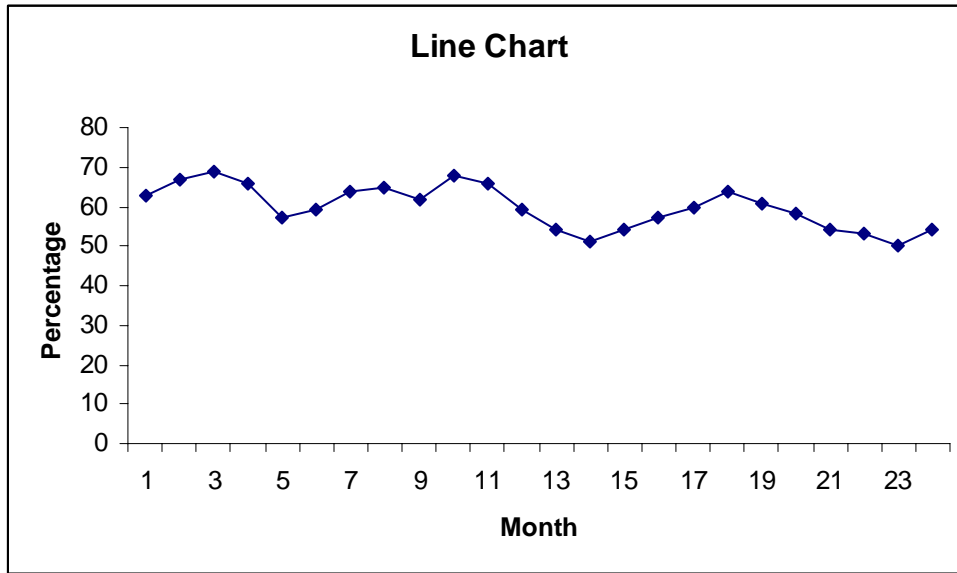
b Deficits began falling after the sixth year (1991), approached 0 in year 15( 200) and started rising again.

2.76



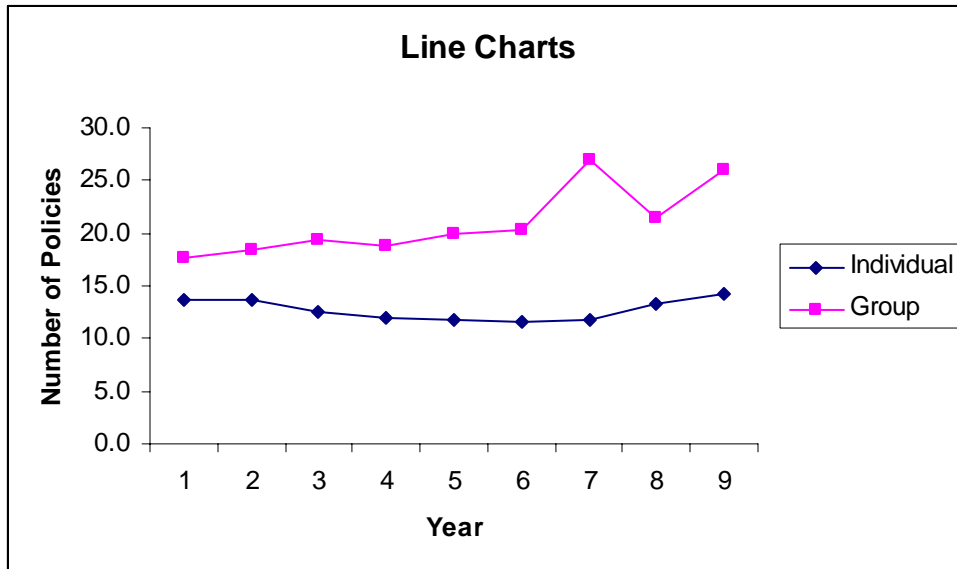
After rising for 3 years, the number of crimes has steadily decreased until year 12, where is started to rise again.

2.77



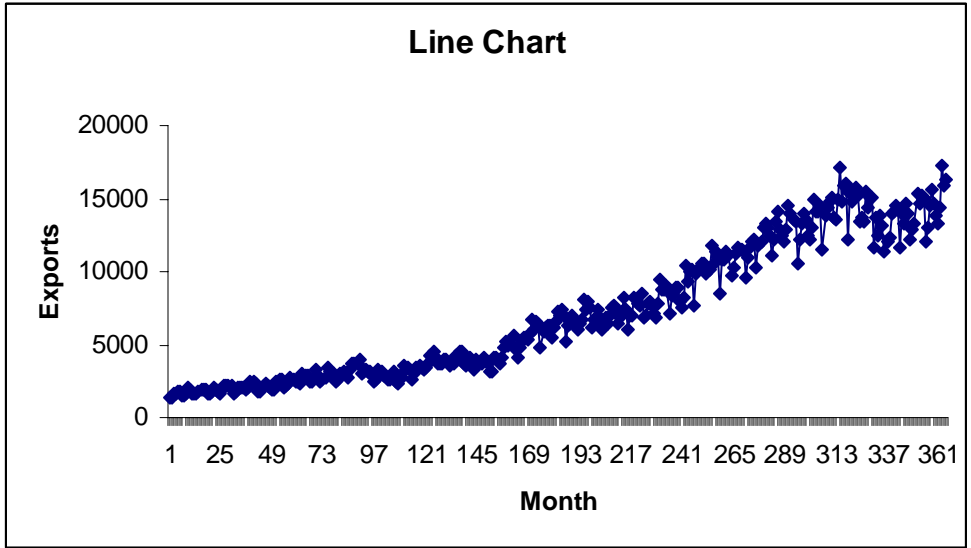
There is some month-to-month fluctuation, but the percentage was only slightly lower after 24 months.

2.78

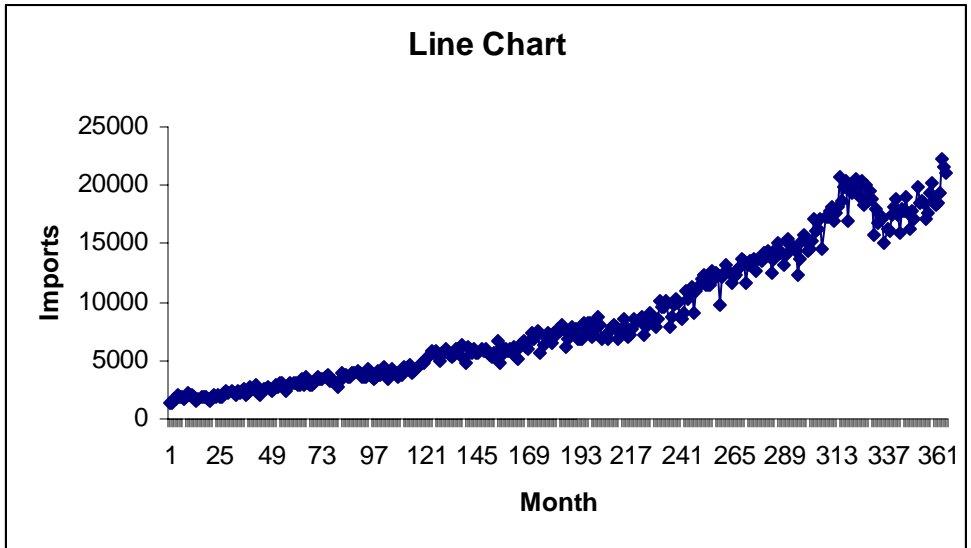


The number of individual policies has been stable while group policies are increasing.

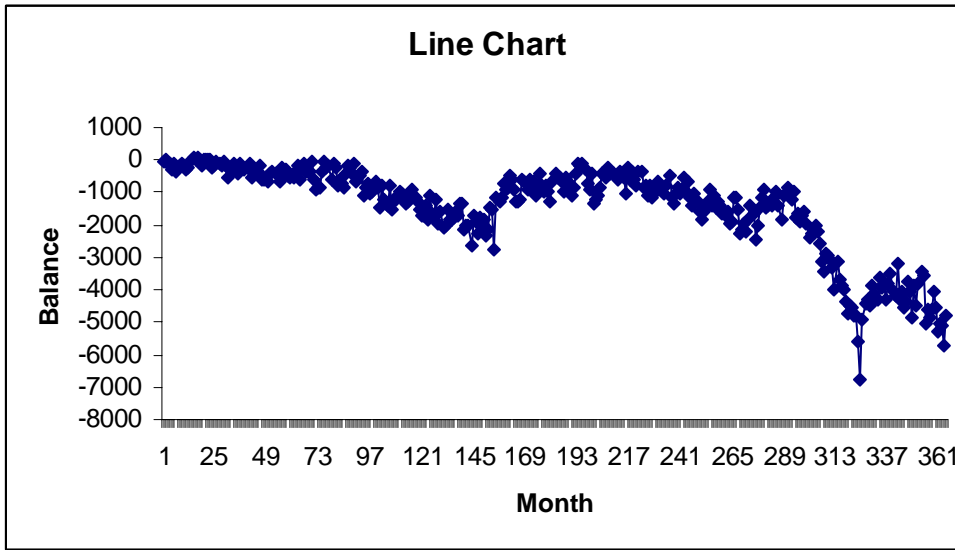
2.79a



b

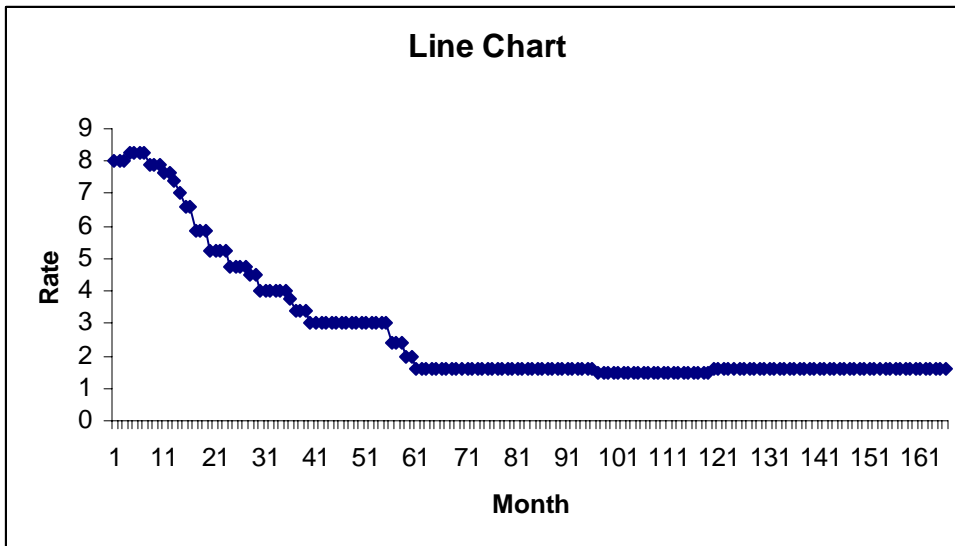


c



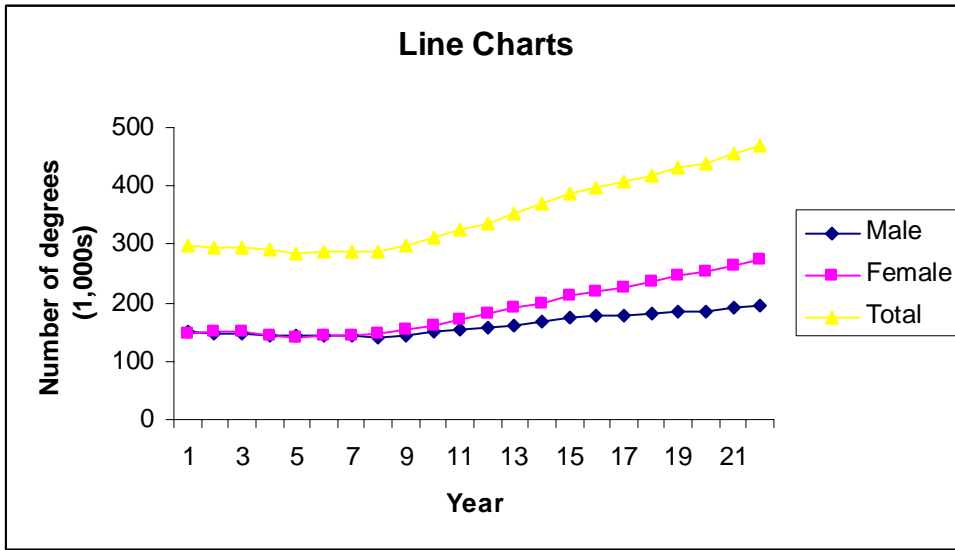
d Trade between the two countries has increased exponentially. However, imports from Canada have increased at a faster rate than exports to Canada.

2.80a



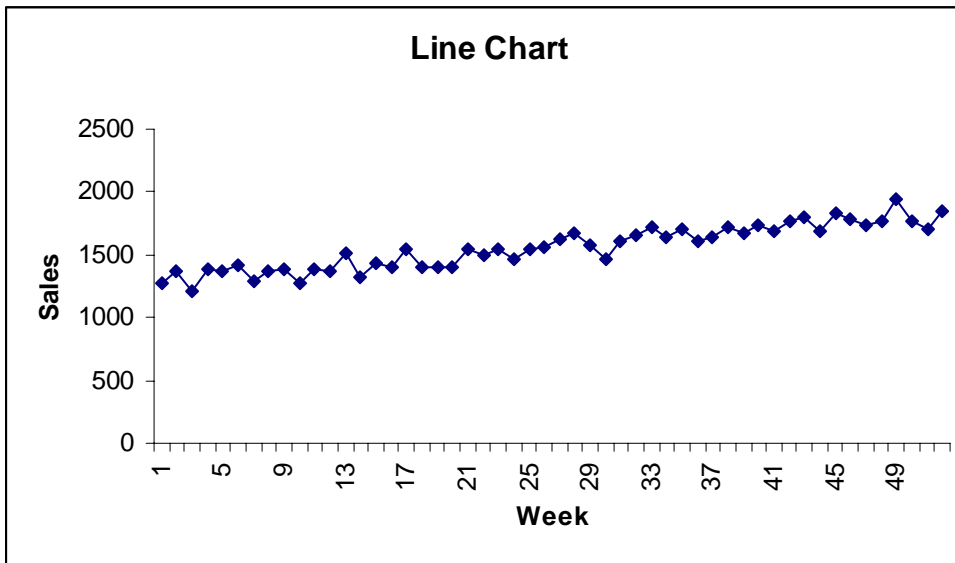
b There was a large decrease over the first half of the period, but has leveled since.

2.81



There has been a gradual increase over the 18-year period.

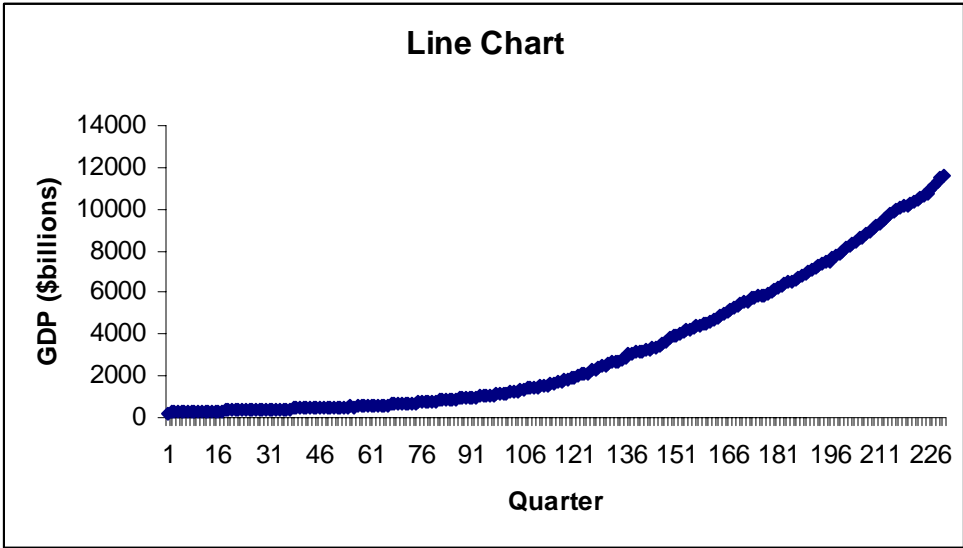
2.82a



b There has been a gradual weekly increase in sales.

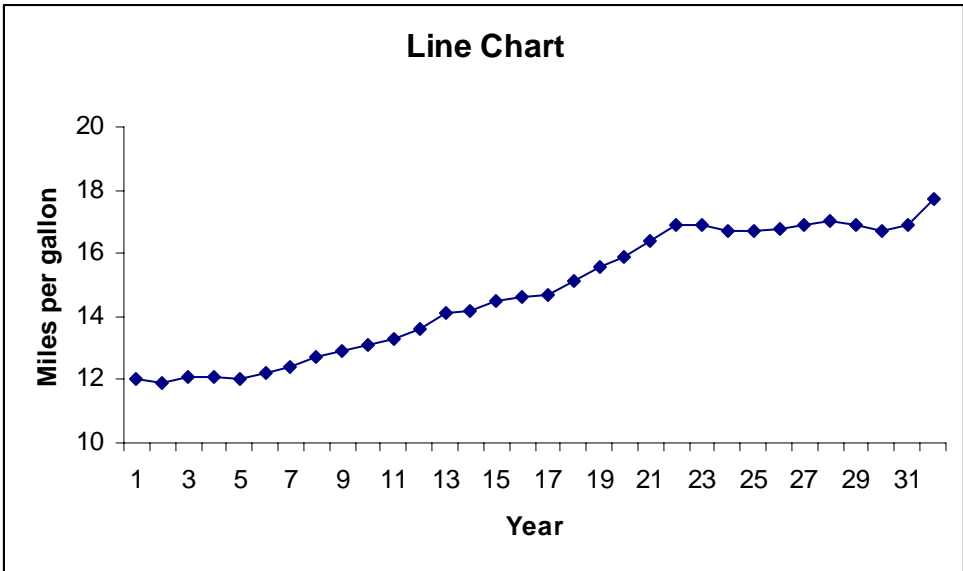
2.83





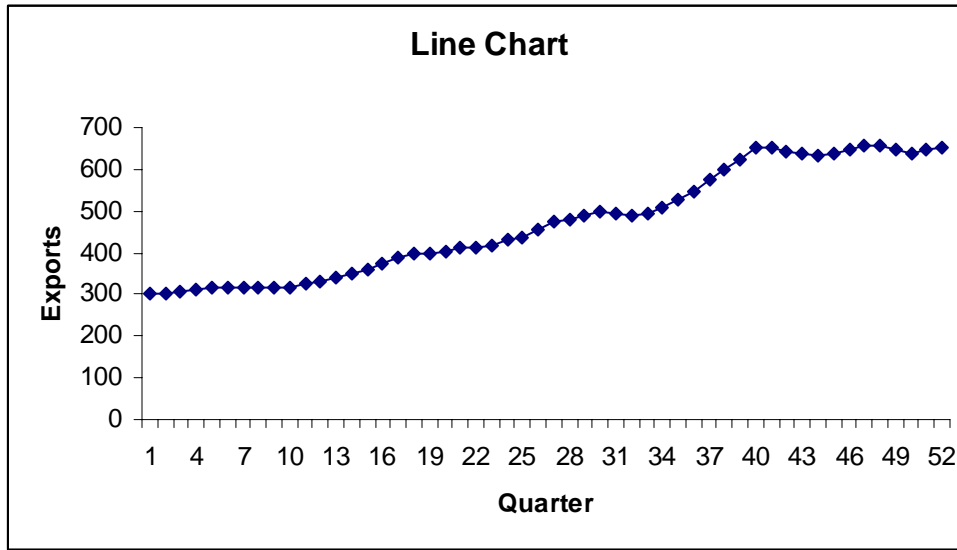
The quarterly figures have grown exponentially.

2.84



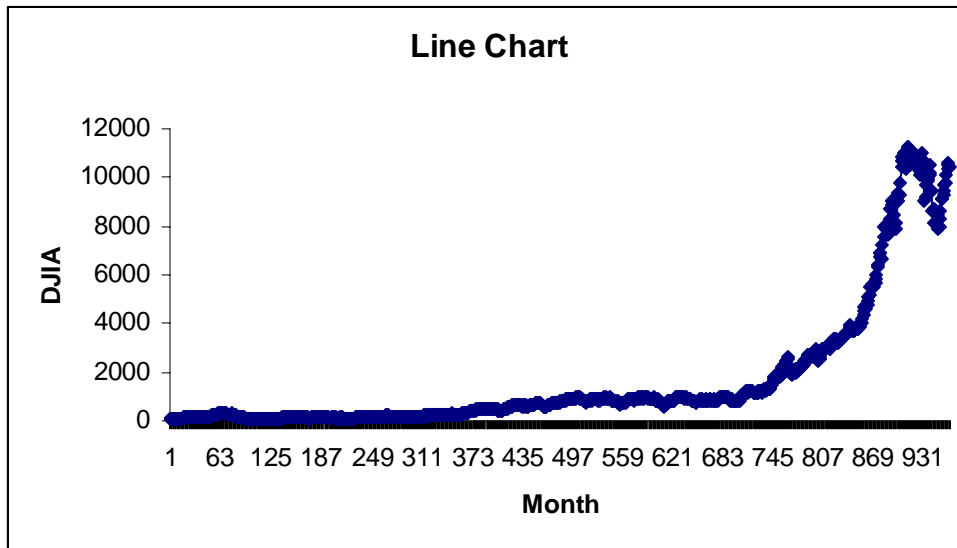
Gas mileage has steadily improved over the past 31 years.

2.85



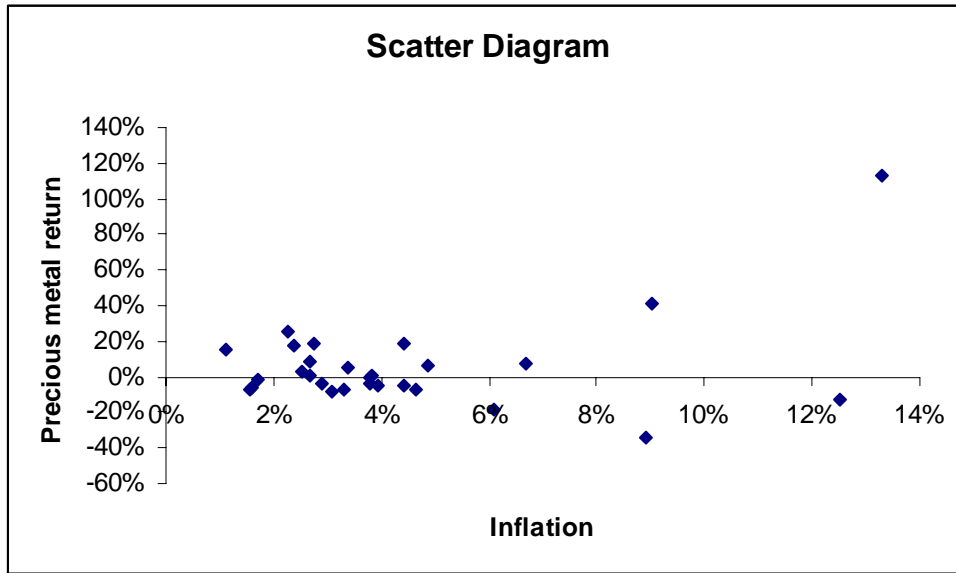
Exports have steadily increased until quarter 41, at which point it leveled off.

2.86



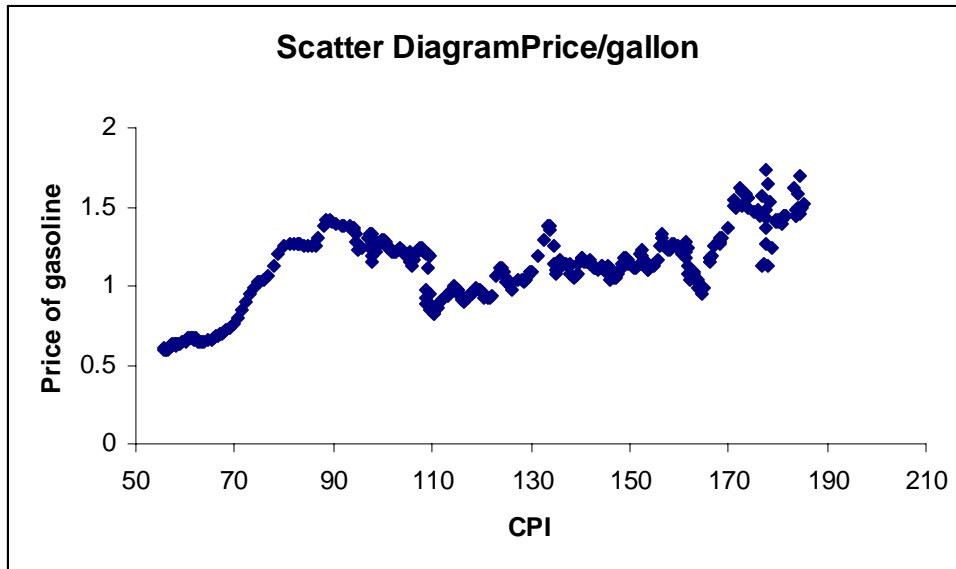
The trend until month 700 (1982) was slow but steady. Then the index grew exponentially until month 900, (1999), at which point there was a significant decrease and recovery.

2.87



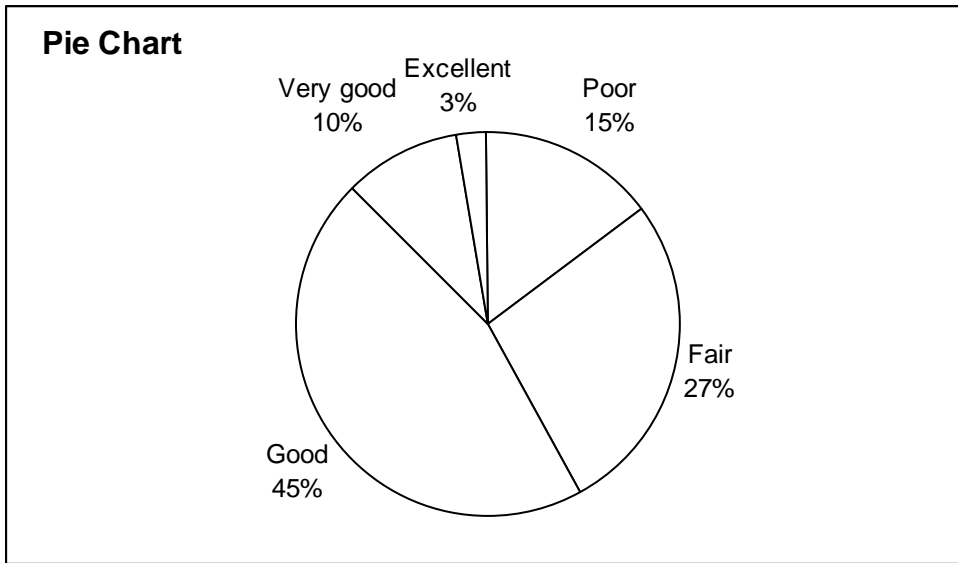
There is a weak linear relationship between inflation rate and precious metal returns.

2.88



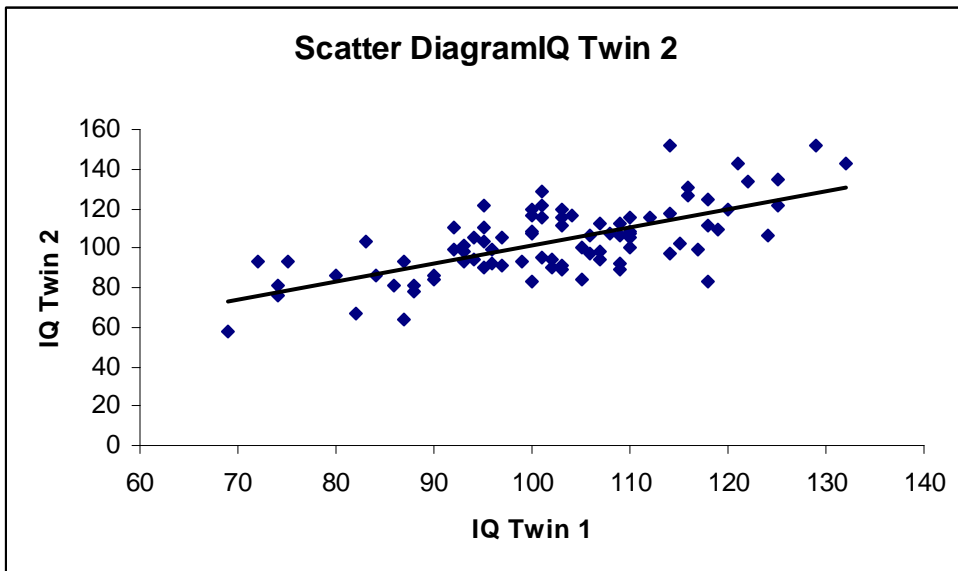
There is a moderately strong linear relationship suggesting that the some of the price increase is due to inflation.

2.89



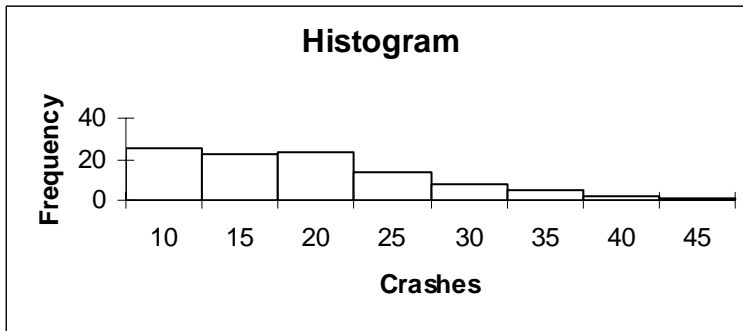
Most of the responses rate the food as good or fair.

2.90



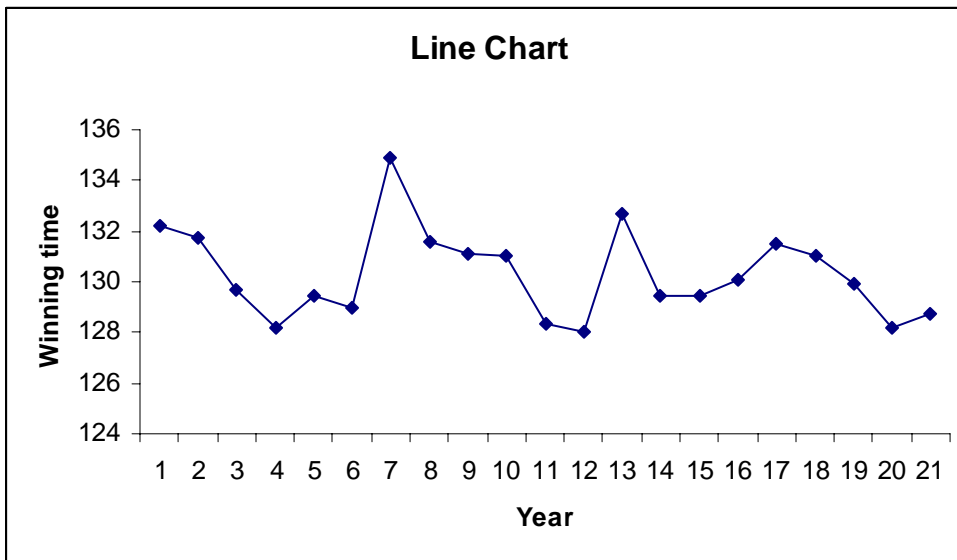
There is a moderately strong linear relationship between the IQs of twins.

2.91

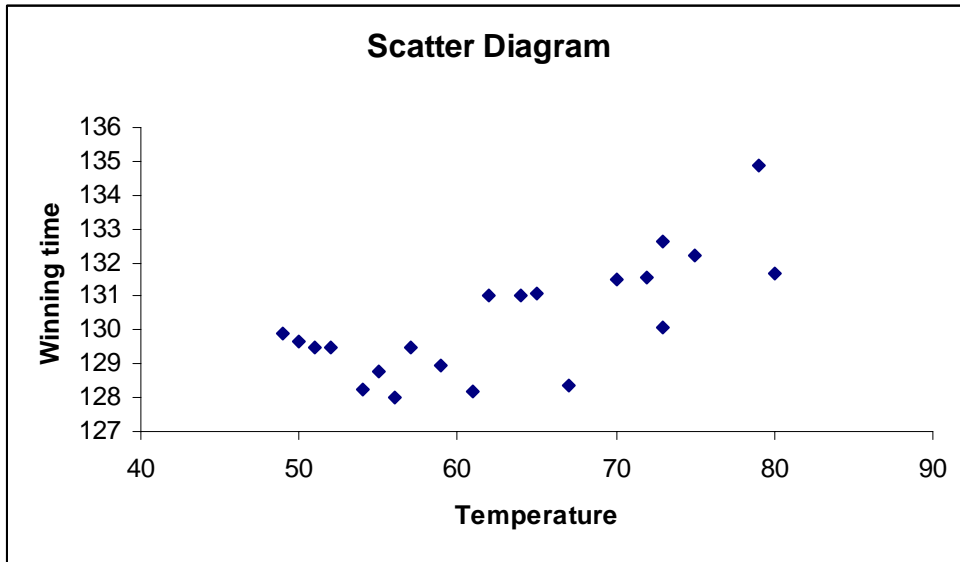


The histogram is positively skewed. Most computer users have less than 25 crashes per 12 week period.

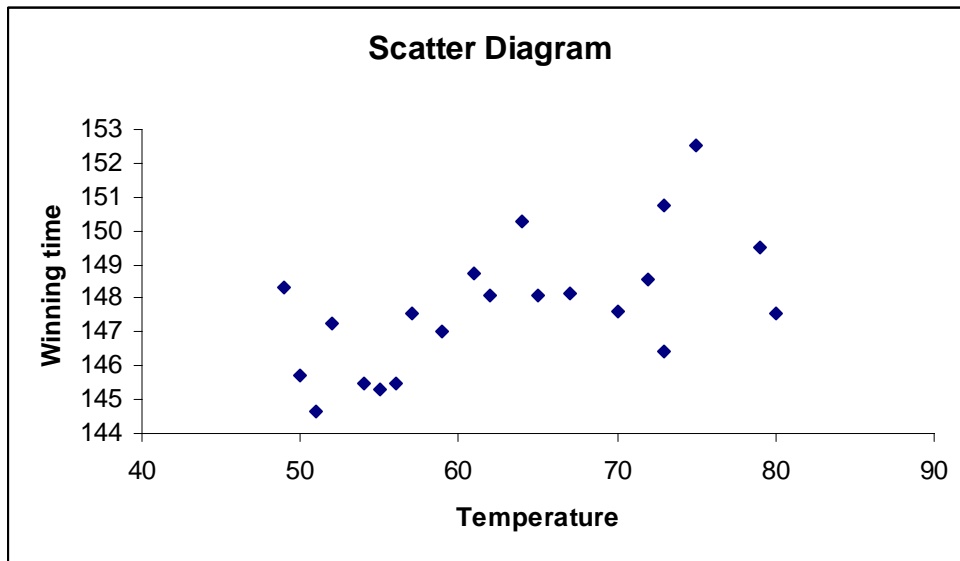
2.92 Although there are year-to-year fluctuations the winning time appears to be constant.



2.93

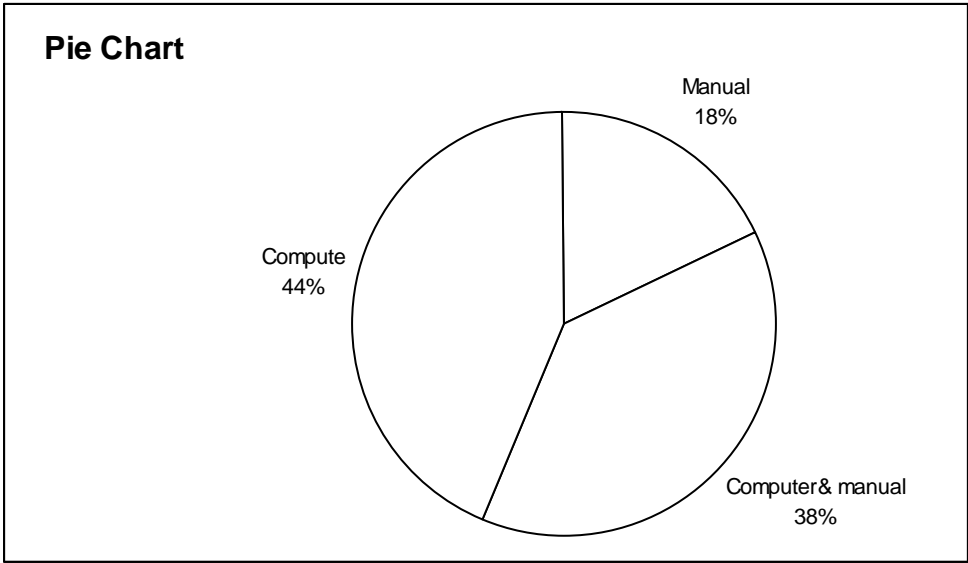


There is a strong positive linear relationship between temperature and winning times. This explains some of the fluctuations in the line chart in Exercise 2.92.



2.94

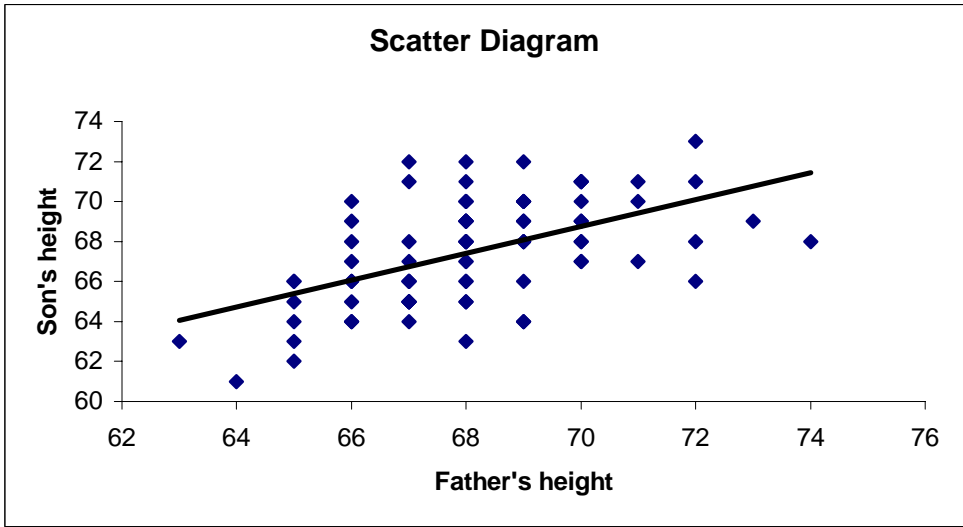
There is a moderately strong positive linear relationship between temperature and winning time.



2.95

The most popular approach is to use the computer exclusively, closely followed by a combination of manual calculations and computer solutions. Would be statistics textbook authors are recommended to write books that combine both approaches.

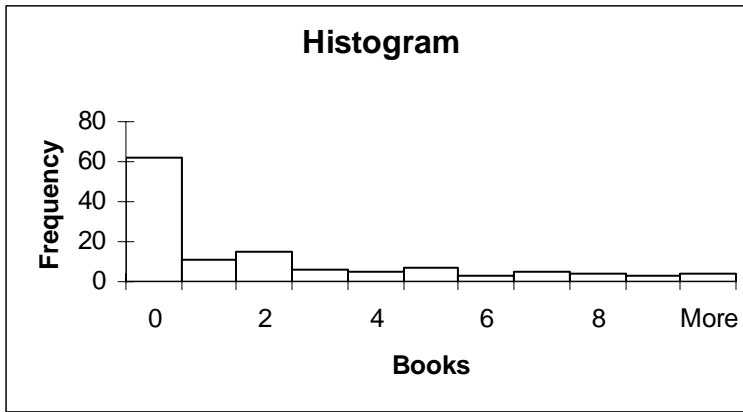
2.96a



b The direction is positive.

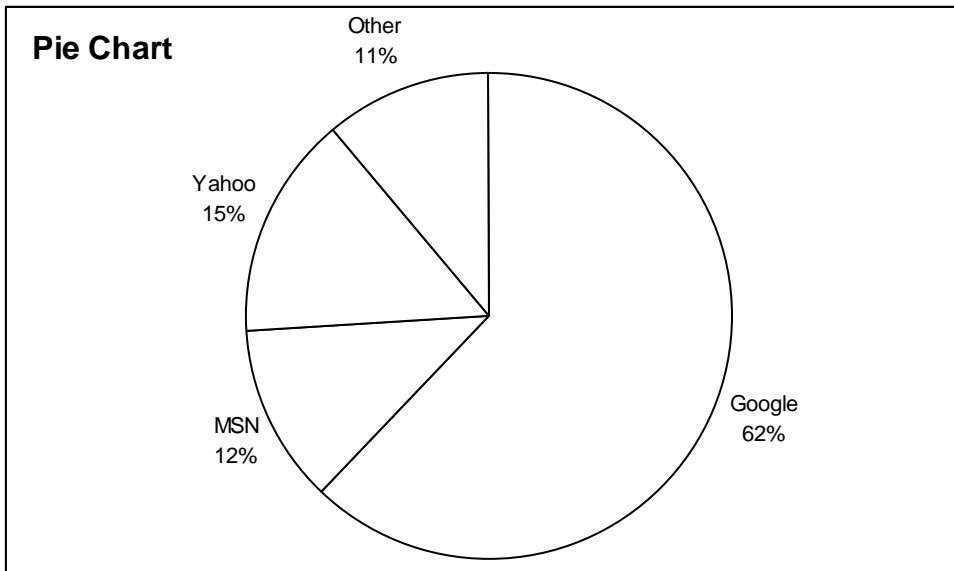
c There does appear to be a linear relationship.

2.97



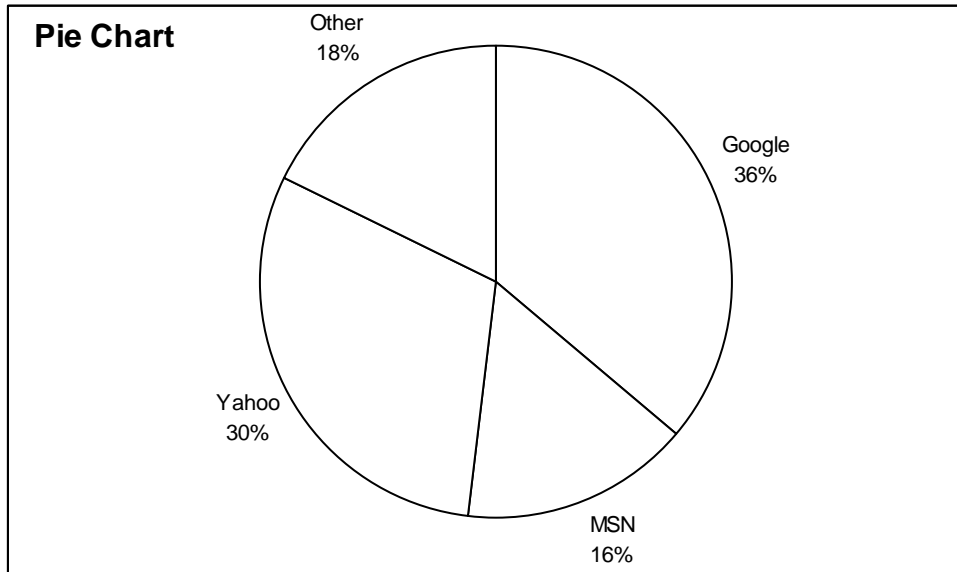
Most students borrowed no books.

2.98 Canada



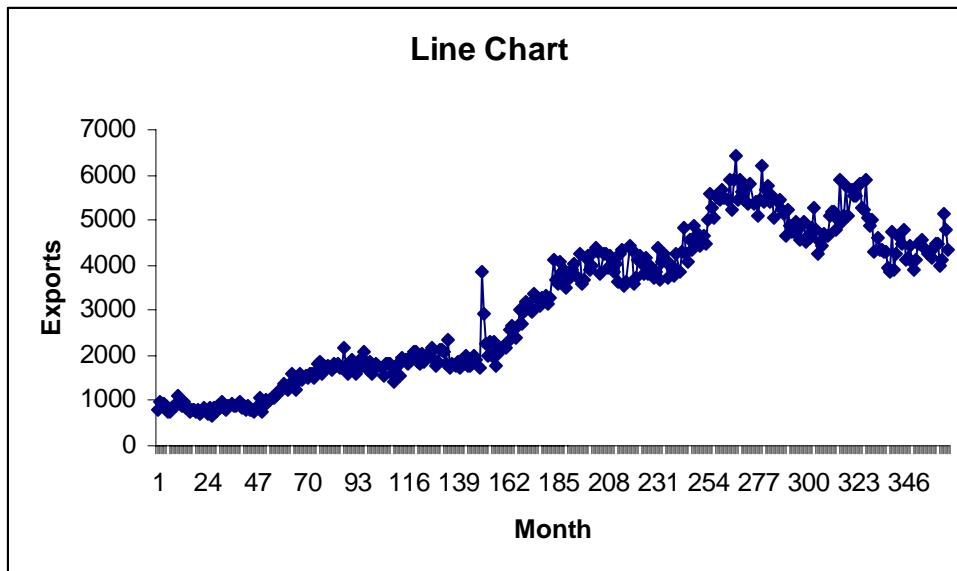


U.S.

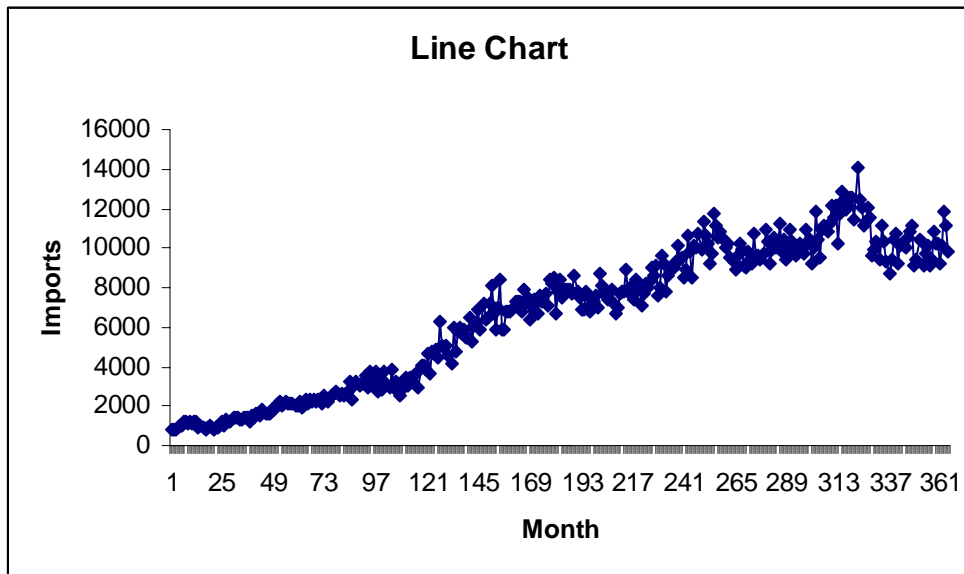


In Canada Google is the most popular by a wide margin. In the United States Google and Yahoo are the leaders.

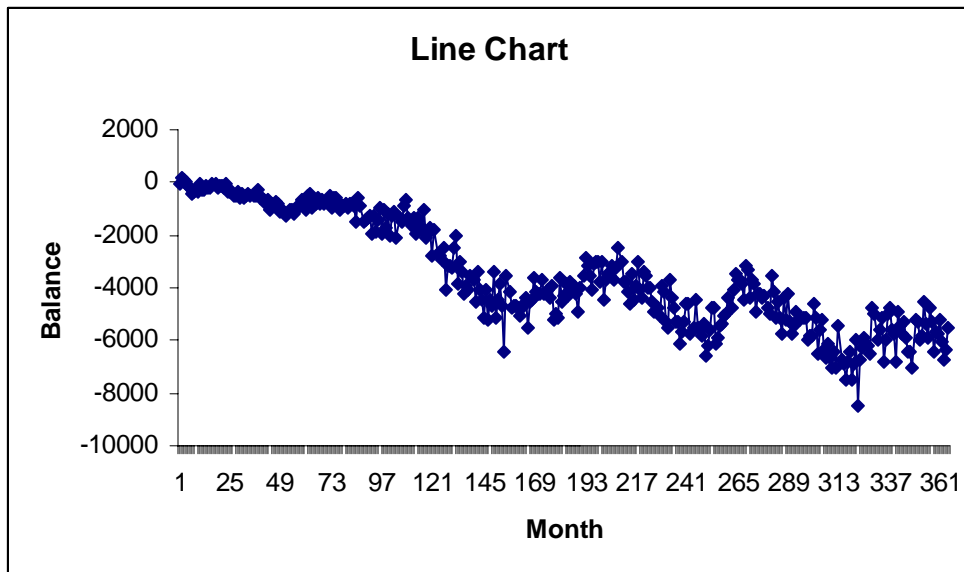
2.99a



b

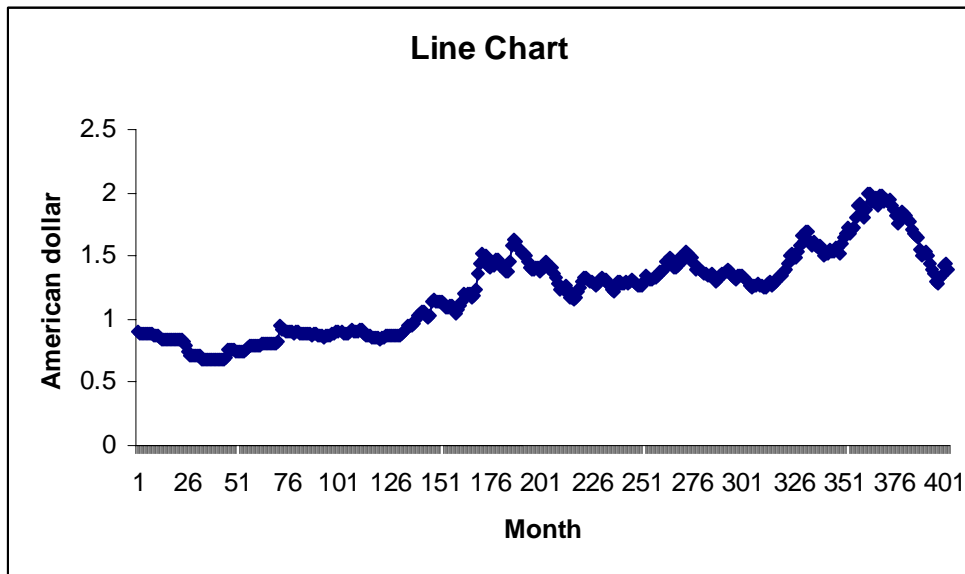


c



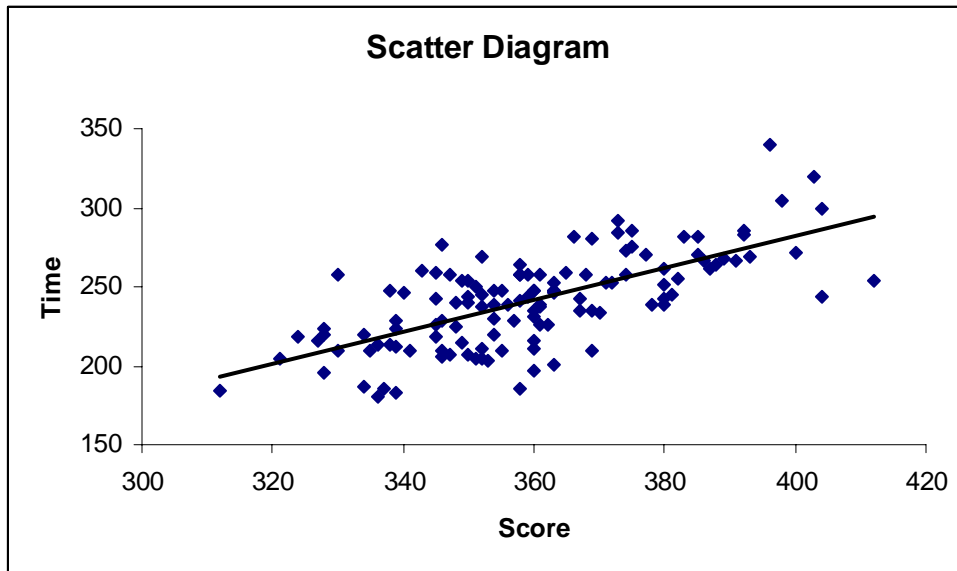
d Imports to Japan and exports from Japan have grown over the past 28 years. However, imports have grown much more quickly.

2.100



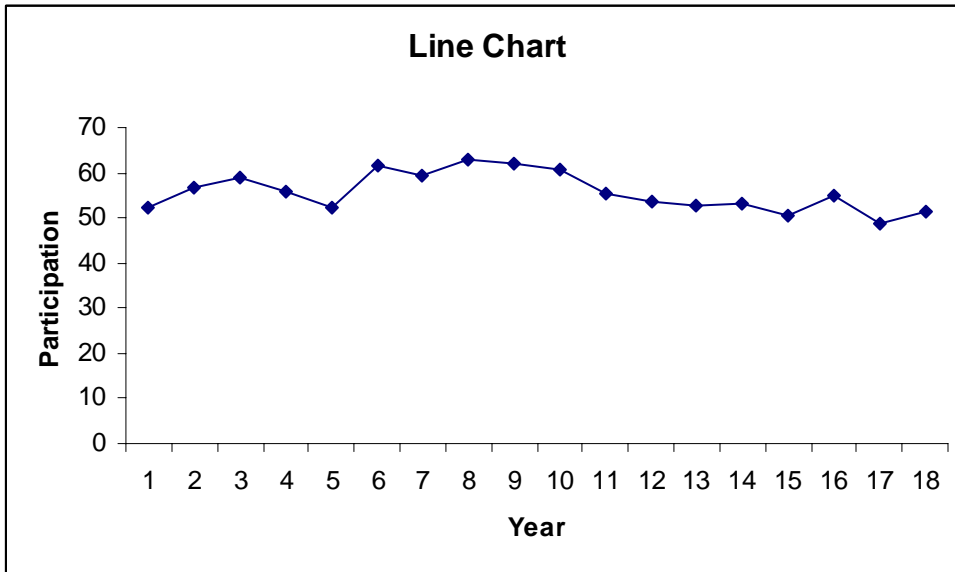
The value of the American dollar has risen over the years.

2.101

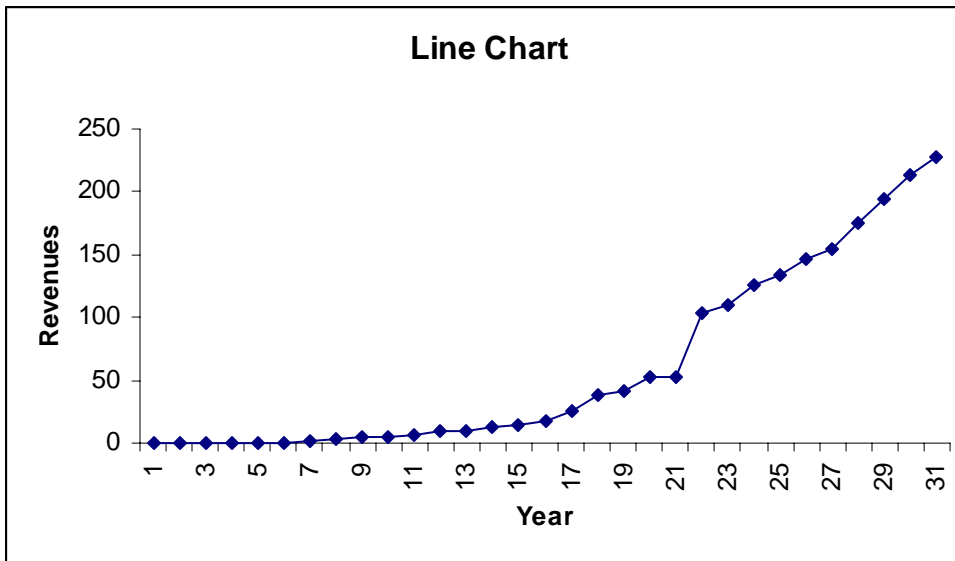


There is a moderately strong linear relationship between time and score.

2.102



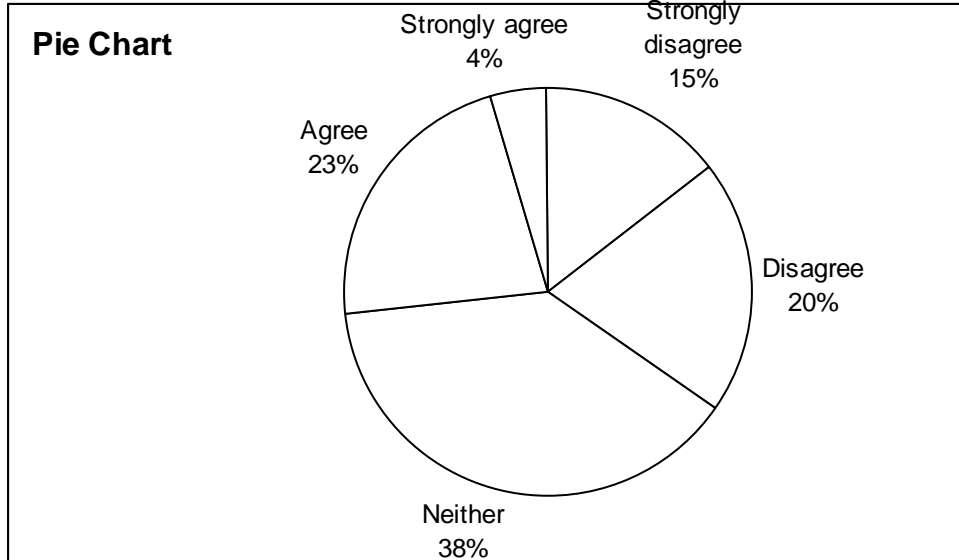
The participation rate varies between 50 and 60%.



2.103

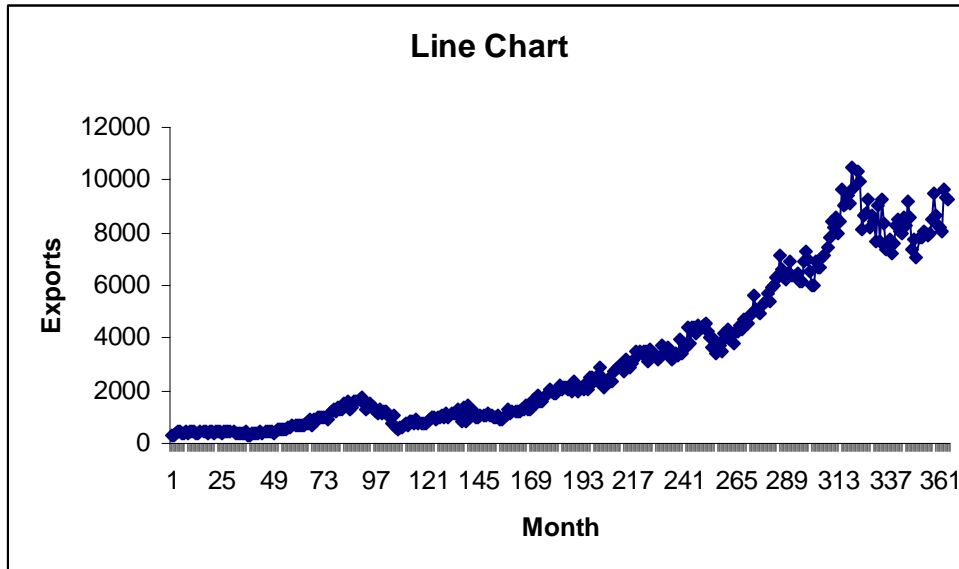
Growth in revenues has increased exponentially.

2.104

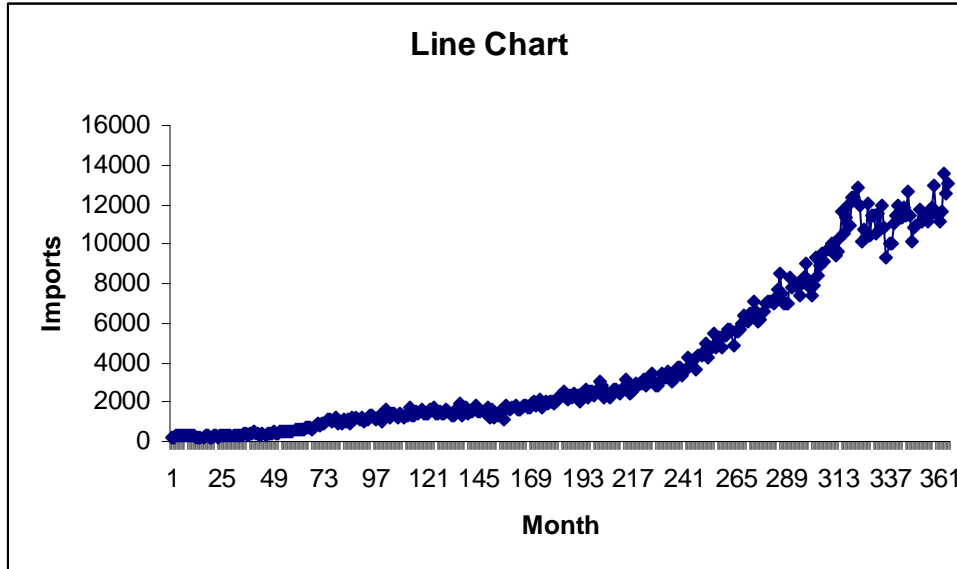


Most students would not agree.

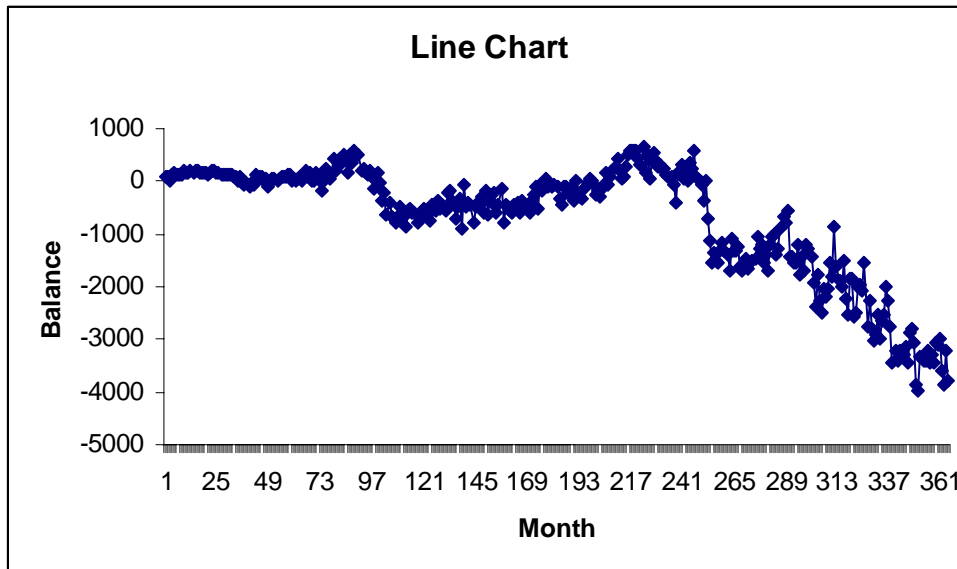
2.105a



b

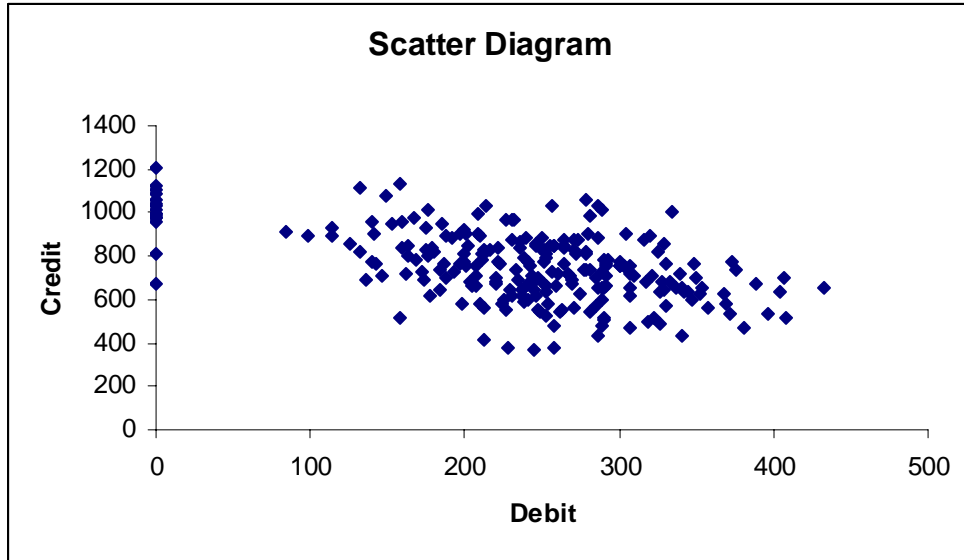


c



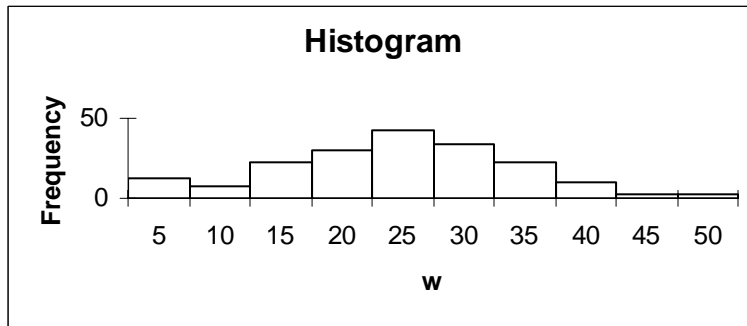
d Trade has been increasing but imports have increased faster than exports to Mexico.

2.106



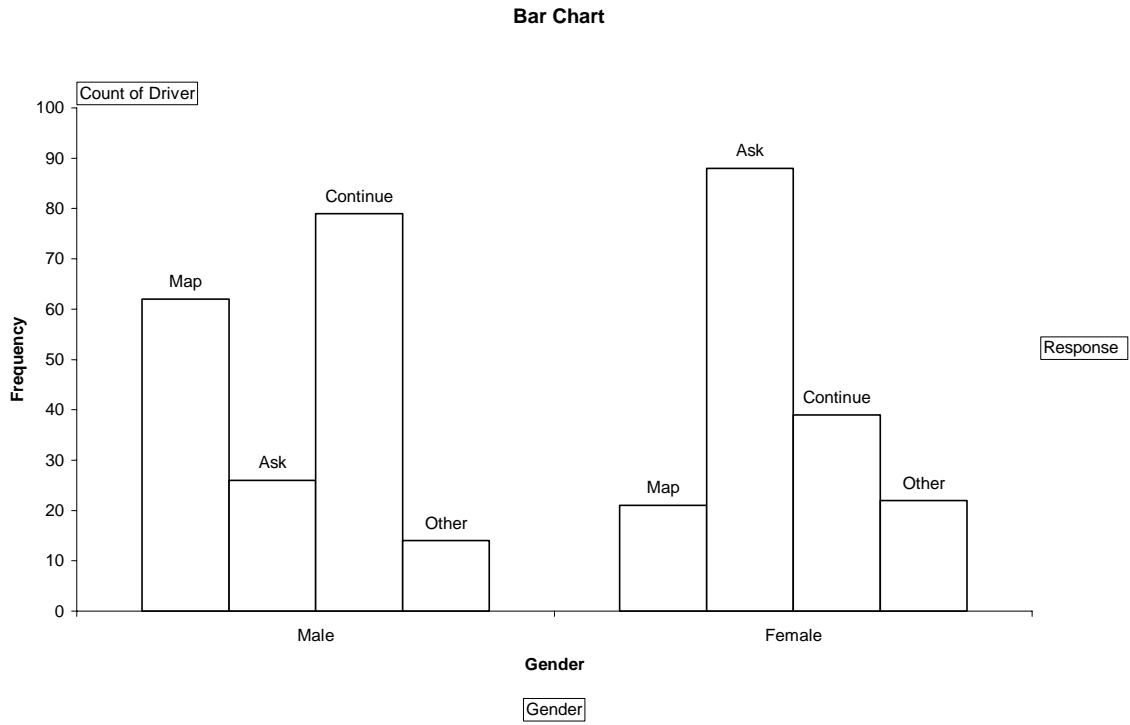
There is a moderately strong negative linear relationship.

2.107



The histogram is almost bell shaped (slightly bimodal). Many people gain between 10 and 35 pounds.

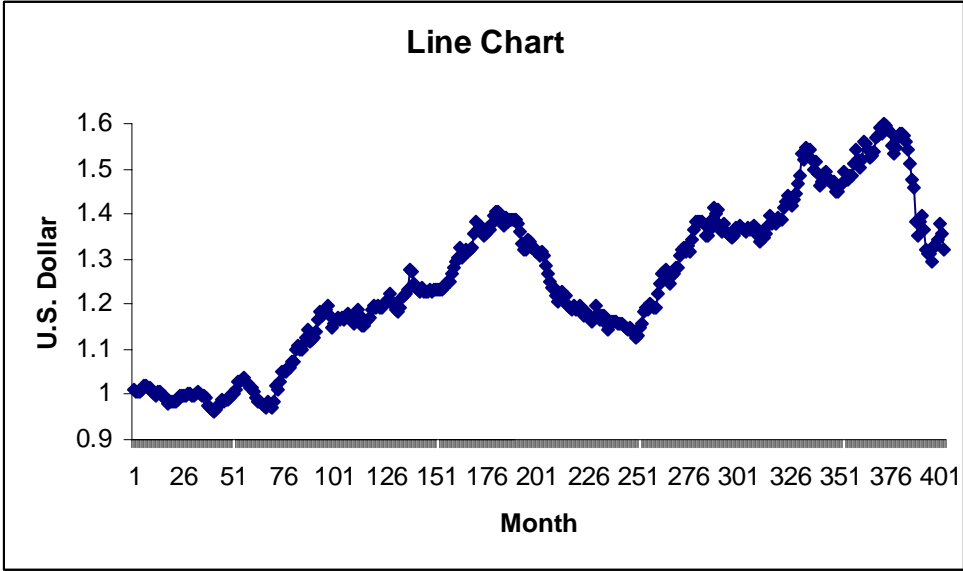
2.108



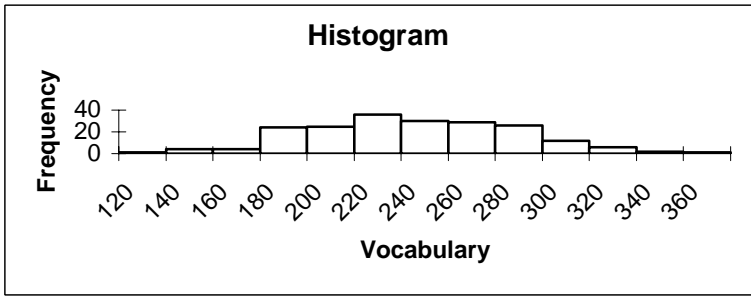
There are large differences between male and female responses. There is a strong relationship between gender and what drivers do when lost.

2.109





The US dollar increased in value until month 176 (1985), decreases until month 251(1991), rose again until month 376 (2002), and then fell sharply.

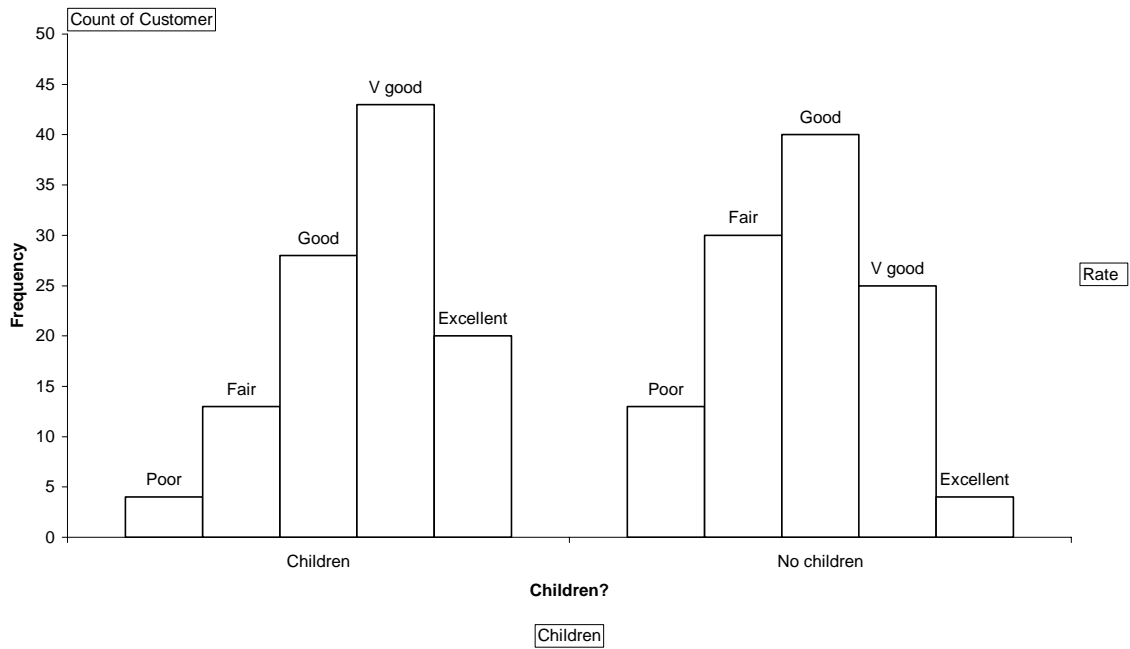


2.110

Most vocabularies lie between 160 and 280 words.

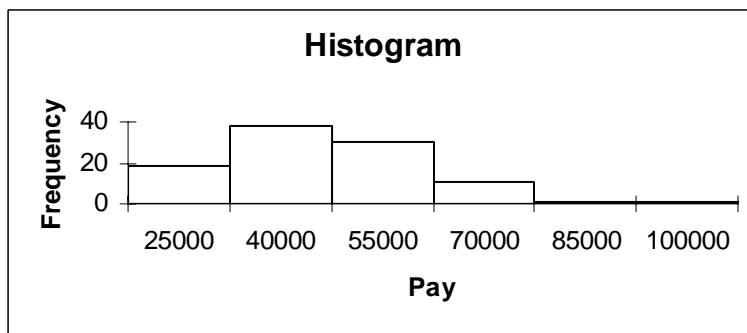
2.111

**Bar Chart**



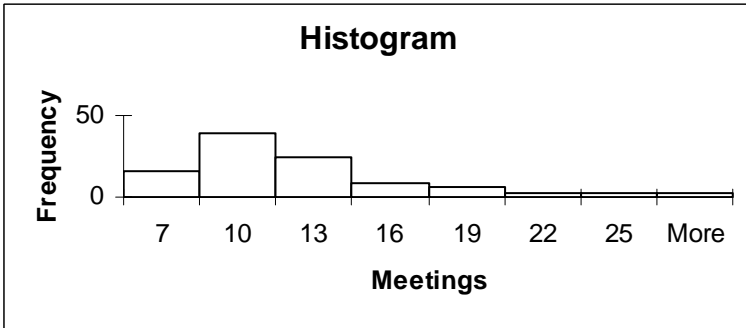
The rating and whether the children of customers accompanied them are related.

2.112



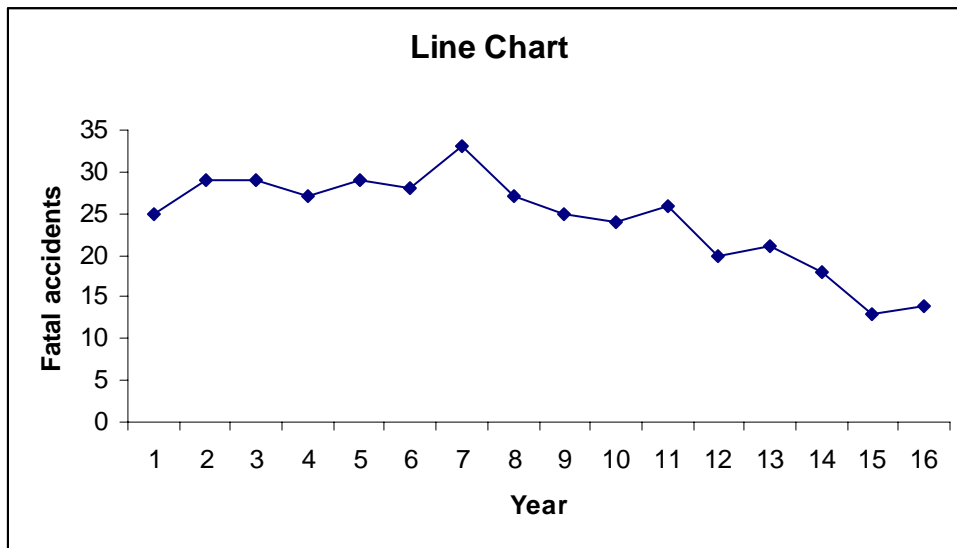
Most directors earned between \$25,000 and \$55,000.

2.113

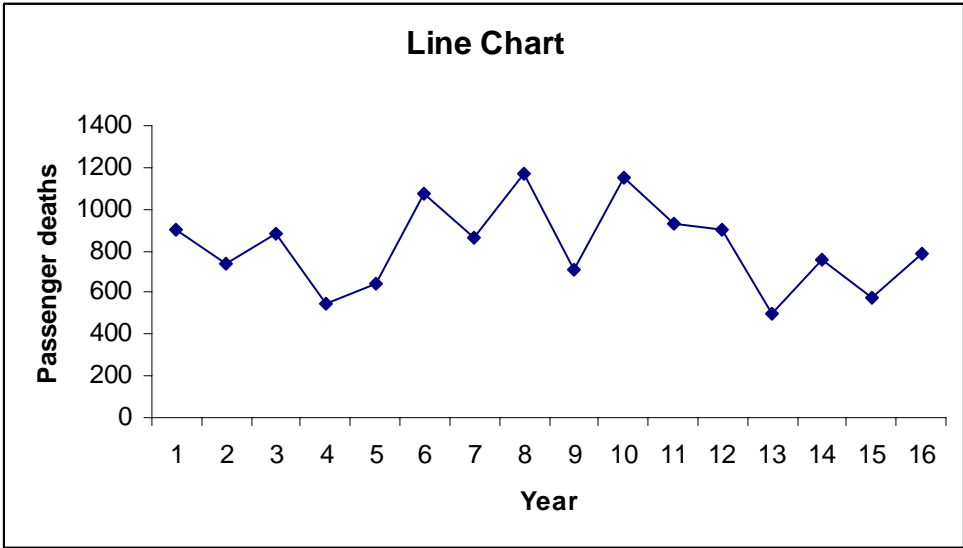


Most directors attended less than 13 meetings.

2.114 Fatal accidents

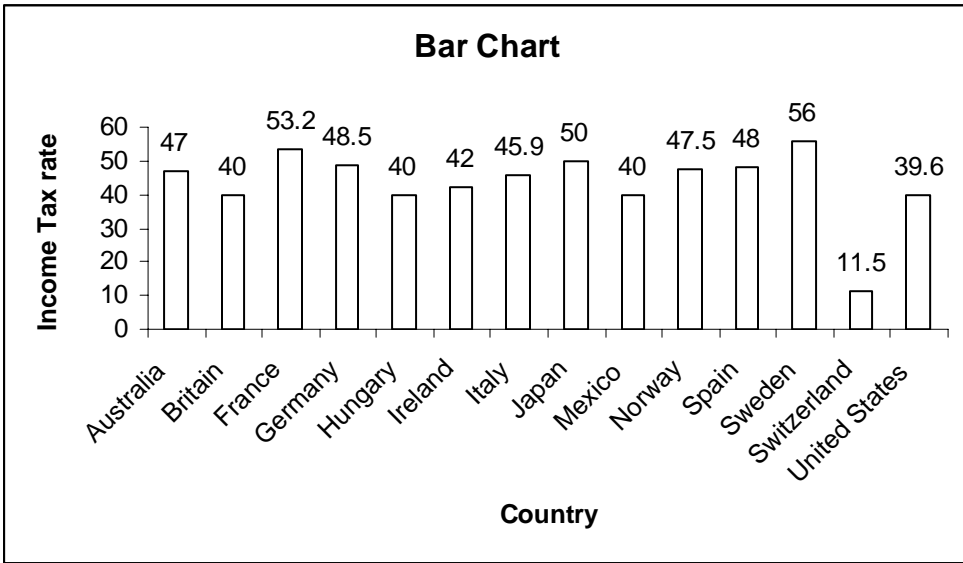


Passenger deaths



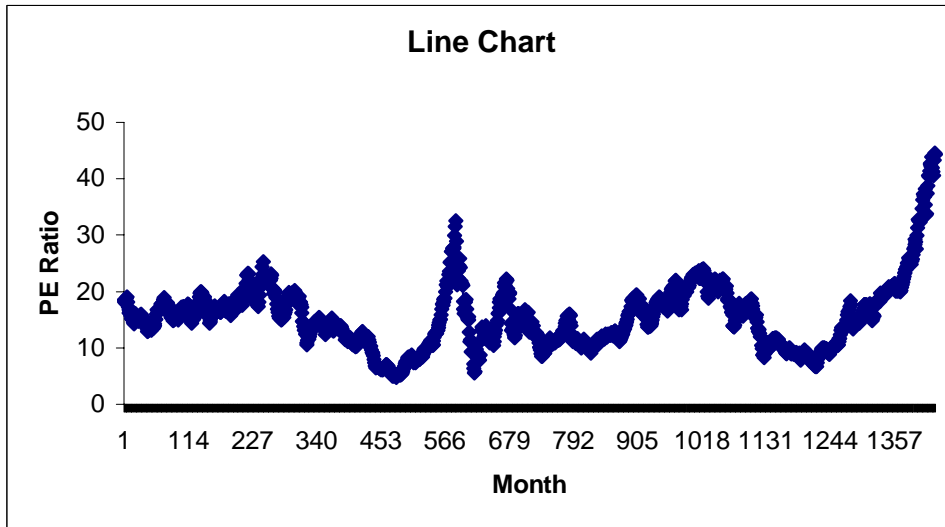
Safety has not improved using the number of passenger deaths. However, using the number of fatal accidents, safety has improved.

2.115



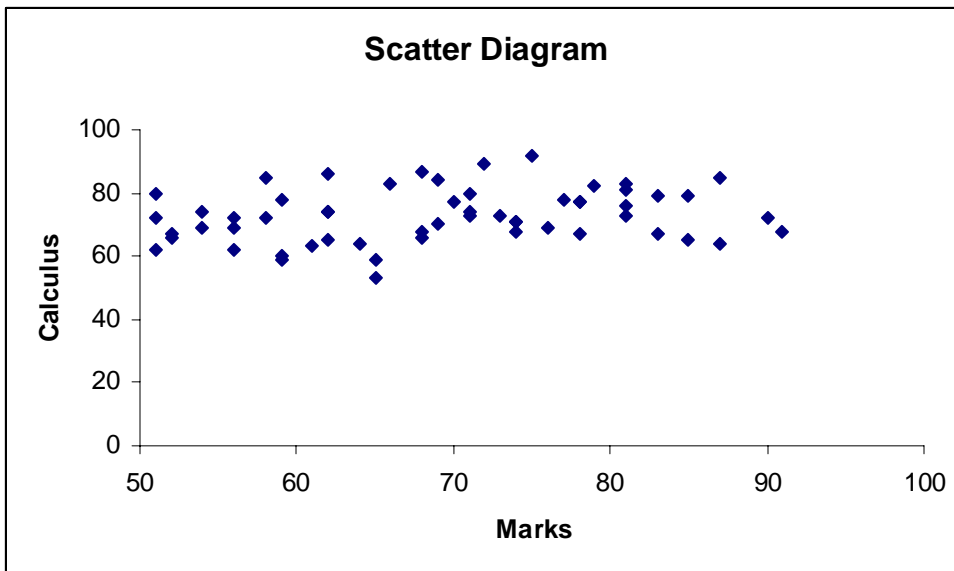
All countries, except Switzerland set their highest income tax rate at about 40% or higher.

2.116

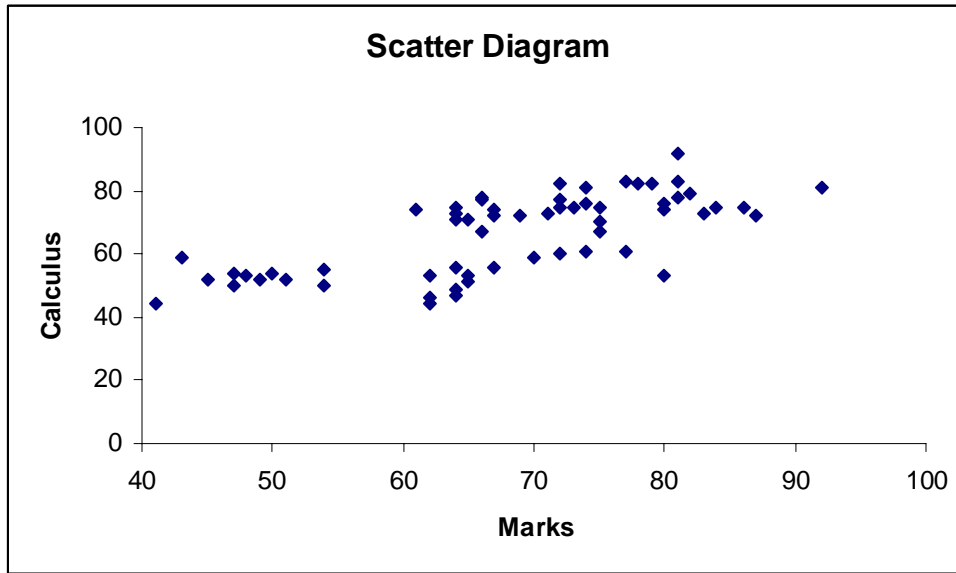


The average PE ratio appears to lie between 5 and 25 except for two periods, just before the 1929 stock market crash and in the 1990's.

2.117 Business Statistics course (Example 2.6)

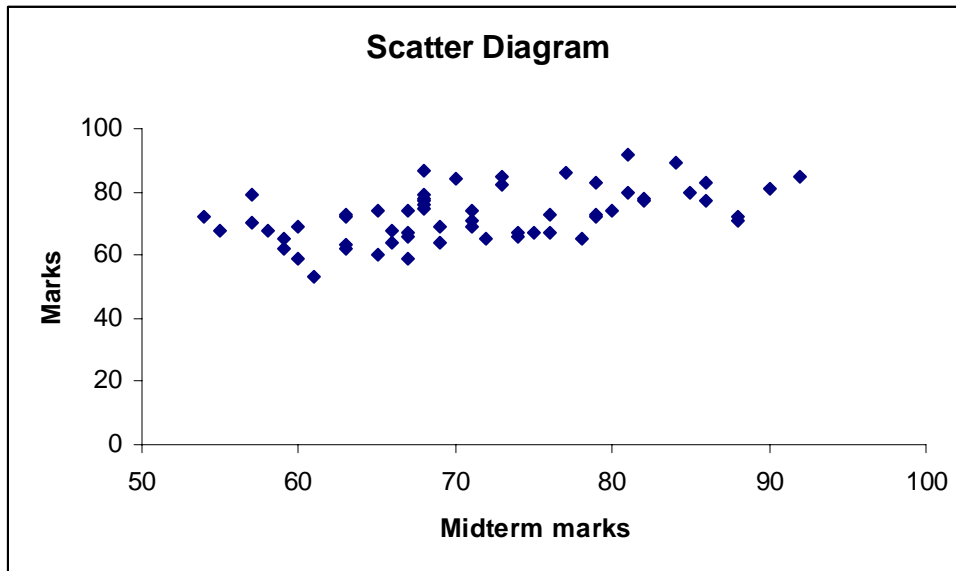


Mathematical Statistics course (Example 2.7)

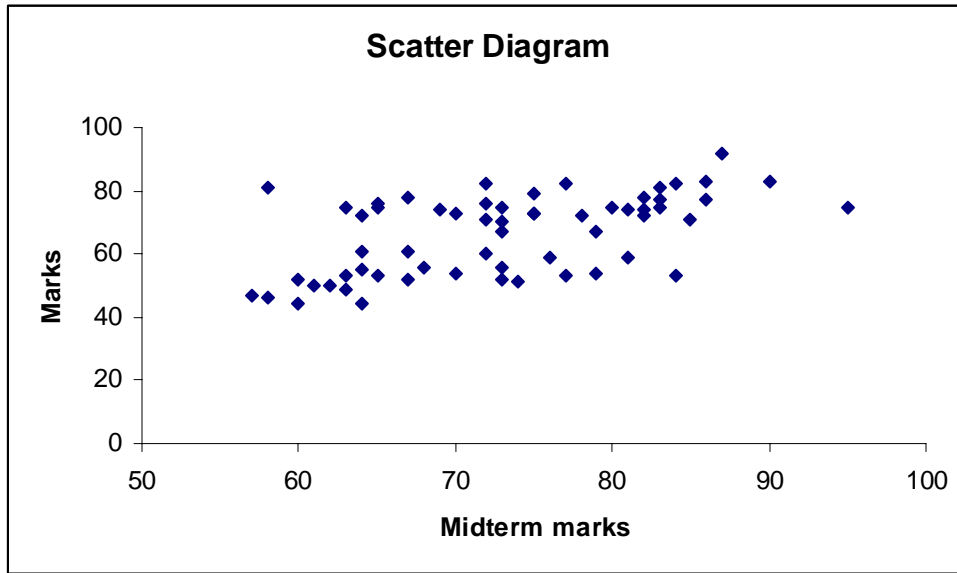


There appears to be a stronger linear relationship between marks in the mathematical statistics course and calculus than the relationship between the marks in the business statistics course and the marks in calculus.

2.118 Business Statistics course (Example 2.6)



Mathematical Statistics course (Example 2.7)

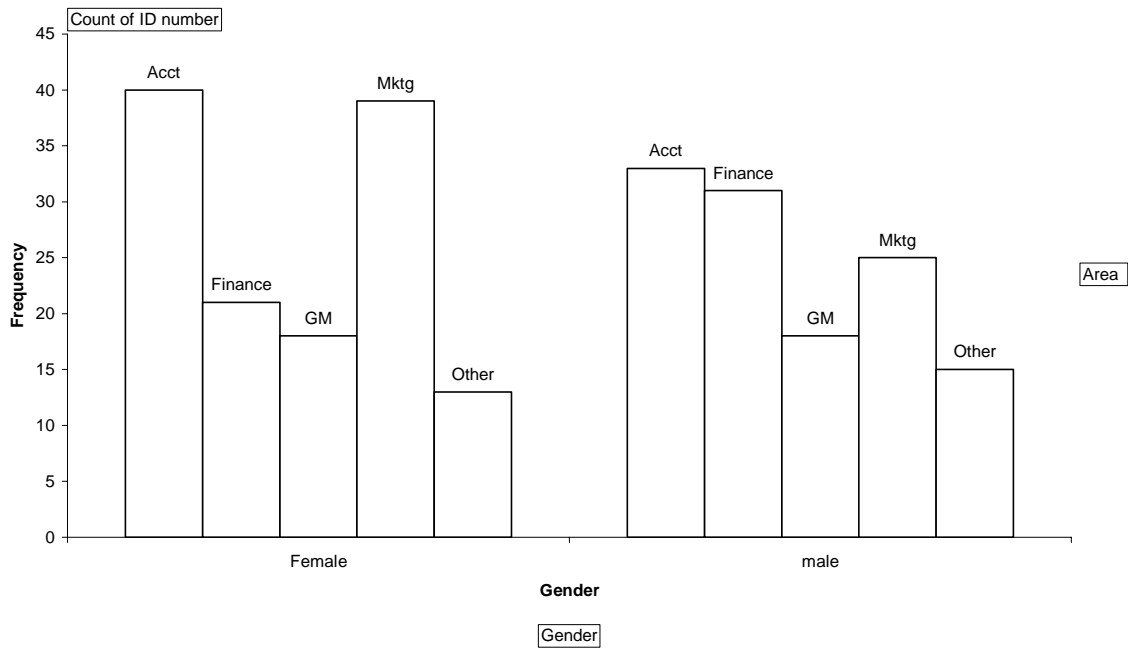


The relationship between midterm marks and final marks appear to be similar for both statistics courses.

2.119 a

	A	B	C	D	E	F	G
1	Count of ID number	Area					
2	Gender	1	2	3	4	5	Grand Total
3	1	40	21	18	39	13	131
4	2	33	31	18	25	15	122
5	Grand Total	73	52	36	64	28	253

**Bar Chart**



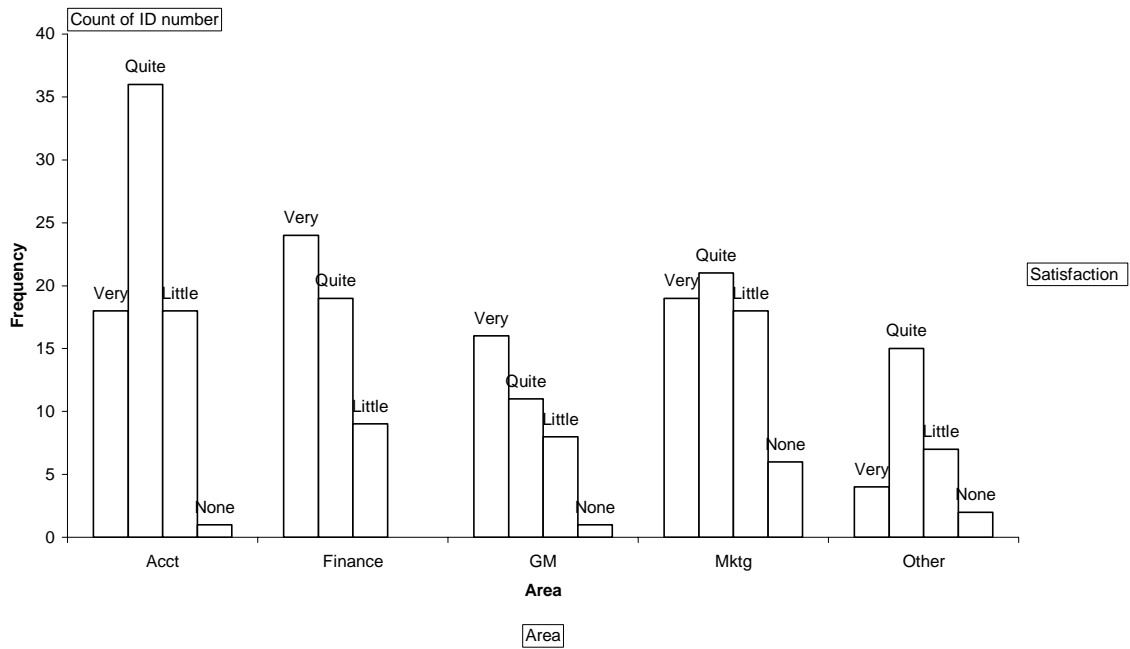
Males and females differ in their areas of employment. Females tend to choose accounting marketing/sales and males opt for finance.

b

	A	B	C	D	E	F
3	Count of ID number	Satisfaction				
4	Area	Very	Quite	Little	None	Grand Total
5	Acct	18	36	18	1	73
6	Finance	24	19	9		52
7	GM	16	11	8	1	36
8	Mktg	19	21	18	6	64
9	Other	4	15	7	2	28
10	Grand Total	81	102	60	10	253

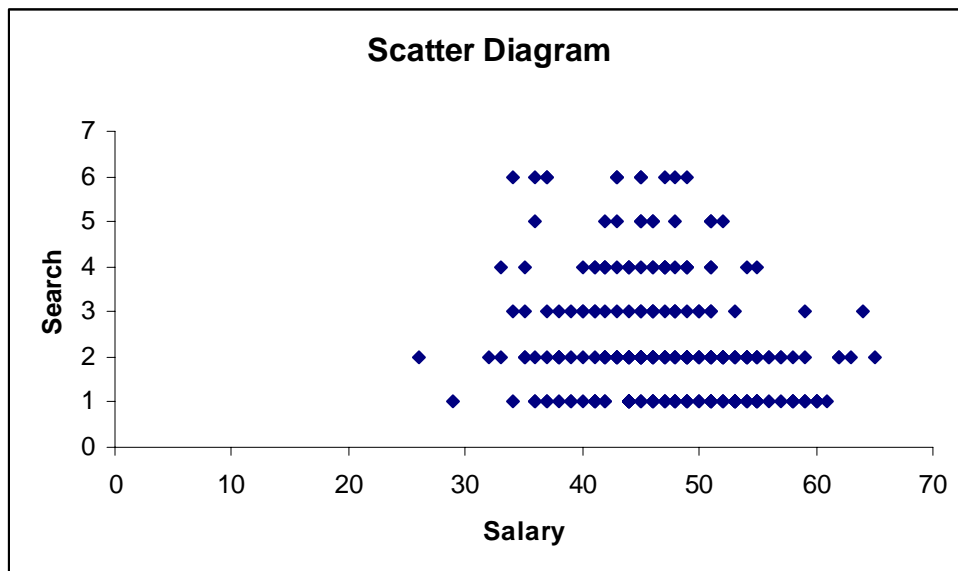


**Bar Chart**



Area and job satisfaction are related. Graduates who work in finance and general management appear to be more satisfied than those in accounting, marketing/sales, and others.

c



There is no linear relationship between salary and the time needed to land a job.

