SOLUTIONS MANUAL

STATISTICS
FOR MANAGEMENT AND ECONOMICS

ABBREVIATED

IDENTIFY

COMPUTE

INTERPRET

KELLER

7e

Chapter 2

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

2.2 a Interval

b Interval

c Nominal

d Ordinal

2.3 a Interval

b Nominal

c Ordinal

d Interval

e Interval

2.4 a Nominal

b Interval

c Nominal

d Interval

e Ordinal

2.5 a Interval

b Interval

c Nominal

d Interval

e Nominal

2.6 a Interval

b Interval

c Nominal

d Ordinal

e Interval

2.7 a Interval

b Nominal

c. Nominal

d Interval

e Ordinal

f Ordinal

2.8 a Interval

b Ordinal
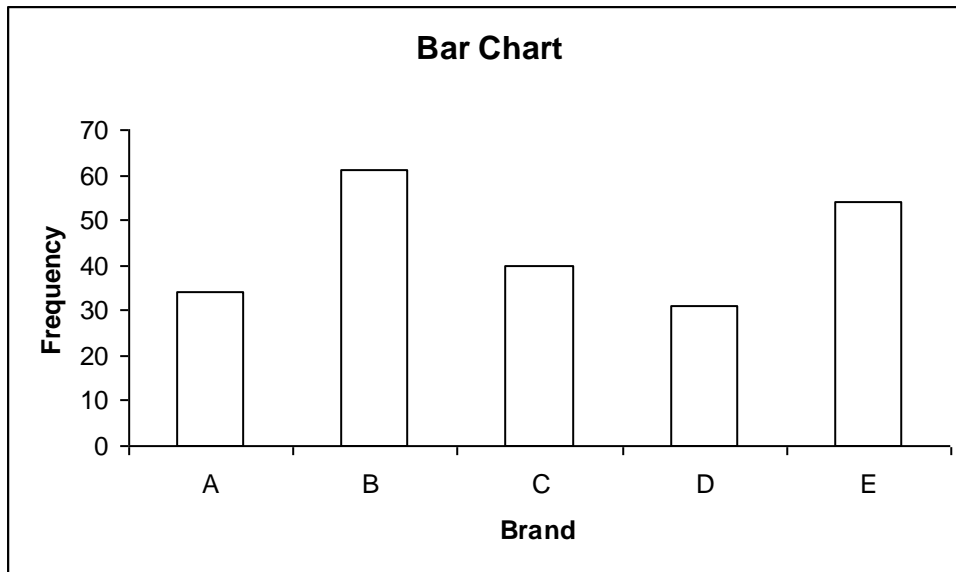
c Nominal

d Ordinal

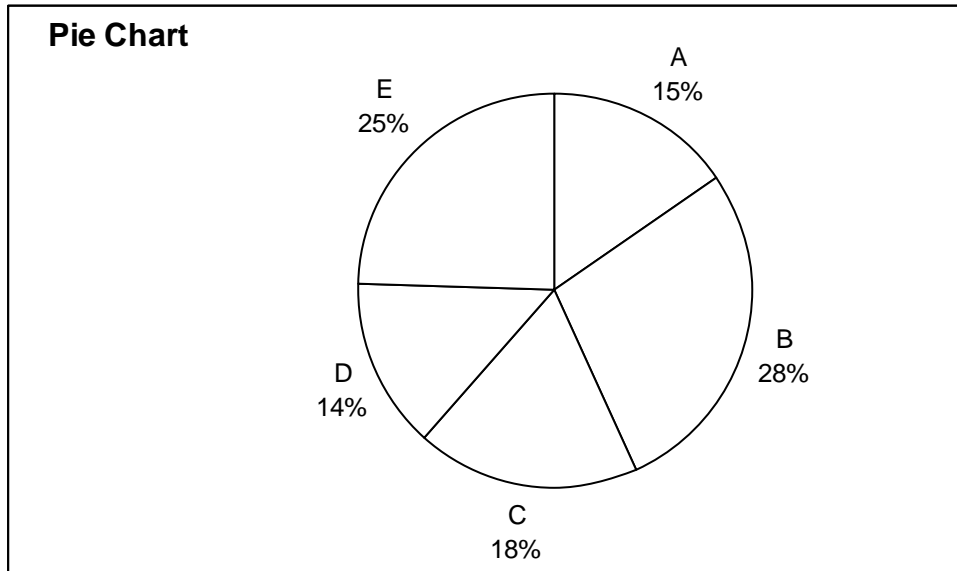2.9 a Interval

b Nominal

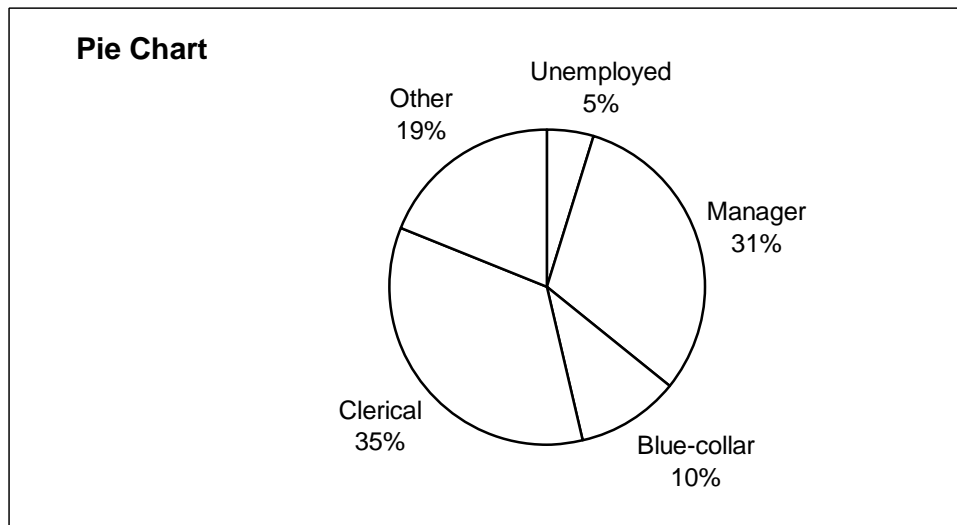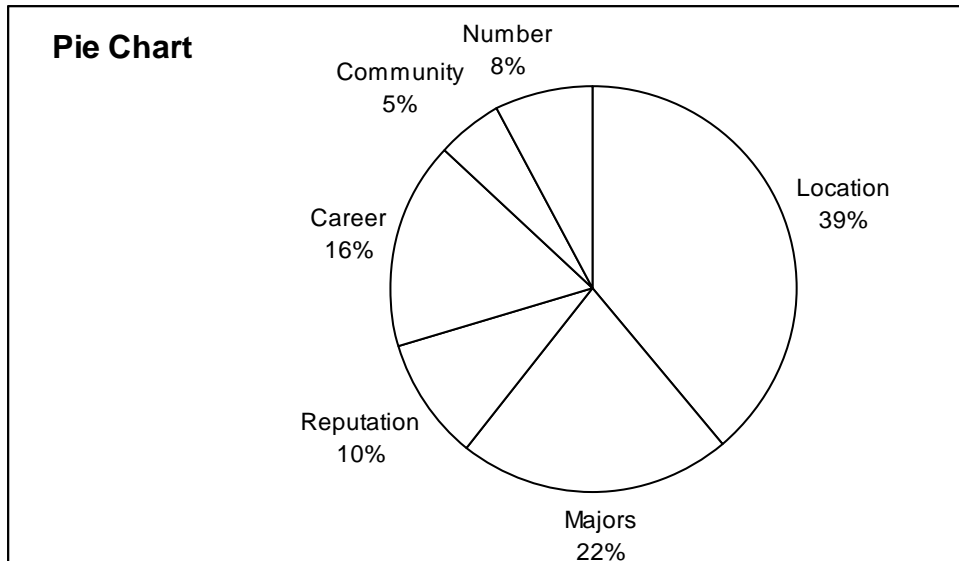c Nominal

2.10 a Ordinal

b Ordinal

c Ordinal

2.11a

Bar Chart

A graph titled "Bar Chart" with vertical axis labeled "Frequency" ranging from 0 to 70, and horizontal axis labeled "Brand" with categories A, B, C, D, E. The bars have approximate frequencies: A = 34, B = 61, C = 40, D = 31, E = 54.

b

Pie Chart

A
15%

E
25%

B
28%

D
14%

C
18%

c Brands B and E are most popular, but no one brand dominates the market.

2.12 a

Pie Chart

Unemployed
5%

Other
19%

Manager
31%

Clerical
35%

Blue-collar
10%

Most graduates are managers or are doing clerical work.

2.13

Pie Chart

Number
8%

Community
5%

Career
16%

Reputation
10%

Majors
22%

Location
39%

Location and choice of majors dominate the responses.

2.14

Pie Chart

Internet
8%

Word
12%

Dealership
28%
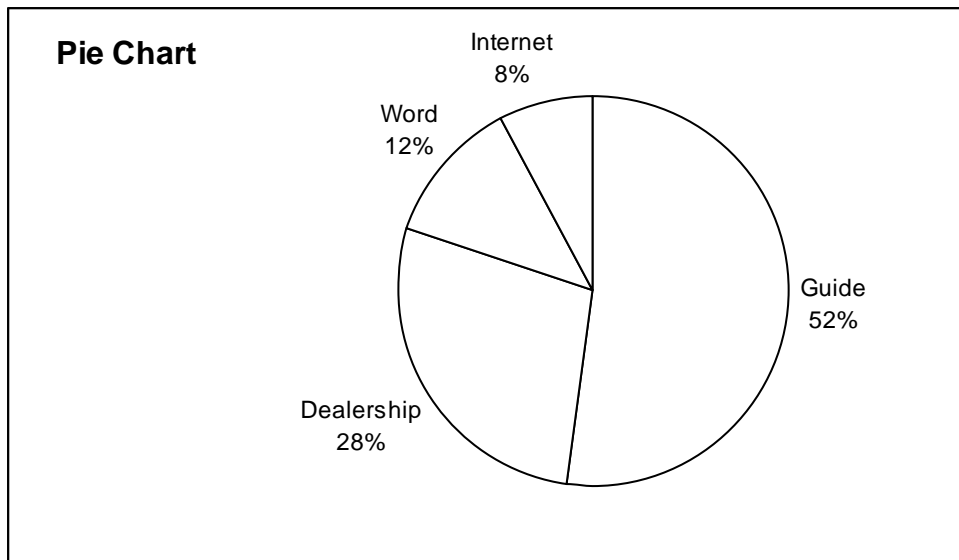
Guide
52%

Most consumers get their information from the consumer guide.

2.15

Bar Chart

	Excellent	Good	Average	Poor	Unacceptable
	119	204	118	59	45
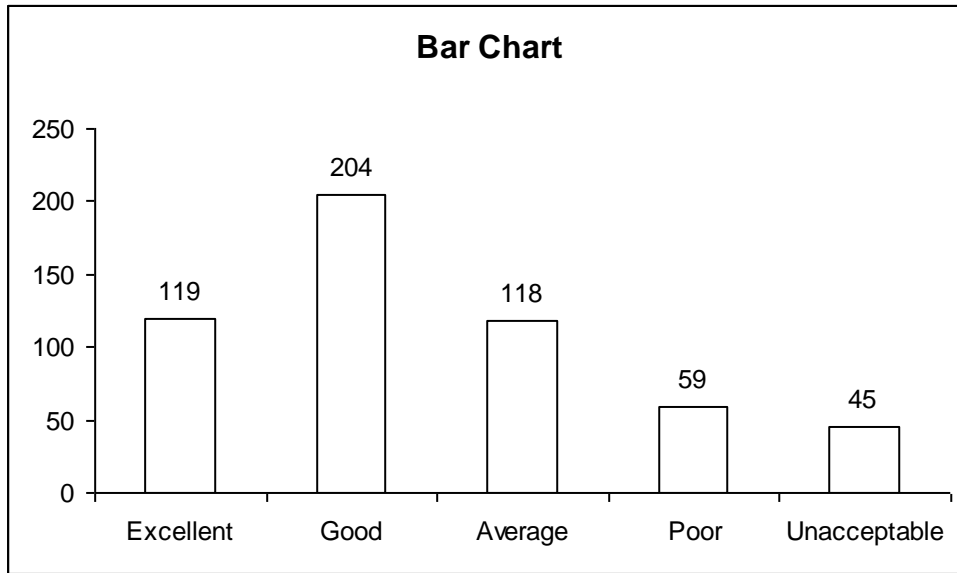
A large proportion of customers rate the facilities as average or better.

2.16

Bar Chart

First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
11	24	35	28	20	6	5	3
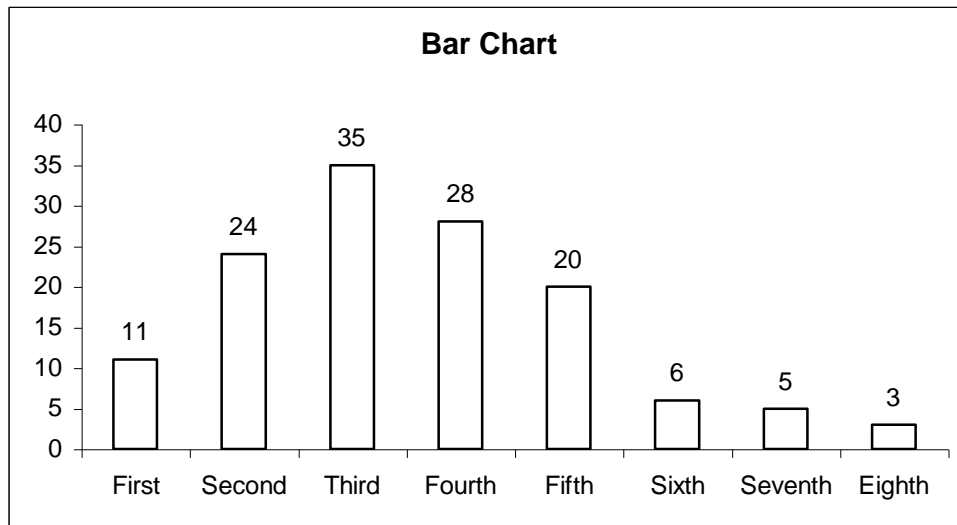
The horse has had a satisfactory career, but not outstanding one.

2.17

Pie Chart

Analytical 4%
Electronic 3%
Medical 6%
Test 12%
Computers 75%
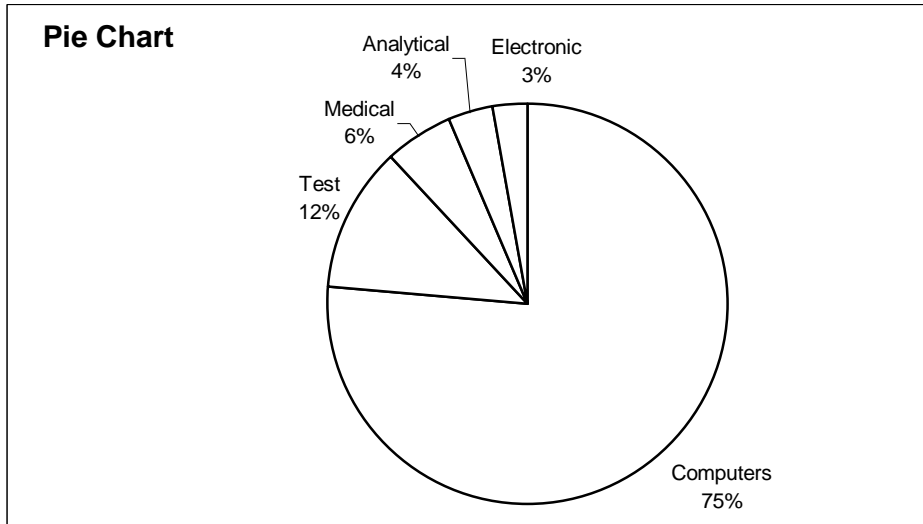
Most of HP's revenue comes from the sale of computers.

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

b

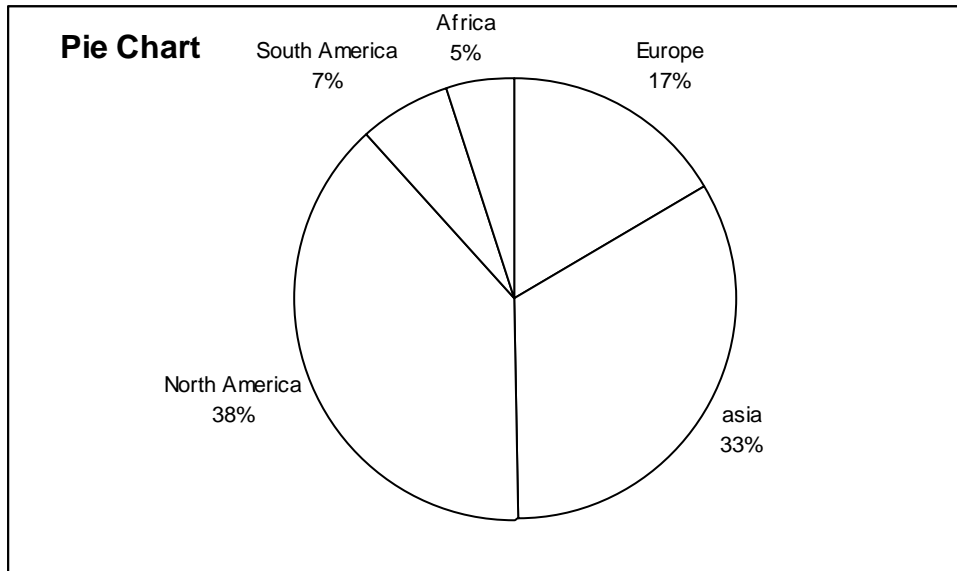**Bar Chart**

Income Group	Percent Invested
<$10K	3%
$10-$20K	13%
$20-$30K	28%
$30-$40K	40%
$40-$50K	49%
$50-$80K	51%
$80-$100K	57%
$100-%250K	63%
>$250K	68%
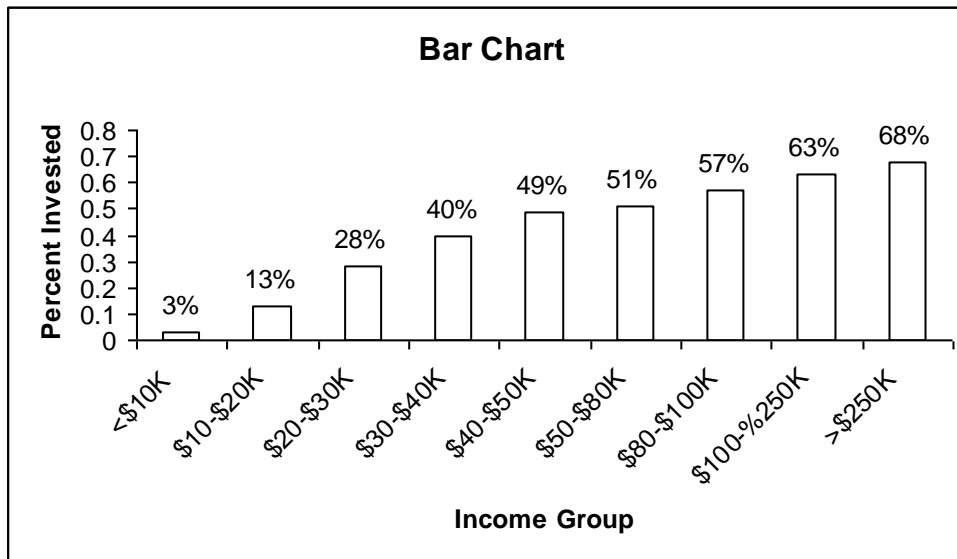
As income increases so does ownership of retirement savings plans.

2.19a

Bar Chart
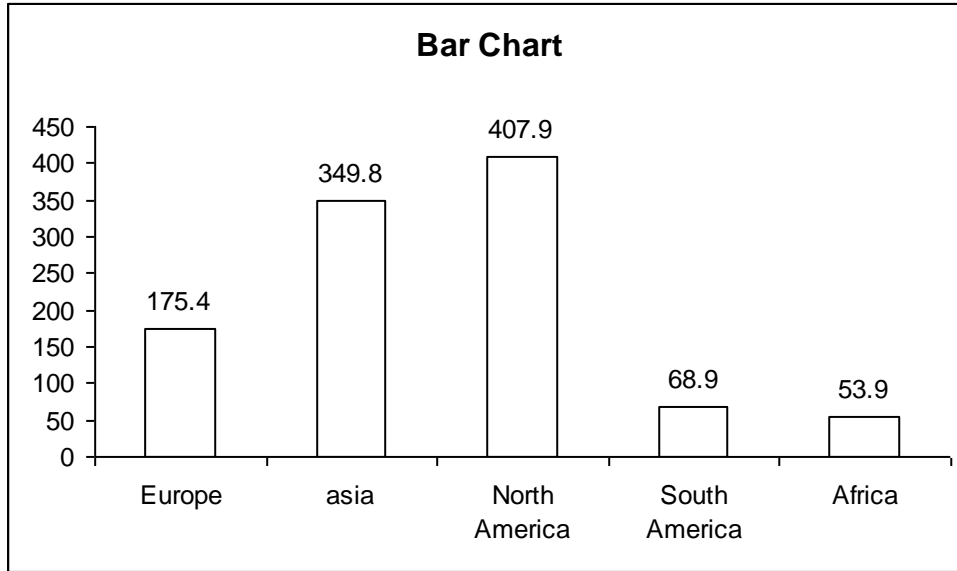
Pie Chart

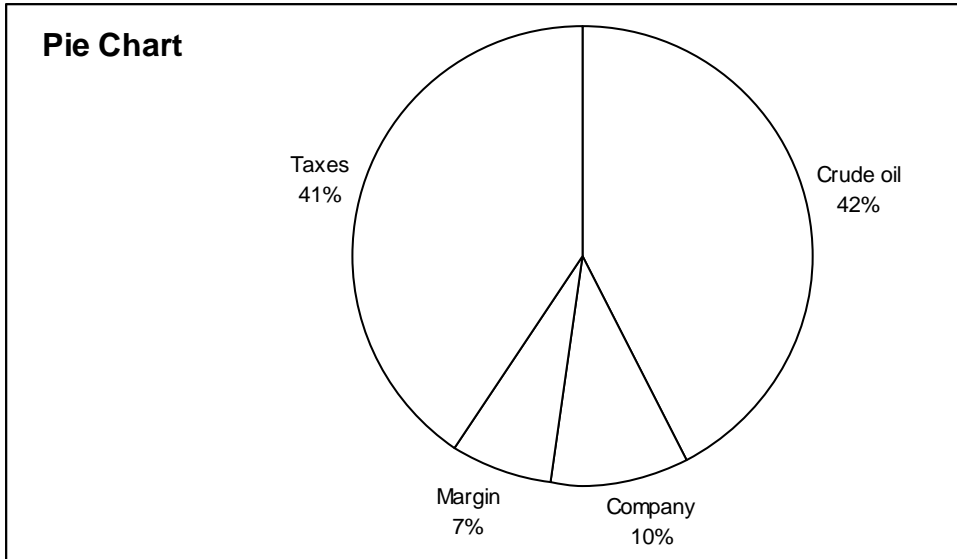Most immigrants come from North America (and Central America) and Asia.

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.
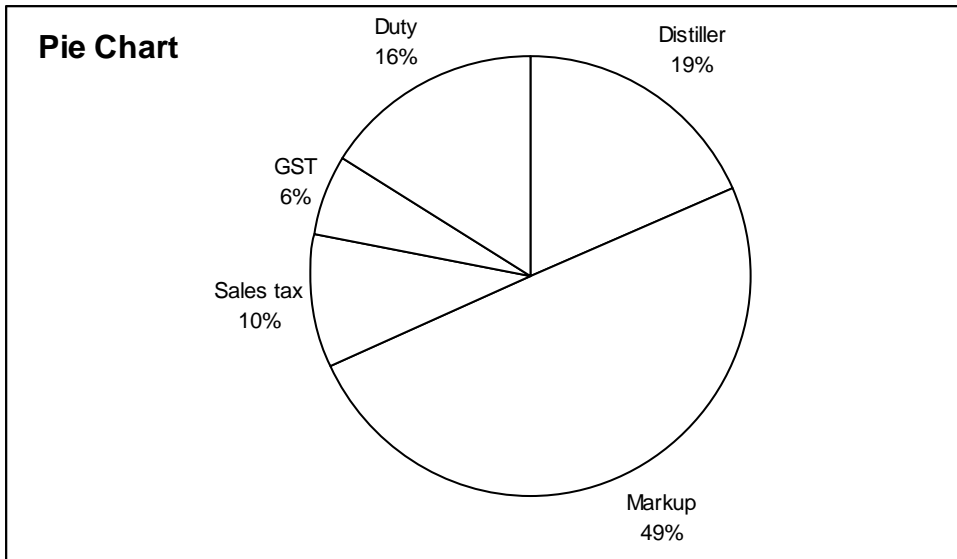
Pie Chart

- 1000+ 15%
- 500 to 999 3%
- 100 to 499 9%
- 25 to 99 15%
- 10 to 24 18%
- <10 40%

Bar Chart

Firm size	Percentage of all firms
<10	33.2
to 24	67.1
25 to 99	83
100 to 499	93.9
500 to 999	96.8
1000+	97.7
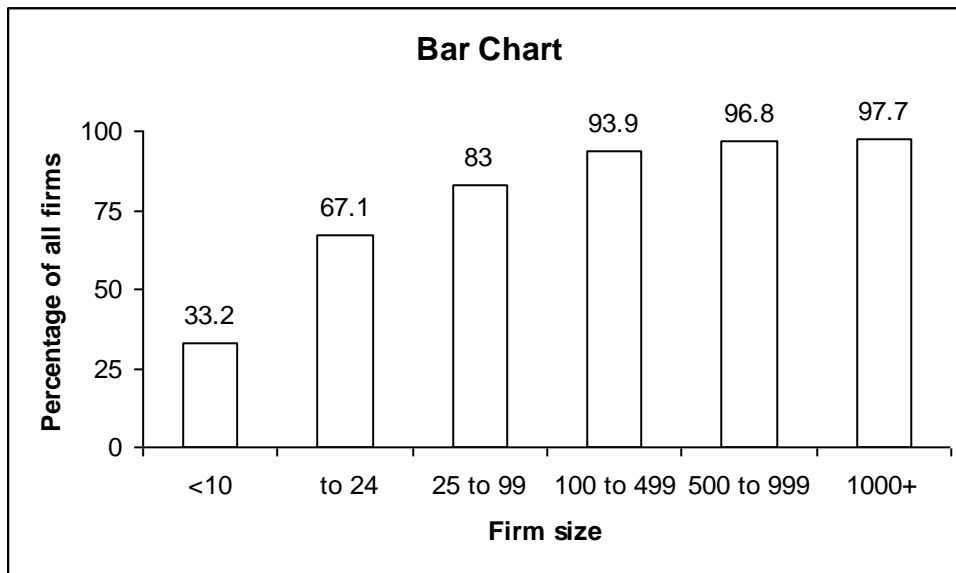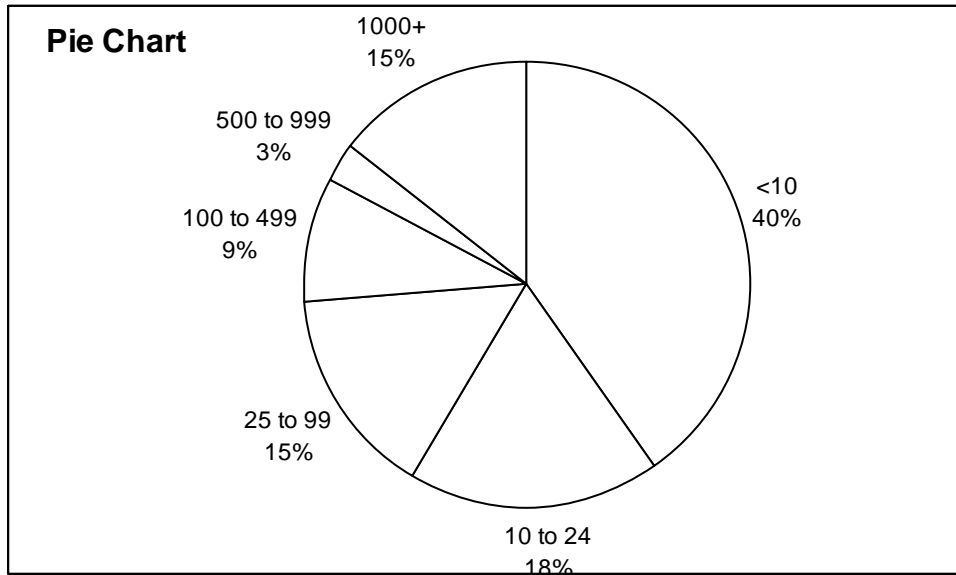
We use a bar chart to depict the proportion of firms in each size category that has health insurance. For example, 97.7% of firms with 1,000 or more employees have health insurance.

2.21

Pie Chart

Taxes 41%
Crude oil 42%
Margin 7%
Company 10%

Canadians pay too much tax.

2.22

Pie Chart

Duty 16%
Distiller 19%
GST 6%
Sales tax 10%
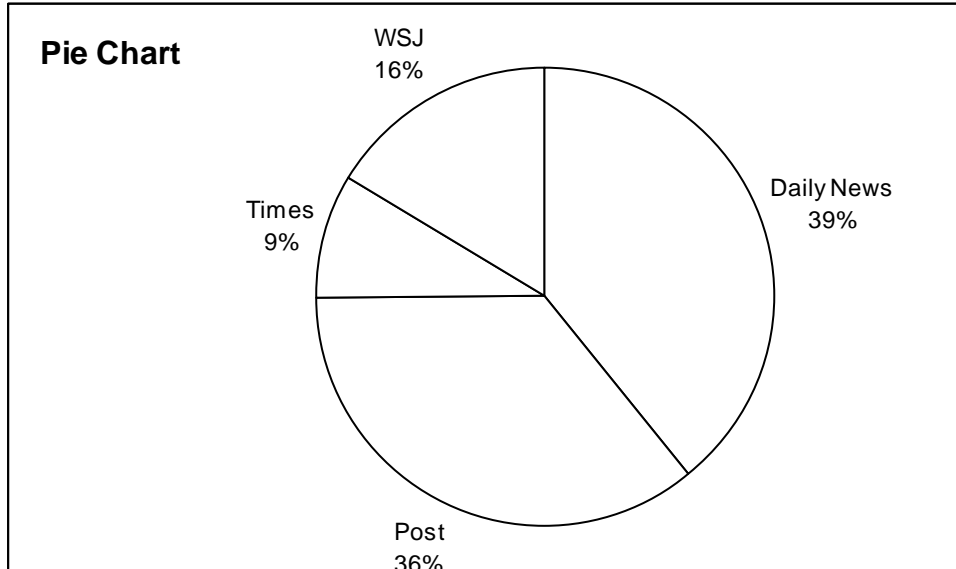Markup 49%

Canadians pay too much tax.

2.23a

Bar Chart

b

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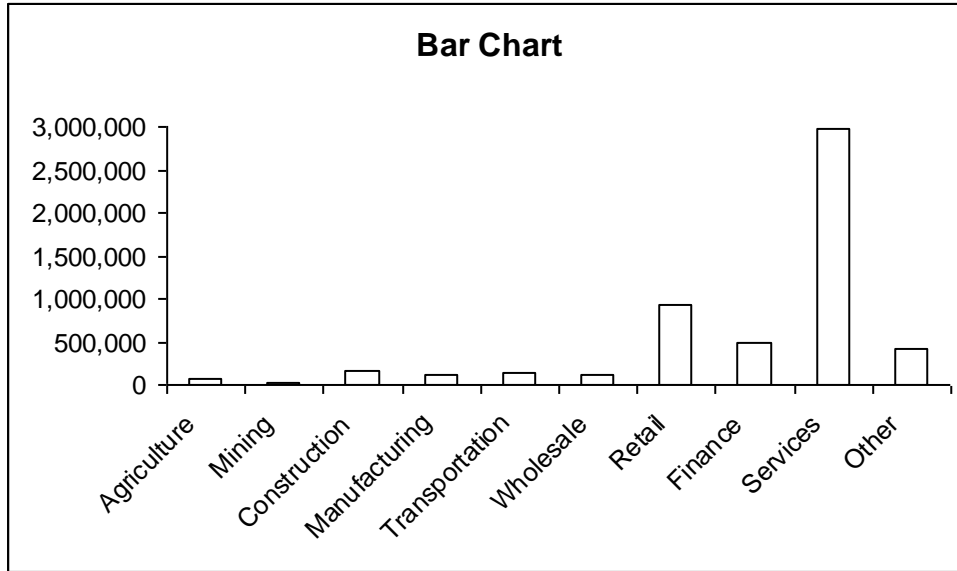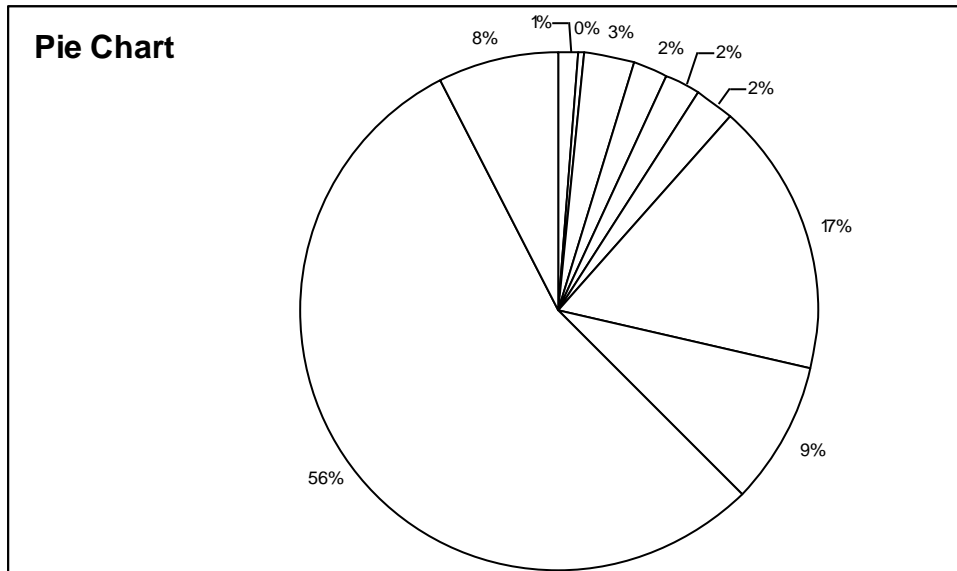
c Both charts indicate that the service and retail industry dominate.

2.24 a

Newspaper	Frequency	Relative Frequency
Daily News	141	.39
Post	128	.36
Times	32	.09
WSJ	59	.16

b

Pie Chart

The Daily News and the Post dominate the market

2.25a

Degree	Frequency
BA	88
BBA	37
B Eng	51
B Sc	24
Other	30

b

Bar Chart

Category	Value
BA	88
BBA	37
BEng	51
BSc	24
Other	30

c

Pie Chart

Category	Percentage
BA	39%
BBA	16%
BEng	22%
BSc	10%
Other	13%
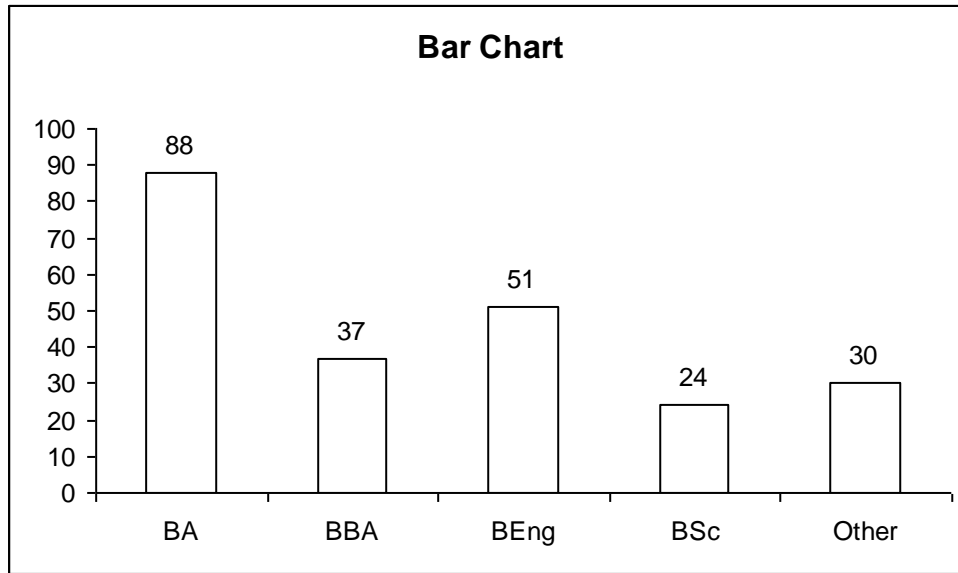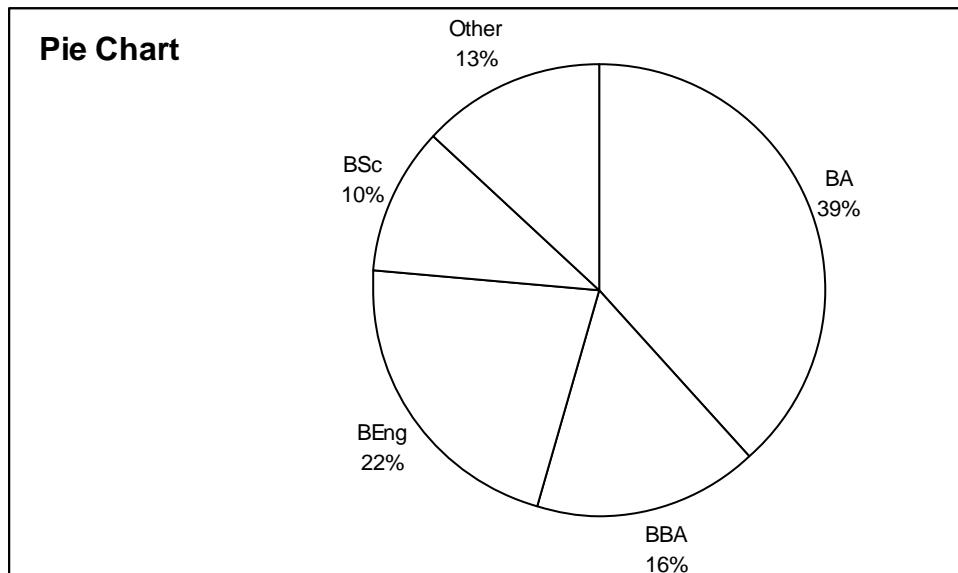
c Most applicants have the BA degree, about one-fifth have a BEng. and one-sixth have a BBA.

2.26

Bar Chart
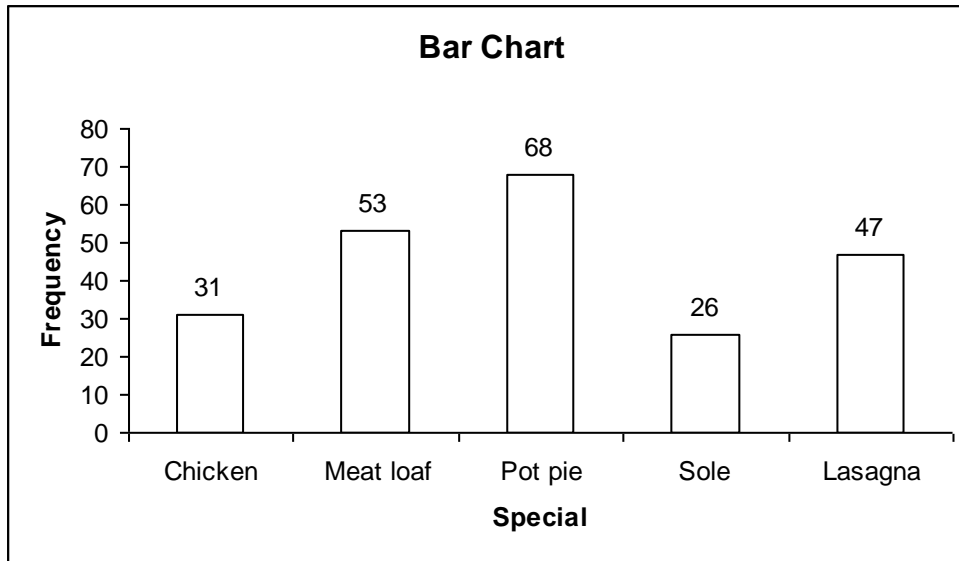
The two most popular specials are turkey pot pie and meat loaf.

2.27

Pie Chart
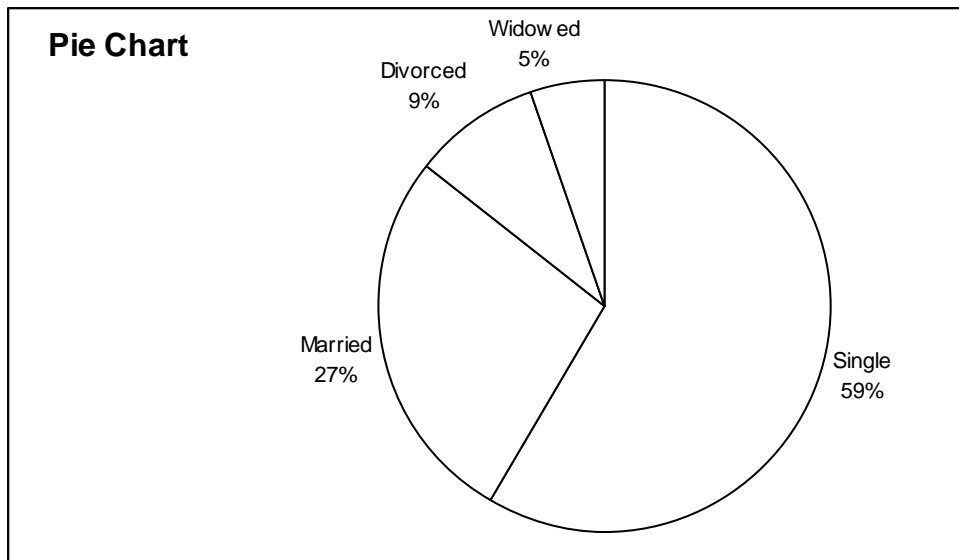
59% of students are single, 27% are married, 9% are divorced, and the rest are widowed.

2.28 a

Bar Chart

A bar chart with vertical axis labeled "Frequency" ranging from 0 to 45 in increments of 5, and horizontal axis labeled "Computer brand" with categories IBM, Compaq, Dell, Other.

- IBM: 21
- Compaq: 13
- Dell: 39
- Other: 25

b

Pie Chart

A pie chart showing:
- IBM 21%
- Compaq 13%
- Dell 40%
- Other 26%
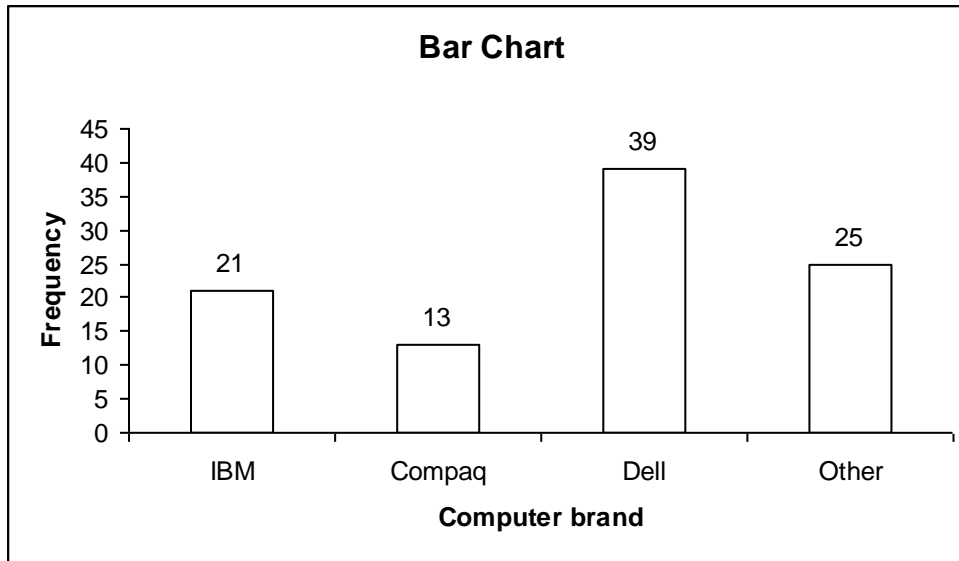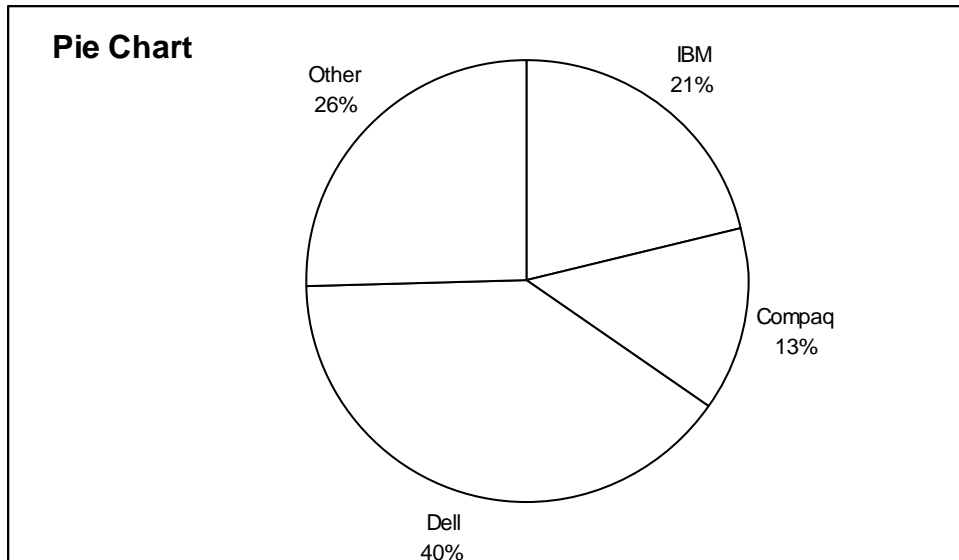
c Dell is most popular with 40% proportion, followed by other, 26%, IBM, 21% and Compaq, 13%.

2.29 a

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

b

Pie Chart

Other 17%
SPSS 6%
SAS 4%
Excel 49%
Minitab 24%
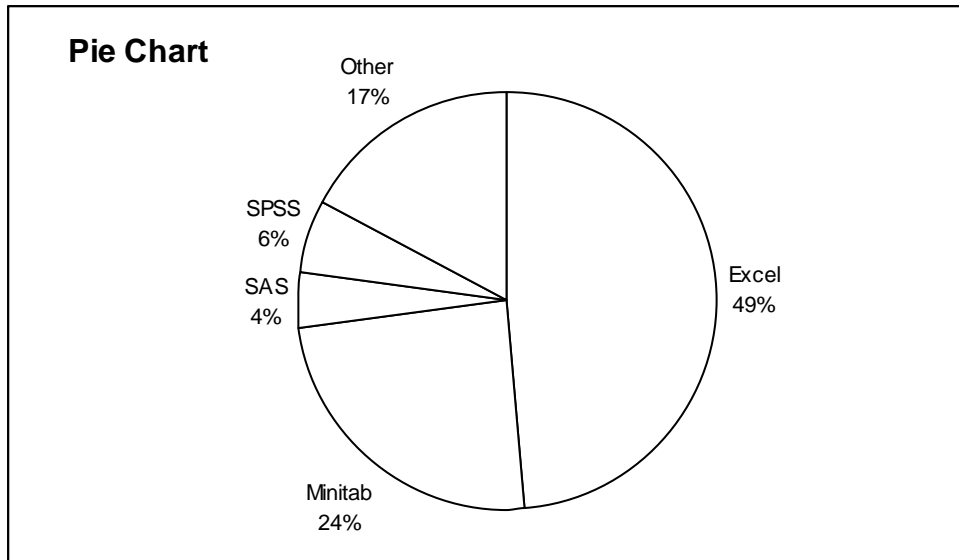
c Excel is the choice of about half the sample, one-quarter have opted for Minitab, and a small fraction chose SAS and SPSS.

2.30

Pie Chart

Worse 12%
Same 21%
Better 67%
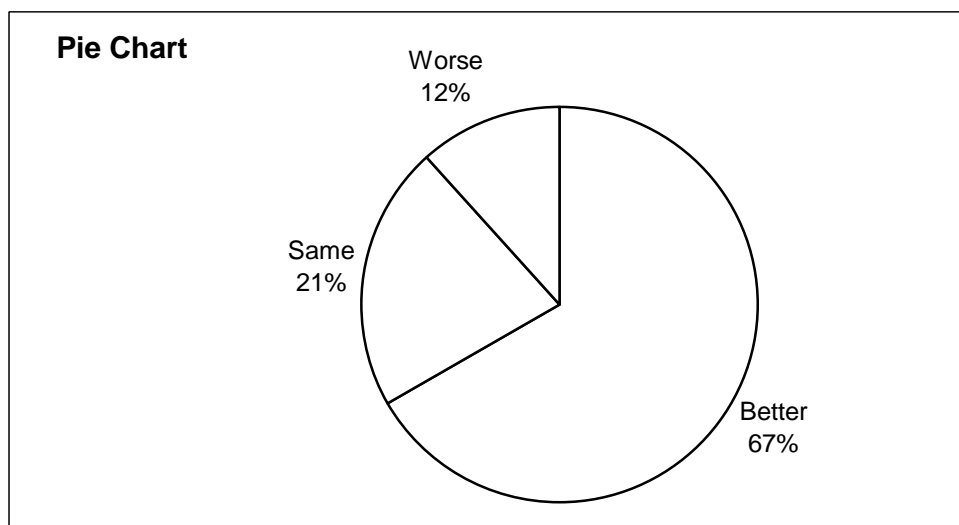
67% said the economy would get better, 21% said the same, and the rest stated that the economy would worsen.

2.31 9 or 10

2.32 10 or 11

2.33 a 7 to 9

b Interval width $\approx \dfrac{188-37}{8} = 18.9$ (rounded to 20); upper limits: 40, 60, 80, 100, 120, 140, 160 180, 200

2.34 a 7 to 9

b Interval width $\approx \dfrac{6.1-5.2}{7} = .13$ (rounded to .15); upper limits: 5.25, 5.40, 5.55, 5.70, 5.85, 6.00, 6.15

2.35a
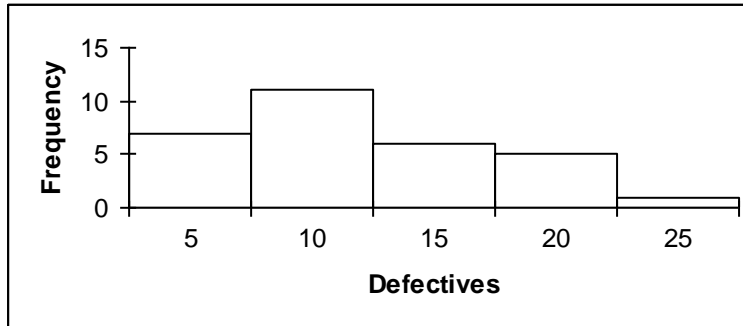
b
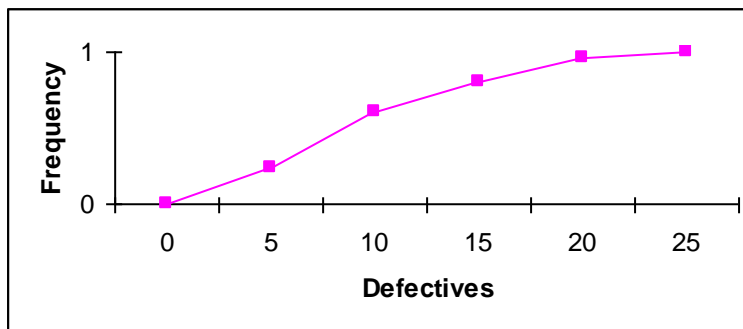
c The histogram is unimodal and somewhat positively skewed.

2.36 a

Histogram

b

Ogive
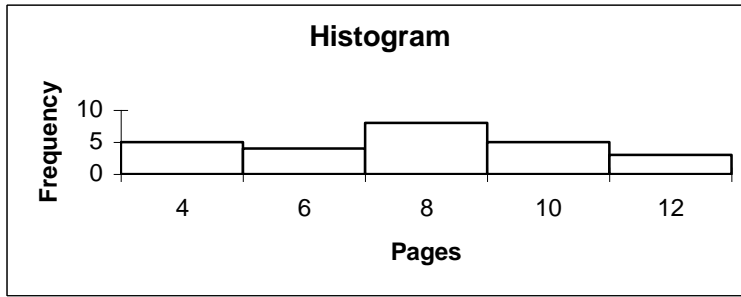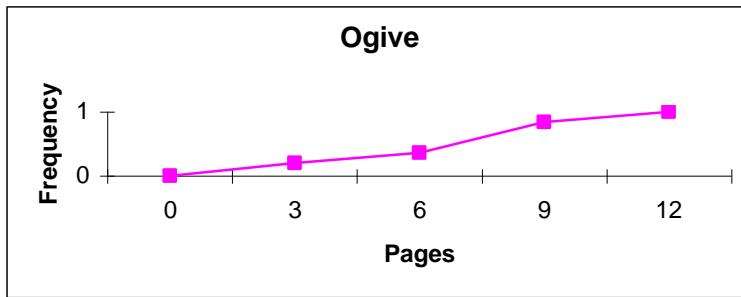
C The number of pages is bimodal and slightly positively skewed.

2.37 a

Stem & Leaf Display		
Stems	**Leaves**	
2	->566889	
3	->01233345566778899	
4	->00111166689	
5	->00123	
6	->1	

b
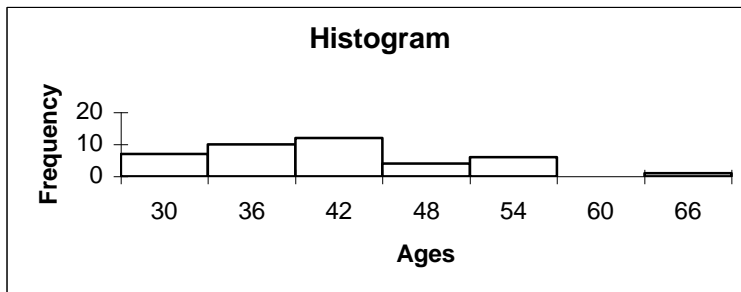
Histogram

c
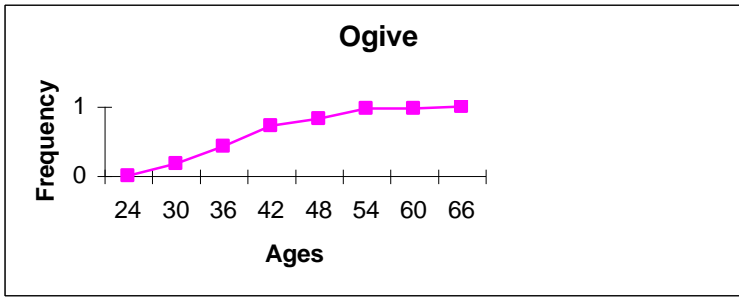
d The ages are bimodal and positively skewed.

2.38
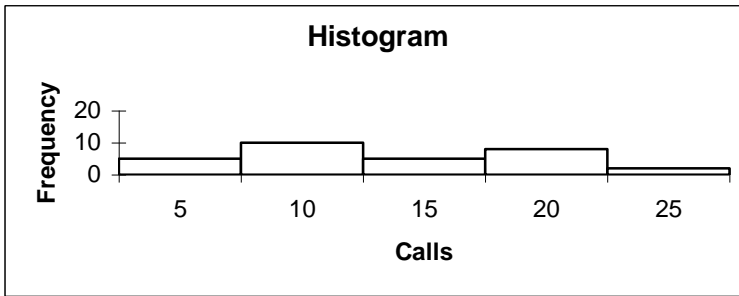
The histogram is bimodal.

2.39 a

Stem & Leaf Display			
Stems	Leaves		
30	->0112222222356667777788		
31	->001113568		
32	->024777		
33	->0047		
34	->024455		
35	->7		
36	->7		
37	->9		

b
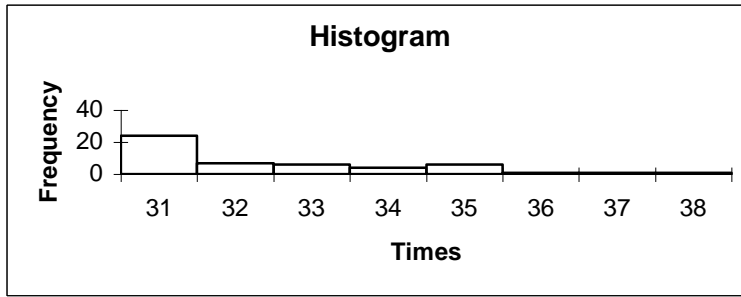
Histogram

c The histogram is positively skewed.

2.40 a

Histogram

b

Ogive
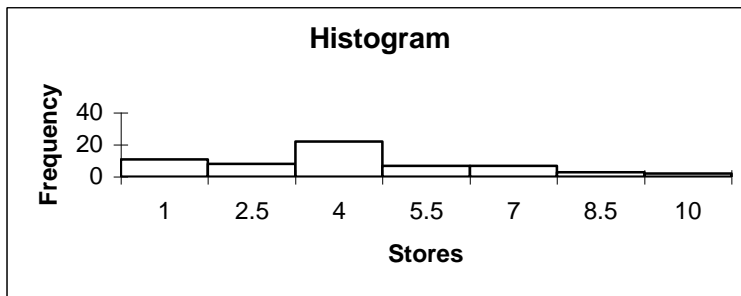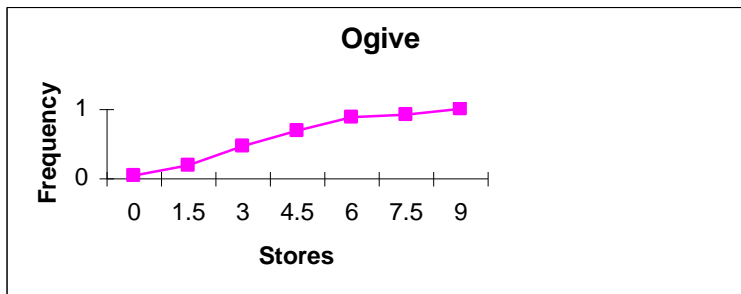
c The number of stores is bimodal and positively skewed.

2.41
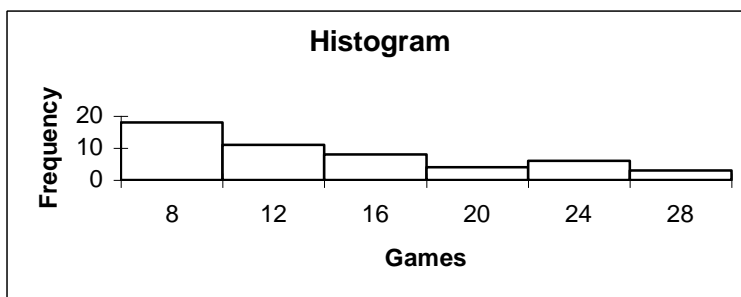
Histogram

The histogram is positively skewed.

2.42 a
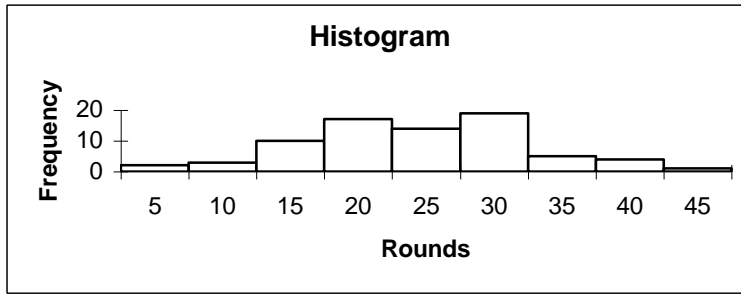
Histogram

b

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

c

Ogive
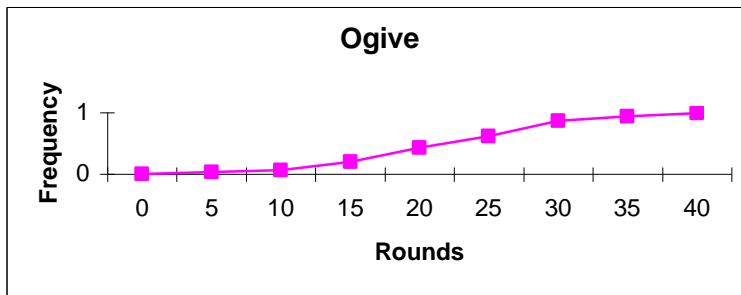
d The histogram is symmetric (approximately) and bimodal.

2.43
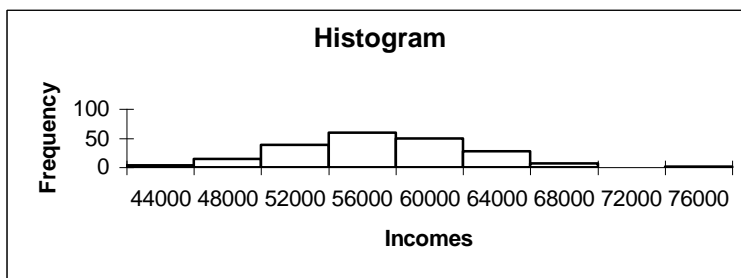
Histogram

The histogram is symmetric, unimodal, and bell shaped.

2.44 a

Histogram

[Frequency vs Prices histogram, x-axis: 200, 225, 250, 275, 300, 325, 350; y-axis: 0, 20, 40]

b

Histogram

[Ogive/cumulative frequency chart, Frequency (%) vs Rounds, x-axis: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45; y-axis: 0%, 50%, 100%]
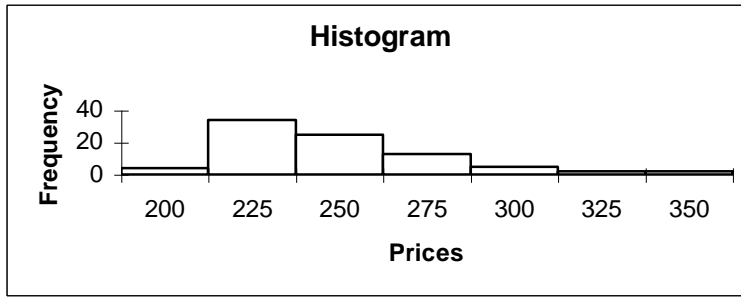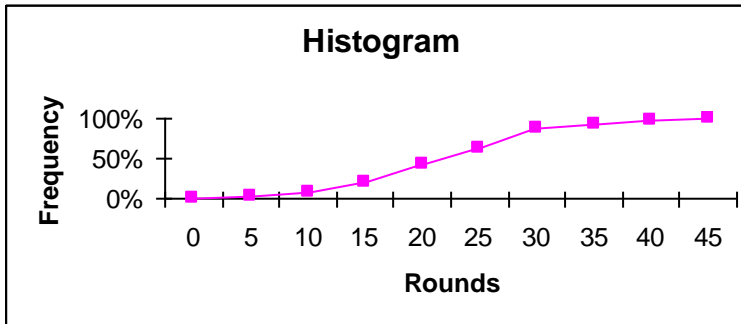
c

	A	B	C	D	E
1	**Stem & Leaf Display**				
2					
3	**Stems**	**Leaves**			
4	0	->359			
5	1	->0023334445556677888888899			
6	2	->000012233344444555666667888889999			
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.

2.45

Histogram

[Frequency vs Customers histogram, x-axis: 25, 30, 35, 40, 45, 50, 55, 60, 65, 70; y-axis: 0, 50, 100]
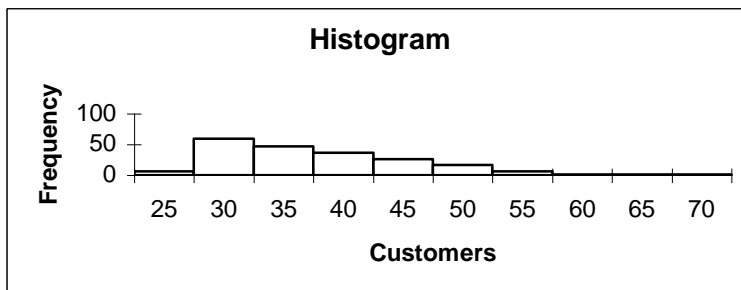
The histogram is unimodal and positively skewed.

2.46 a The histogram should contain 9 or 10 bins. We chose 10.

b
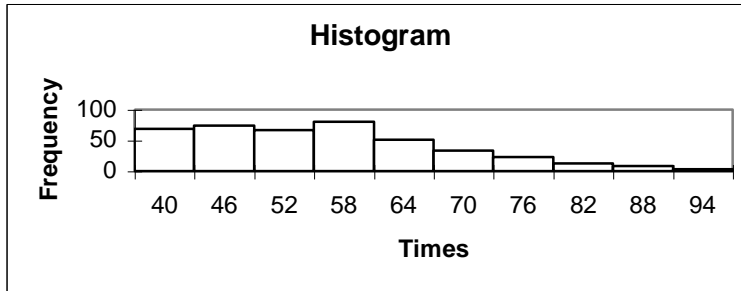
Histogram

c The histogram is positively skewed.

d The histogram is not bell-shaped.

2.47
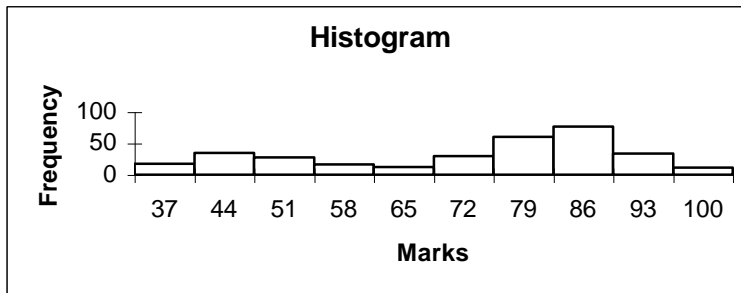
Histogram

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

2.48
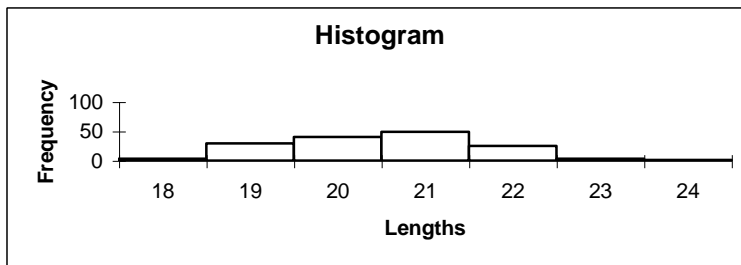
Histogram

The histogram is unimodal, bell-shaped and roughly symmetric. Most of the heights lie between 18 and 23 inches.
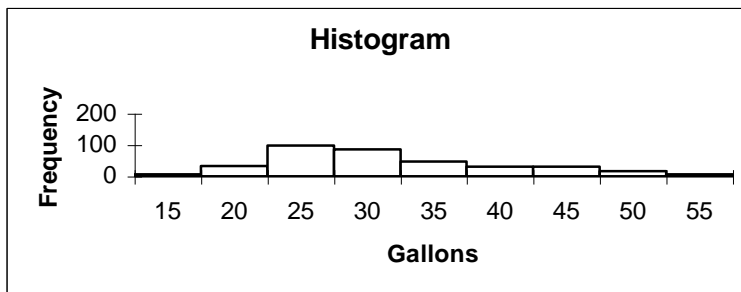
2.49
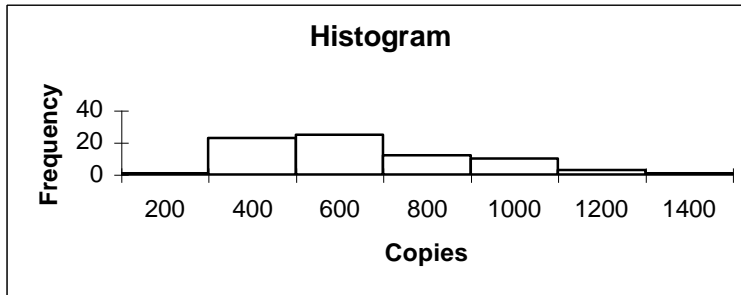
The histogram is unimodal and positively skewed. On most days the number of copies made is between 200 and 1000. On a small percentage of days more than 1000 copies are made.

2.50
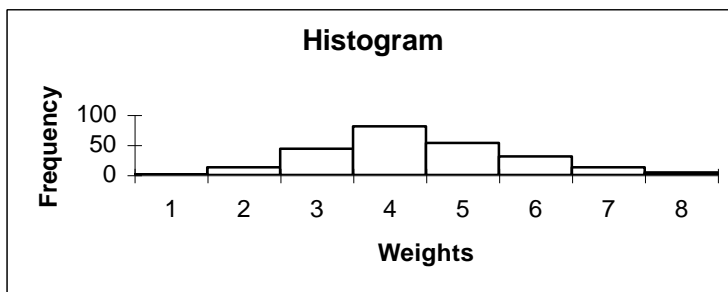
The histogram is unimodal, symmetric and bell-shaped. Most tomatoes weigh between 2 and 7 ounces with a small fraction weighing less than 2 ounces or more than 7 ounces.

2.51

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.

2.52

Histogram

Frequency

30
15
0

12000 15000 18000 21000 24000 27000 30000
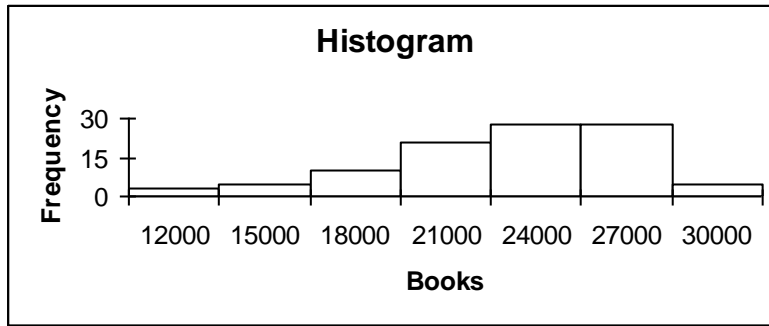
Books

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

Histogram

Frequency

100
50
0

550 600 650 700 750 800 850 900 950

Repaid

b

Histogram

Frequency

40
20
0

450 500 550 600 650 700 750 800

Repaid
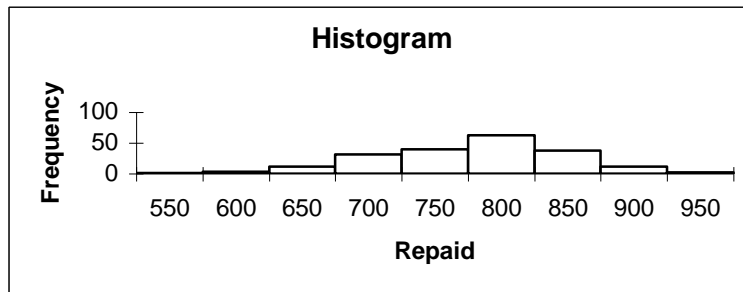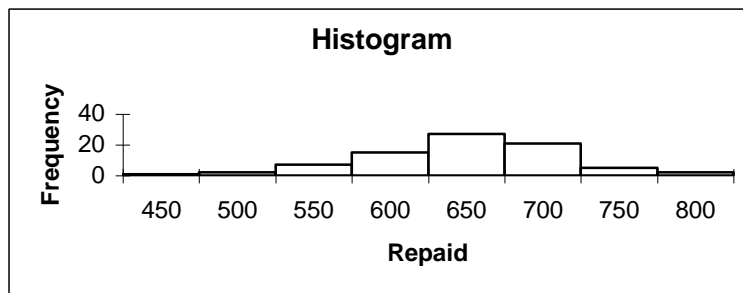
c The scorecards appear to be relatively poor predictors.

2.54 a

Histogram

[Histogram: Frequency (y-axis, 0 to 100) vs Repaid (x-axis, 650 to 900)]

b

Histogram

[Histogram: Frequency (y-axis, 0 to 40) vs Repaid (x-axis, 450 to 700)]
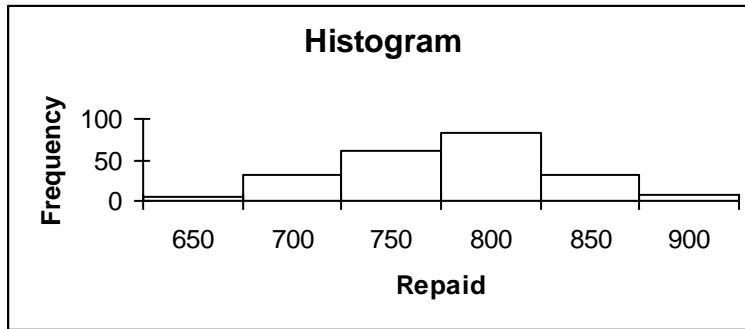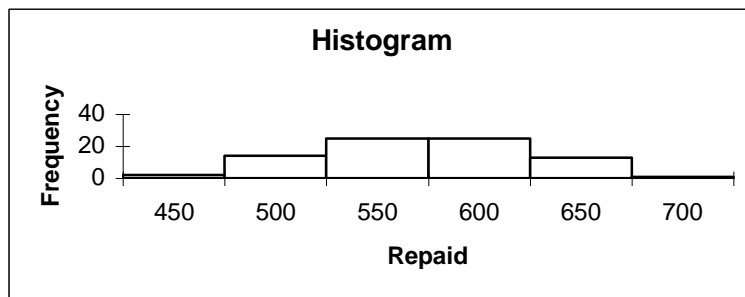
d This scorecard is a much better predictor.

2.55a

Scatter Diagram

[Scatter Diagram: Returns (y-axis, -20 to 40) vs Inflation (x-axis, 0 to 6)]
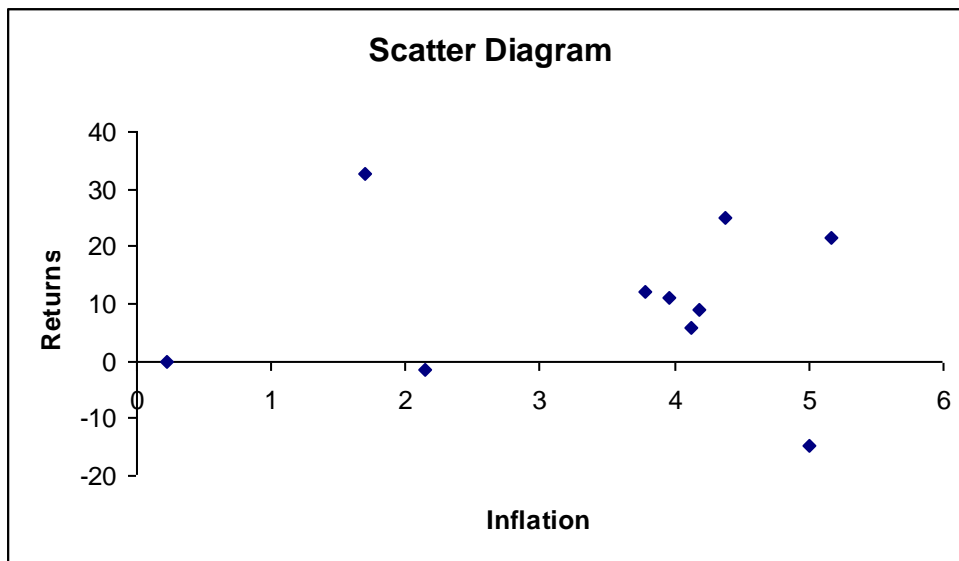
b There is no sign of a linear relationship between inflation (the independent variable) and returns (the dependent variable). Common stocks do not provide a hedge against inflation.

2.56
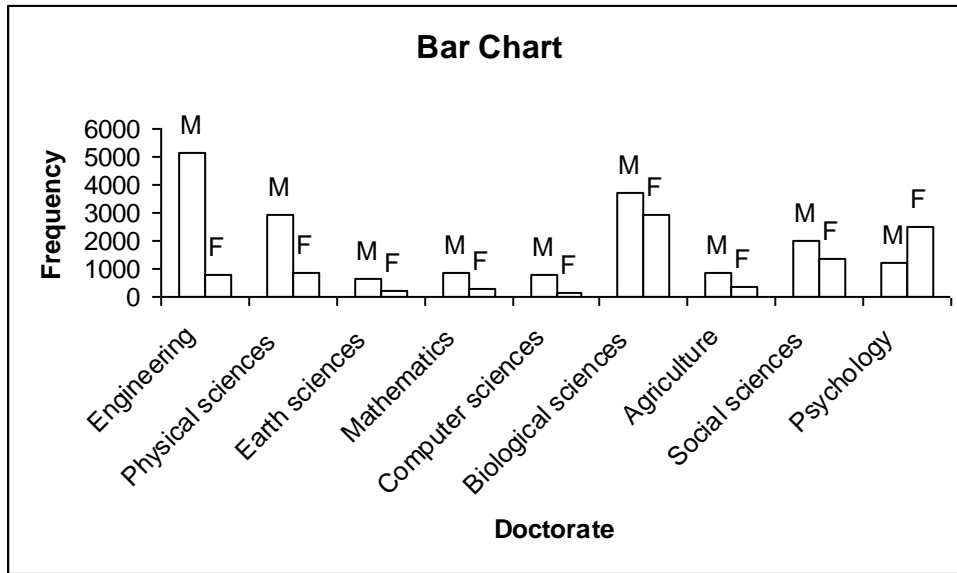
Bar Chart

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

2.57

Bar Chart
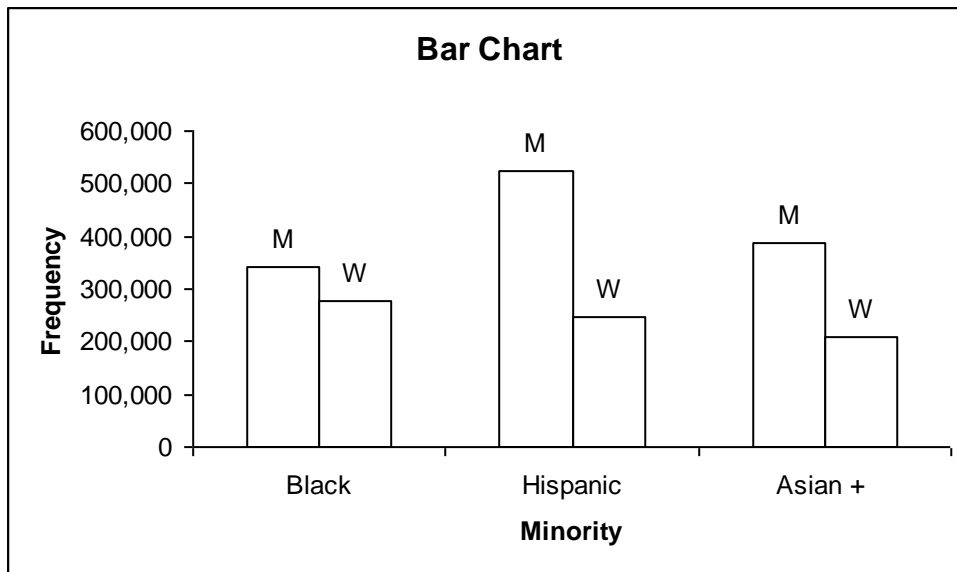
The variables race and gender are only slightly related.

2.58 a

Scatter Diagram
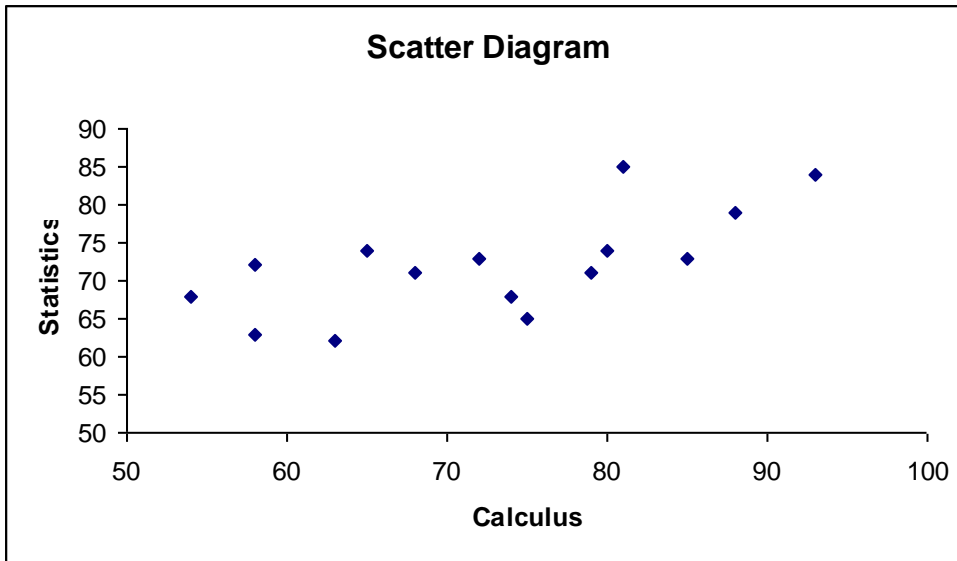
b There is a moderately strong positive relationship between calculus and statistics marks.

2.59

Scatter Diagram
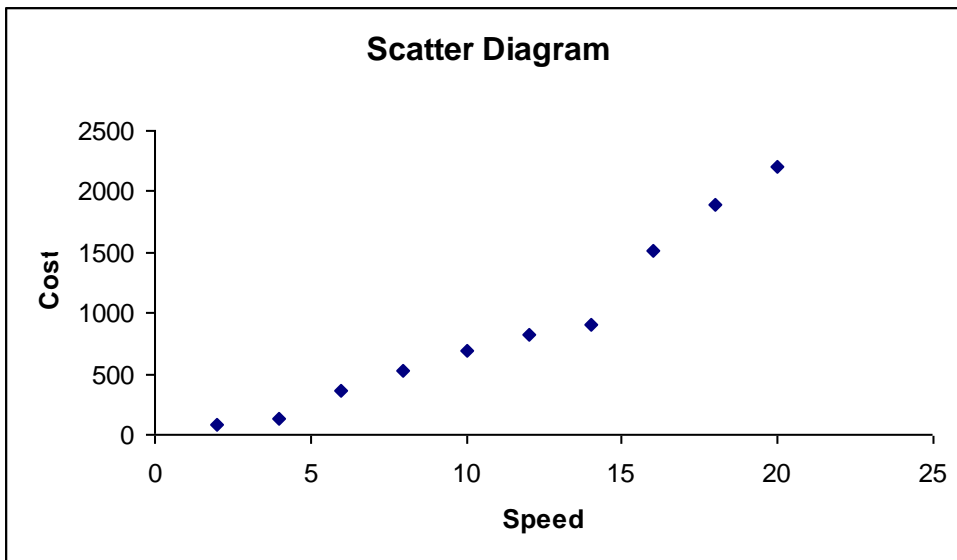
There is a strong positive linear relationship (although there appears to be a quadratic relationship).

2.60
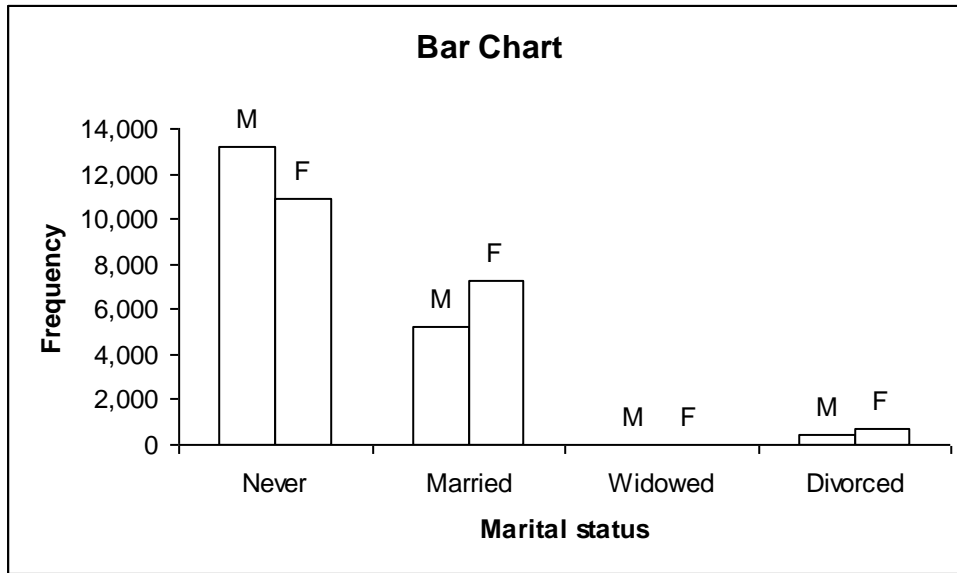
Gender and marital status are unrelated.

2.61a
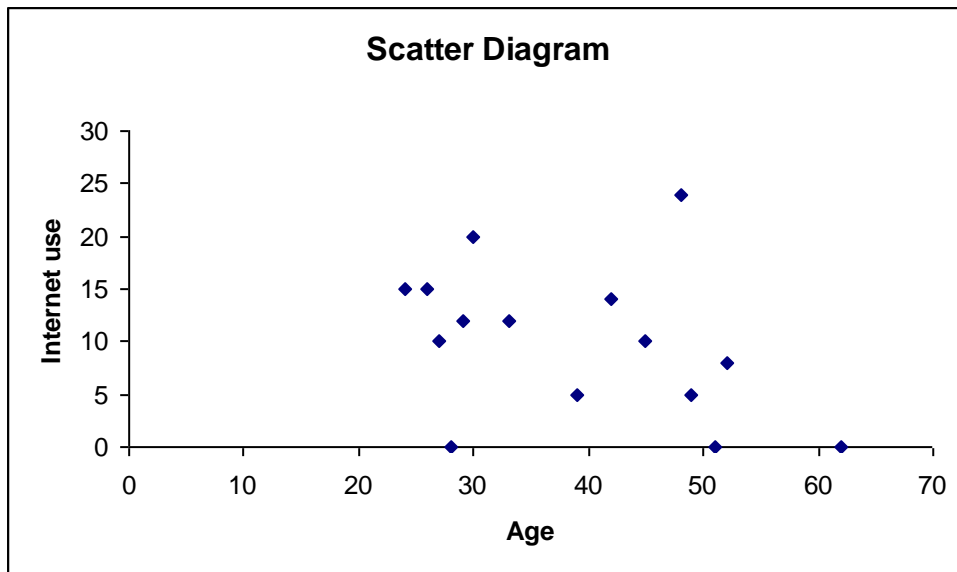
b There does not appear to be a linear relationship.

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
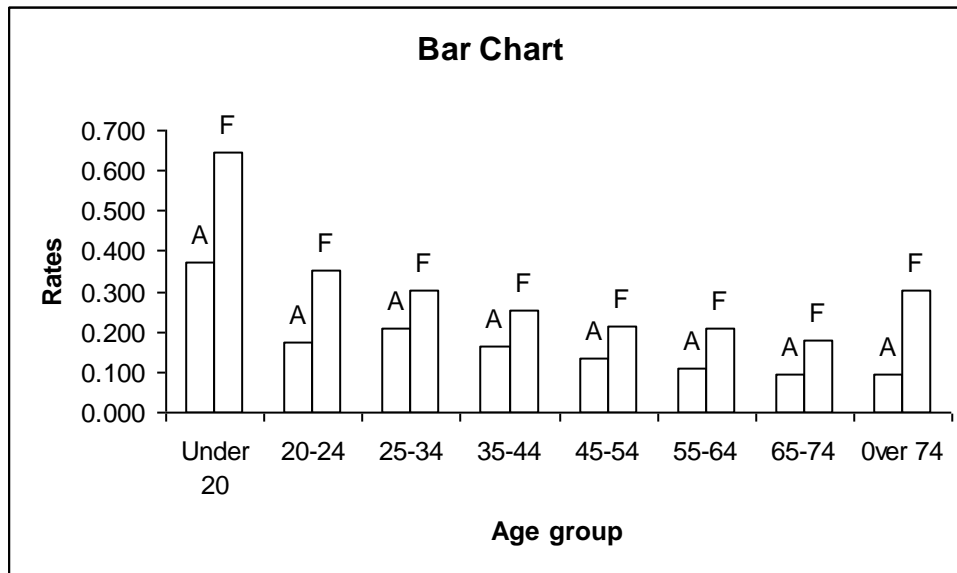
c The accident rate generally decreases as the ages increase. The fatal accident rate decreases until the over 74 age category where there is an increase. As drivers age they become less likely to be involved in an accident. As a result the fatal accident rate also decreases except for the over 74 age 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

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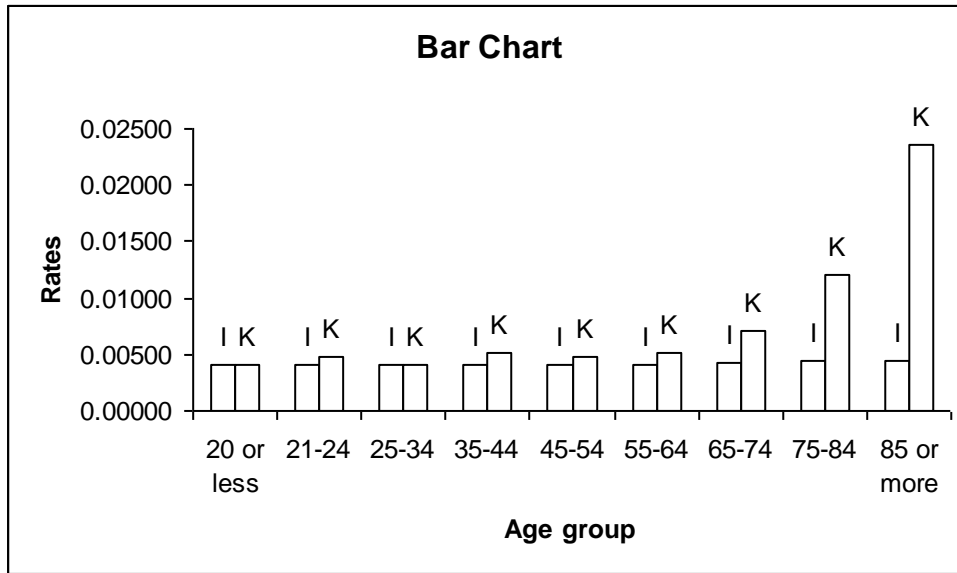
c Older drivers who are in accidents are more likely to be injured or killed.

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

2.64

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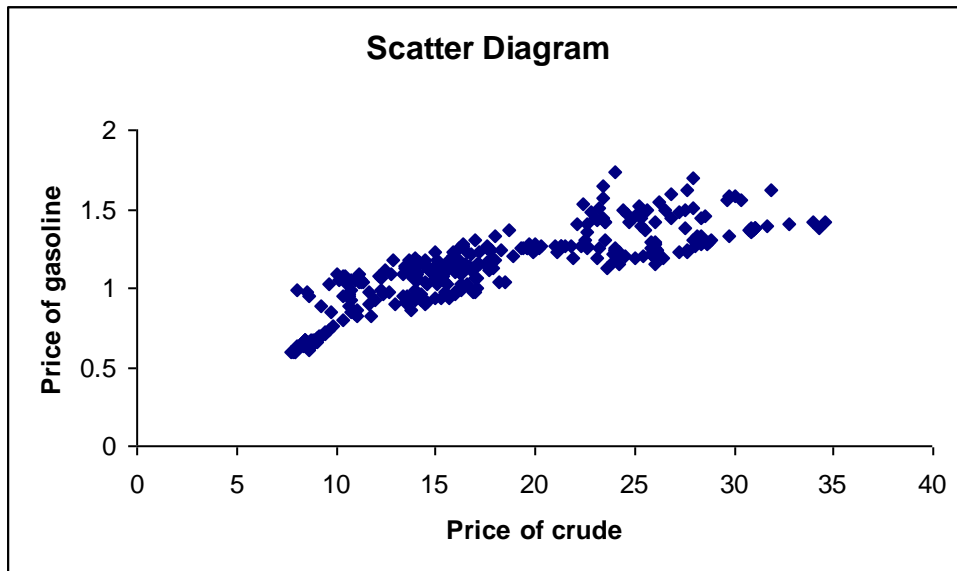
There is a strong positive linear relationship between the prices of crude oil and gasoline.

2.65

Bar Chart

Count of Student
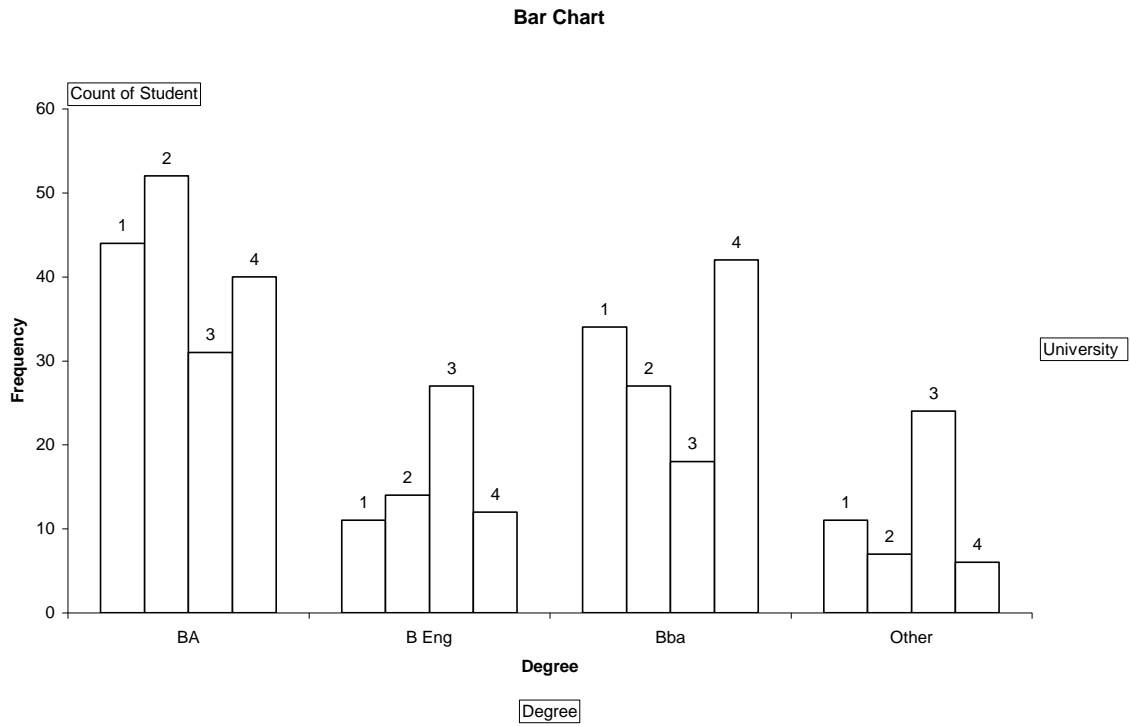
There is a relationship between degree and university.

2.66a
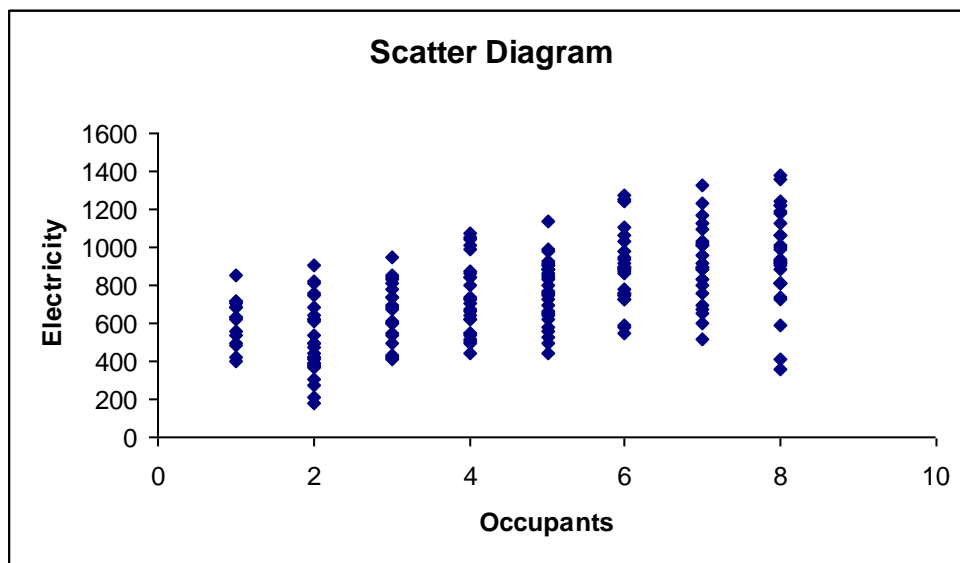
b There is moderately strong positive linear relationship between the number of occupants and electricity use.

2.67
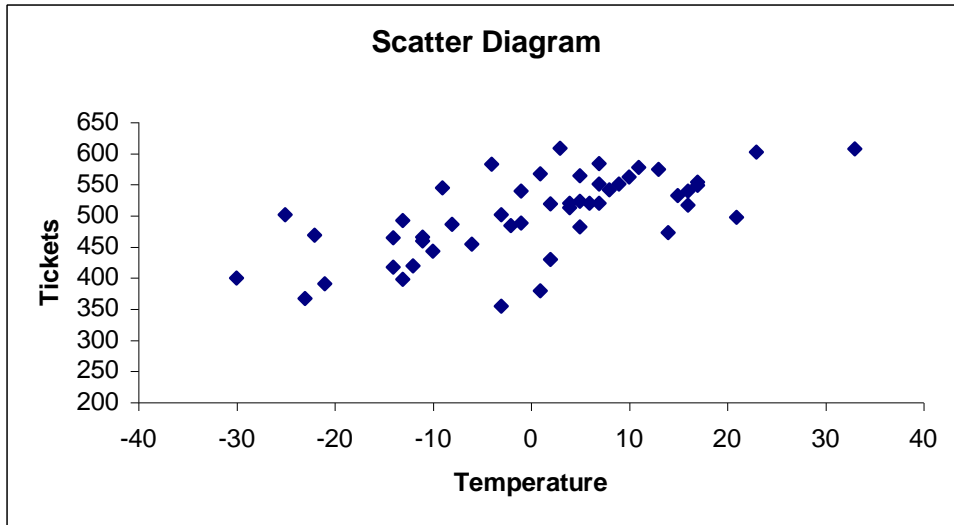
There is a moderately strong positive linear relationship between temperature and the number of tickets.

2.68
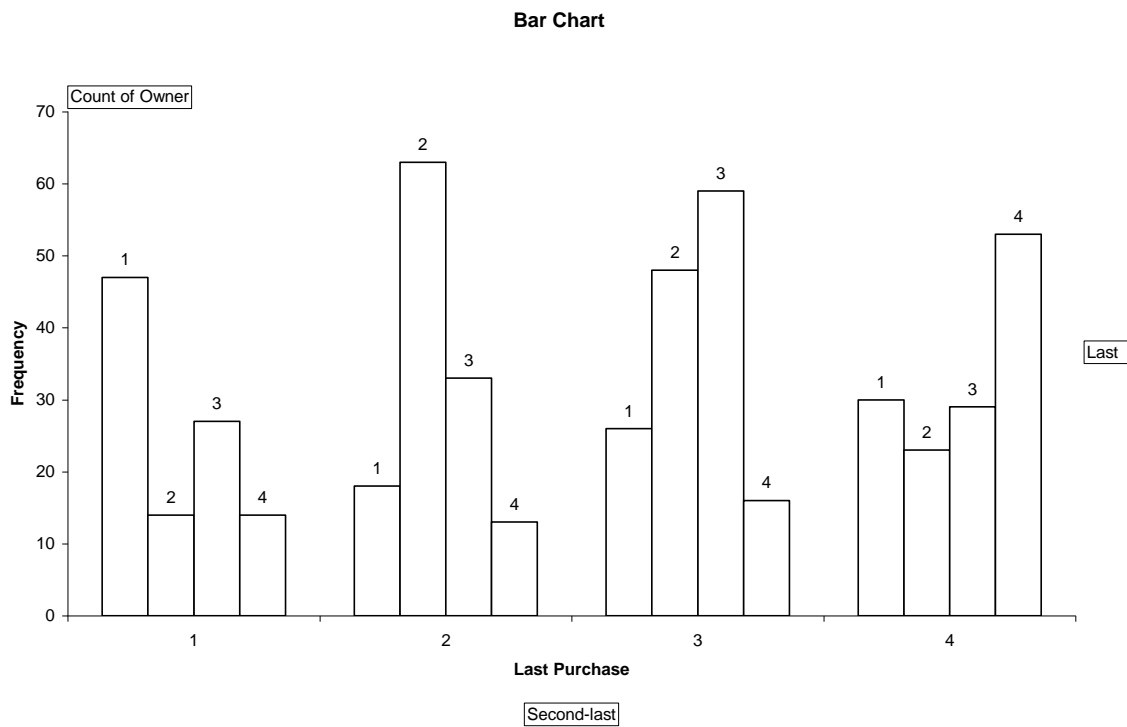
There is a relationship between the last two purchases. There is some brand loyalty.

2.69

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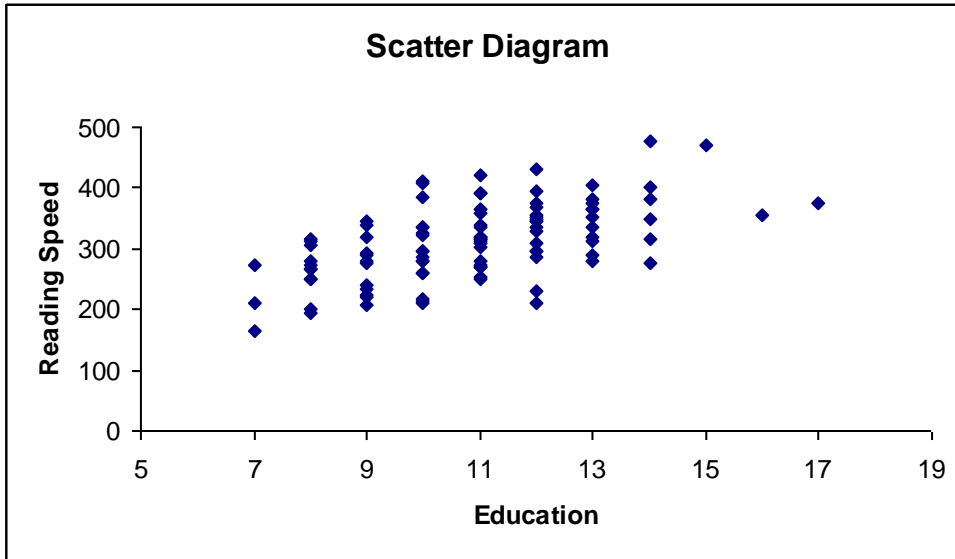
There is a moderately strong linear relationship between years of education and reading speed.

2.70 a

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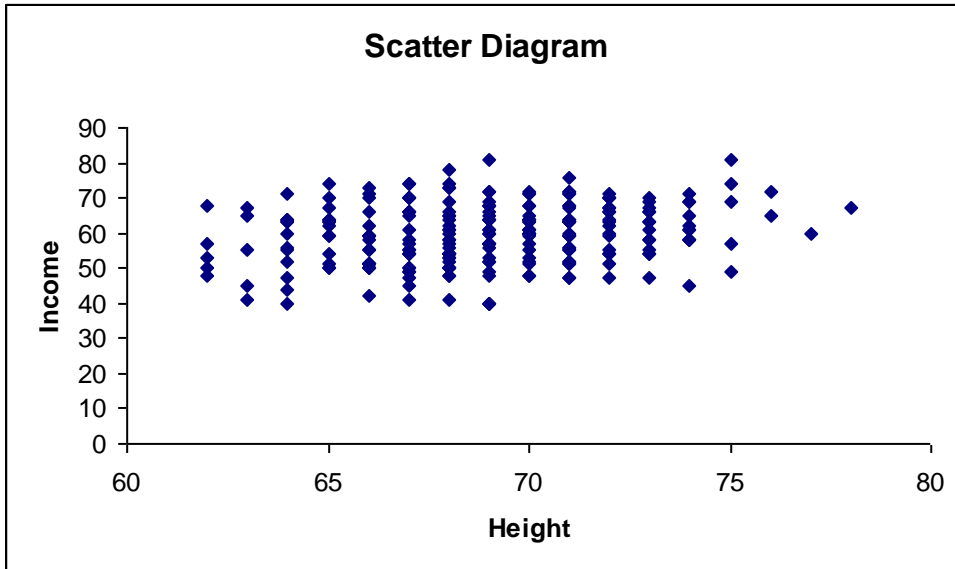
b There is a no linear relationship between the two variables.

2.71

Bar Chart
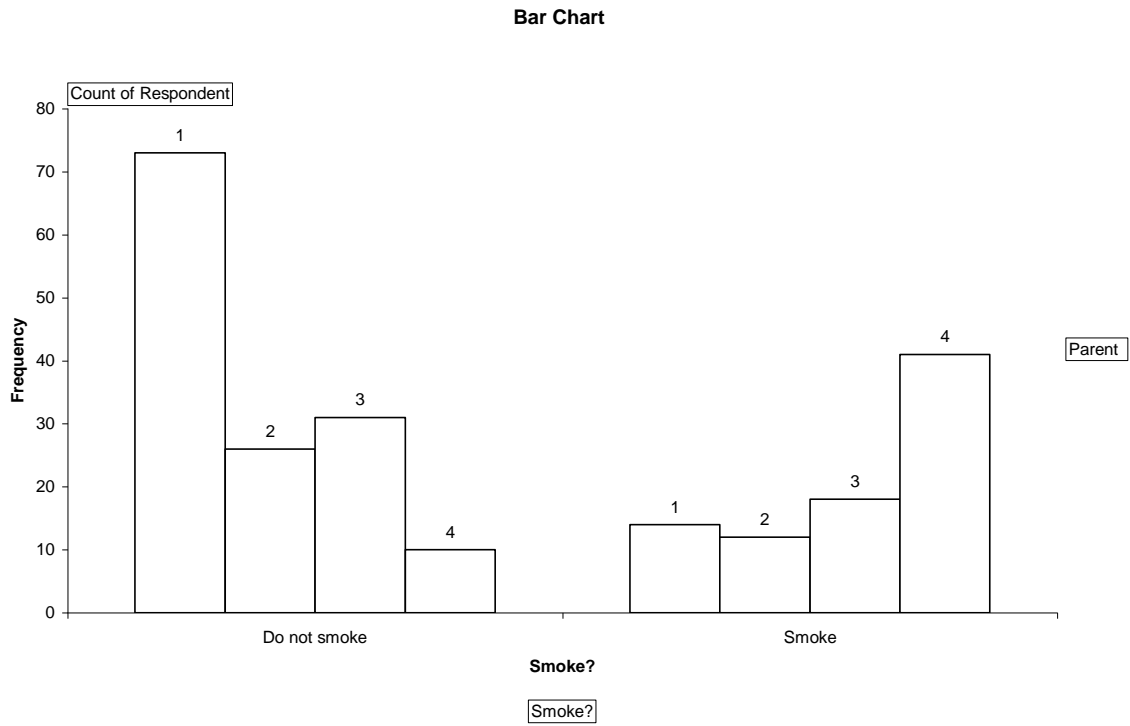
The two nominal variables are strongly correlated.

2.72

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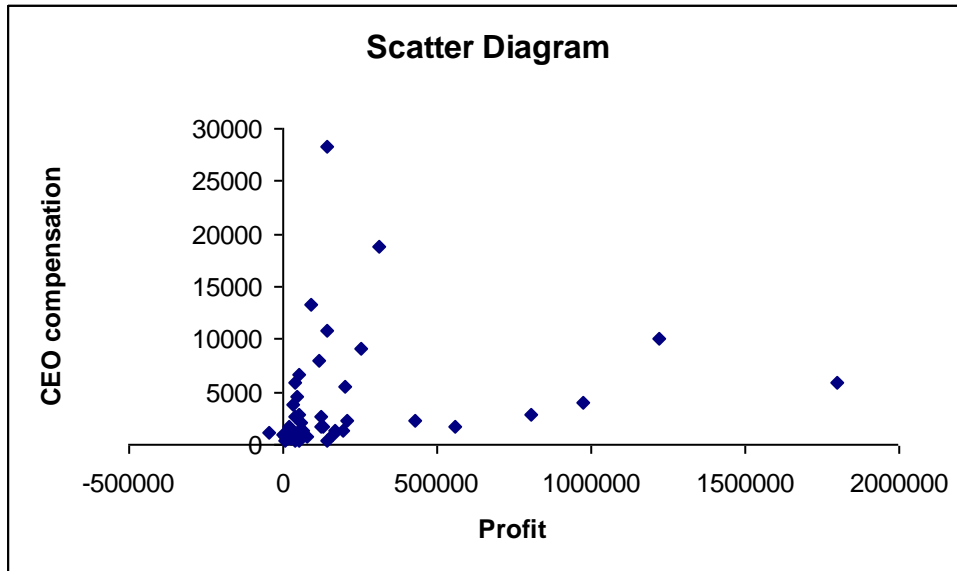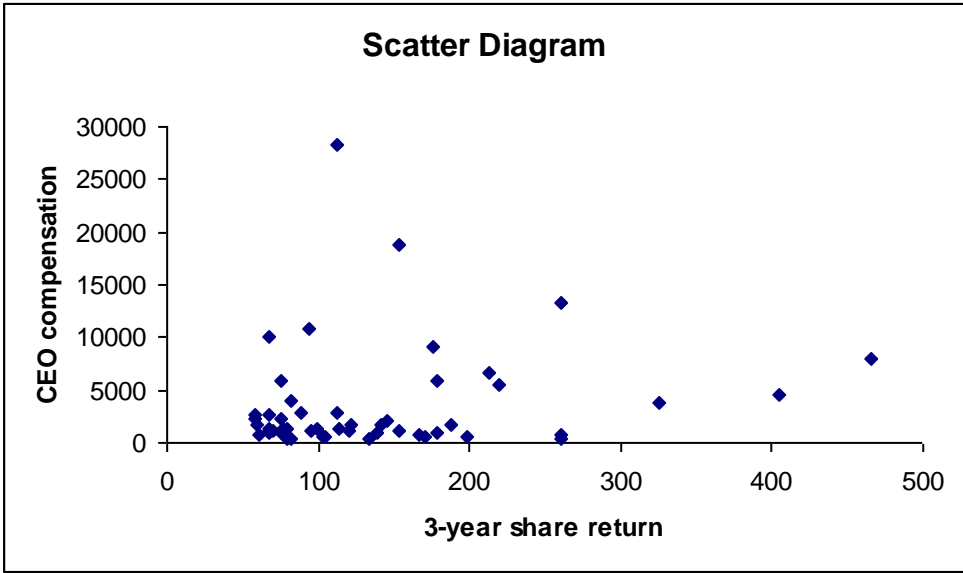
There does not appear to be a linear relationship between profit and CEO compensation or between 3-year share return and CEO compensation.

2.73

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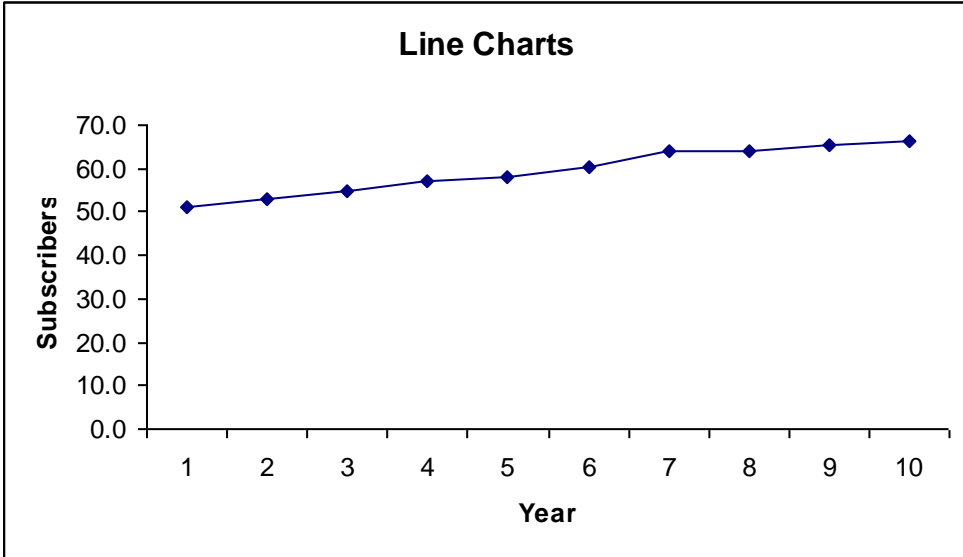
There has been a steady growth in subscribers over the ten-year period.

2.74
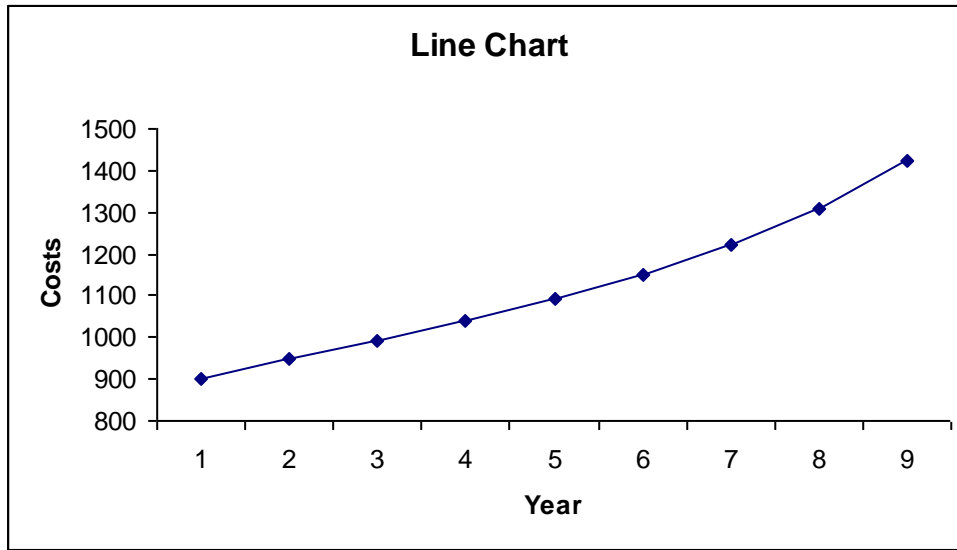
Costs have increased dramatically and appear to be accelerating.

2.75a
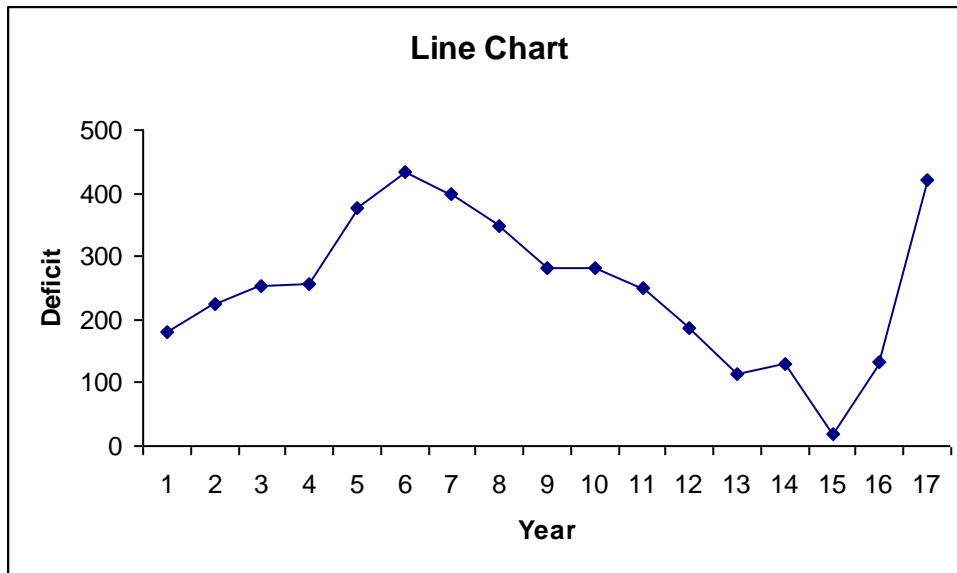
b Deficits began falling after the sixth year (1991), approached 0 in year 15(200) and started rising again.

2.76
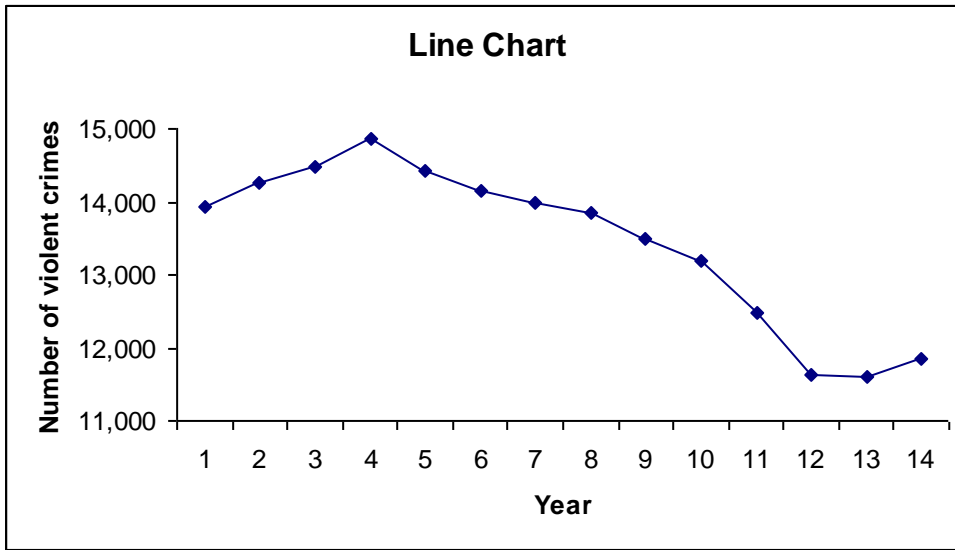
After rising for 3 years, the number of crimes has steadily decreased until year 12, where is started to rise again.

2.77
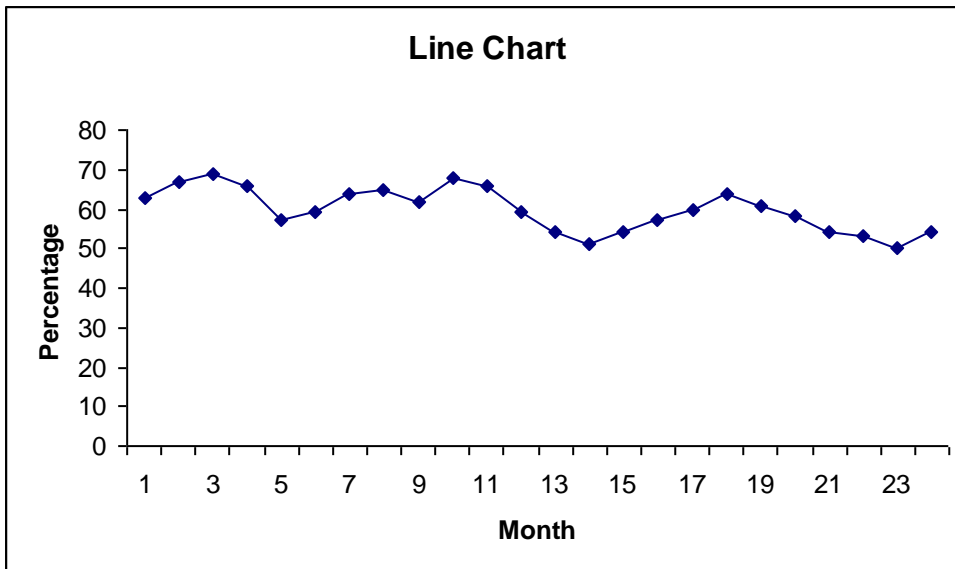
There is some month-to-month fluctuation, but the percentage was only slightly lower after 24 months.

2.78

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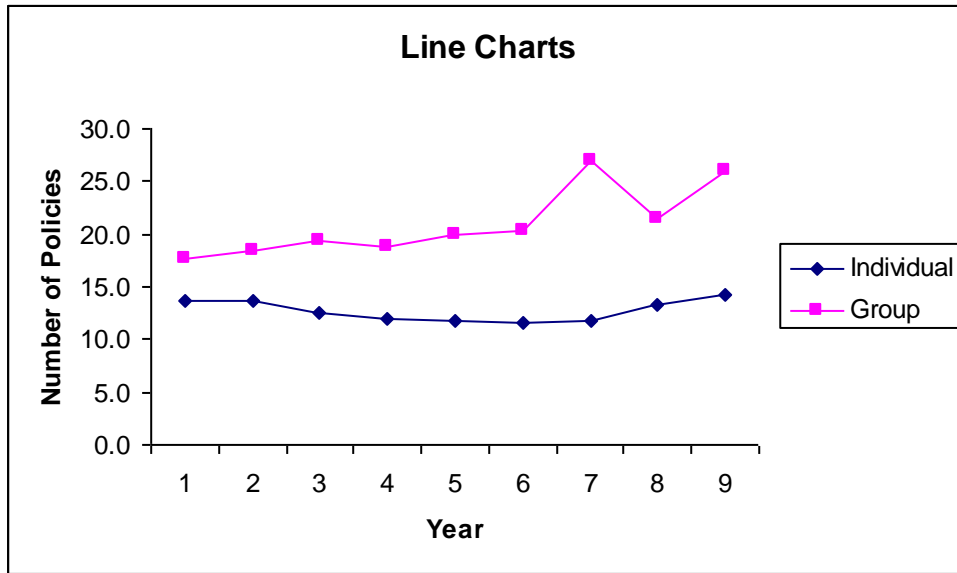
The number of individual policies has been stable while group policies are increasing.

2.79a

Line Chart

b

Line Chart

c

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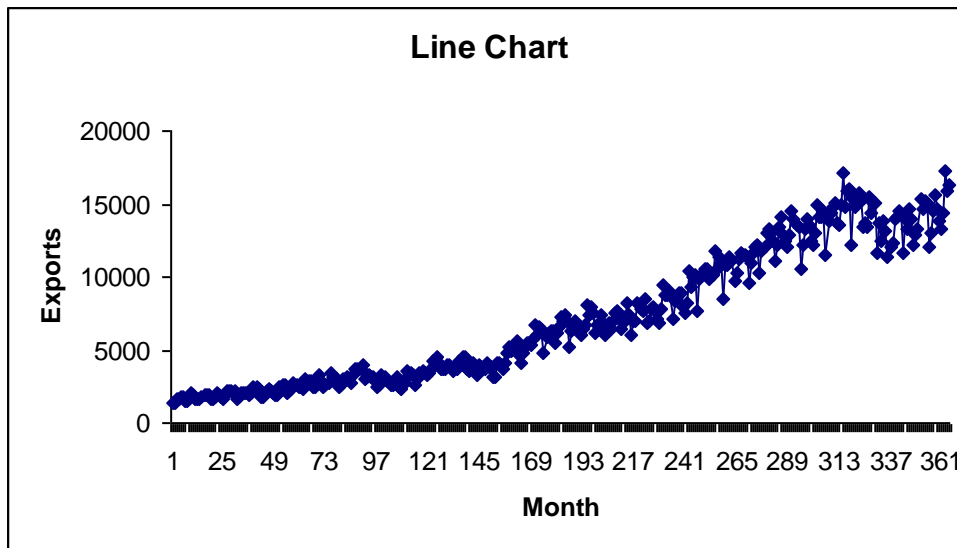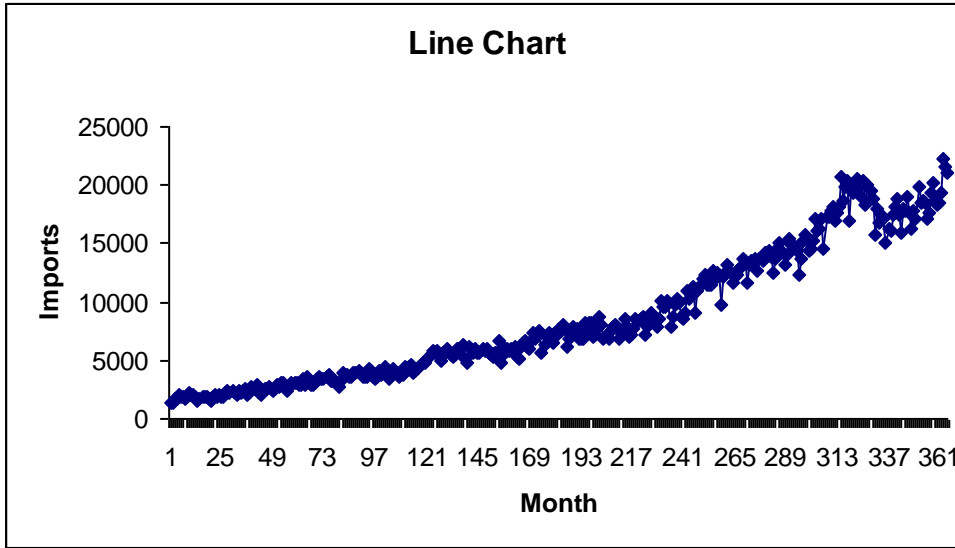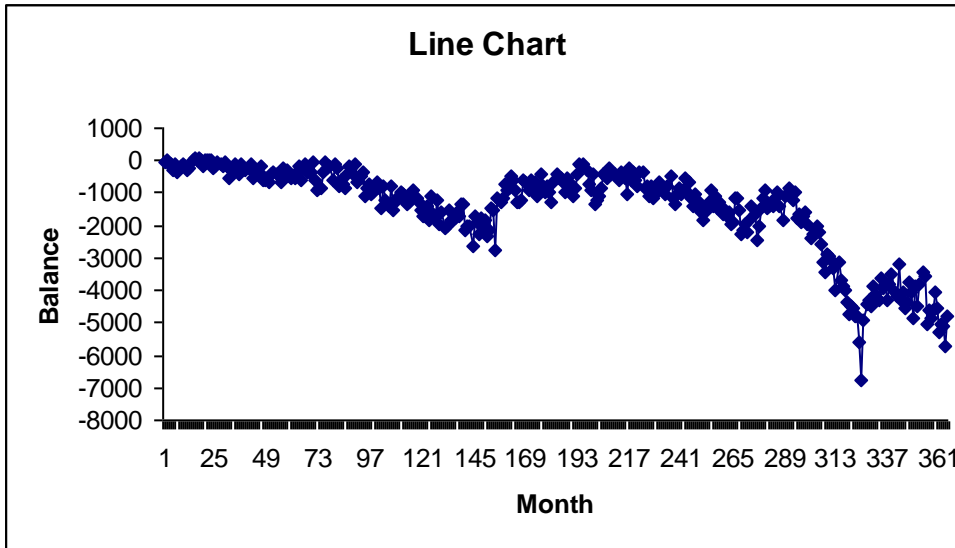
d Trade between the two countries has increased exponentially. However, imports from Canada have increased at a faster rate than exports to Canada.

2.80a

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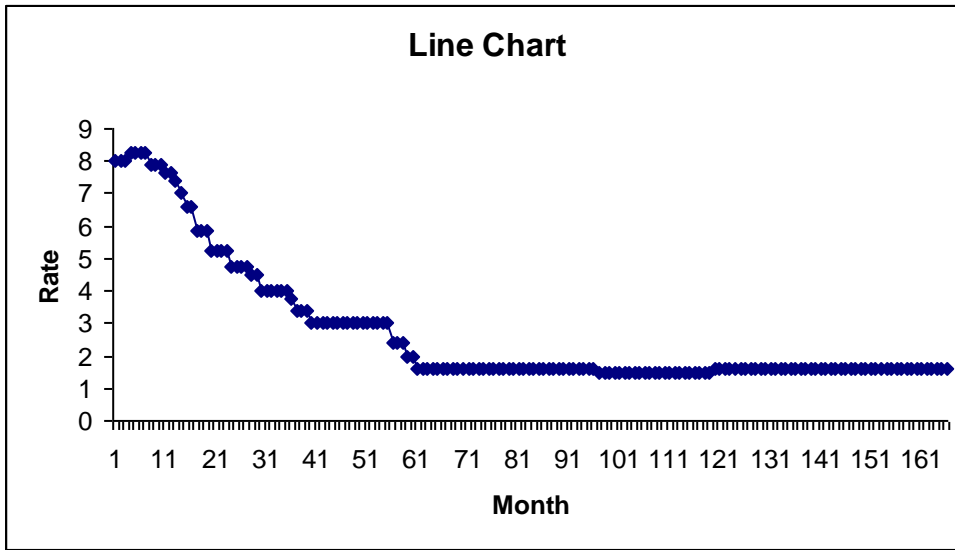
b There was a large decrease over the first half of the period, but has leveled since.

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

Line Charts

2.82a

Line Chart
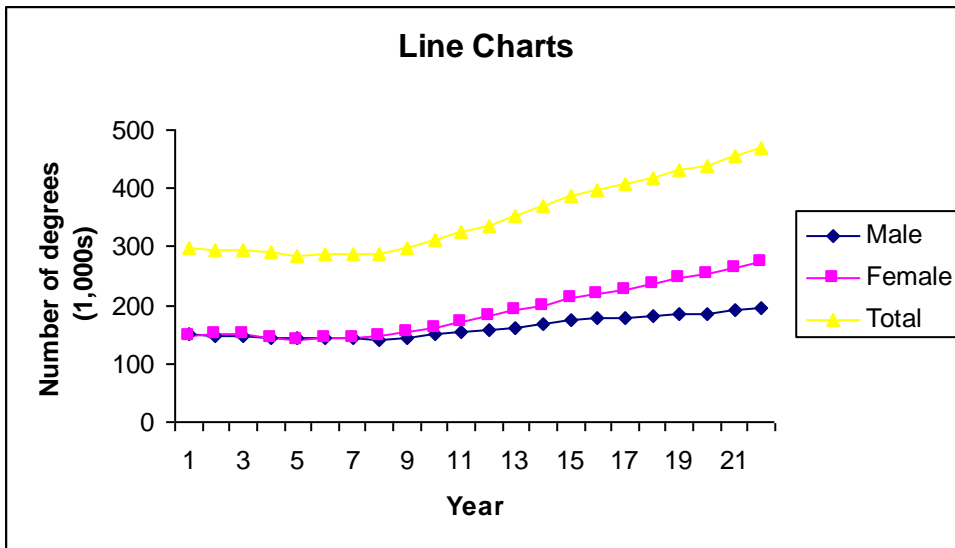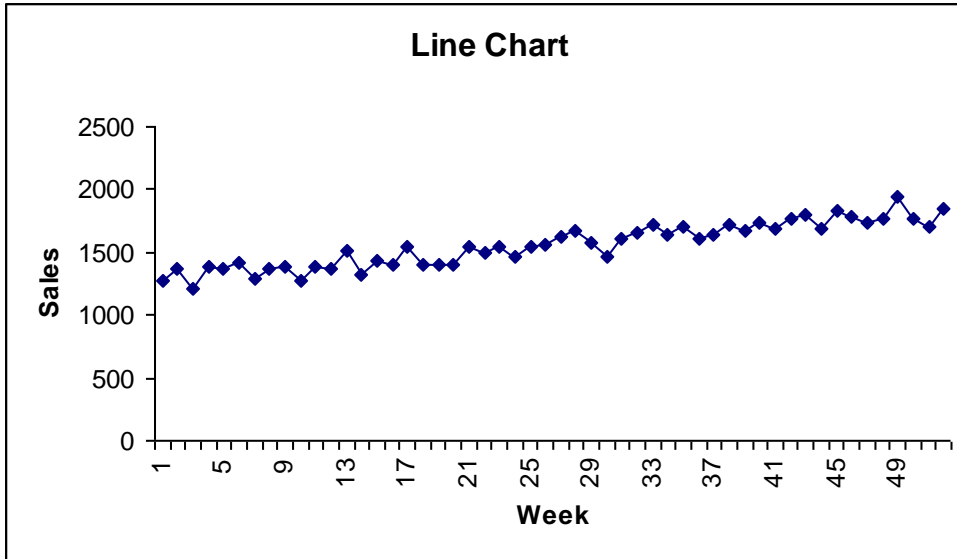
b There has been a gradual weekly increase in sales.

2.83

Line Chart
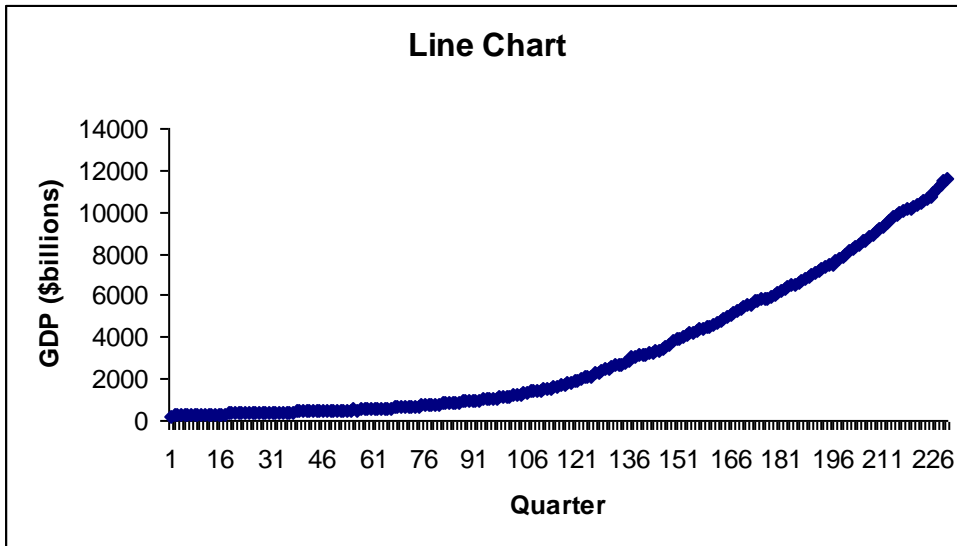
The quarterly figures have grown exponentially.

2.84
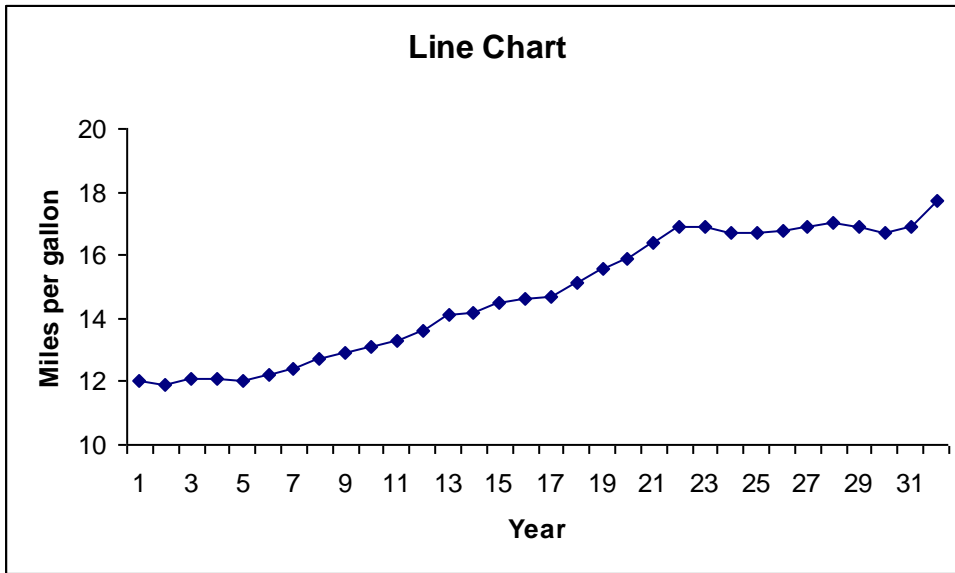
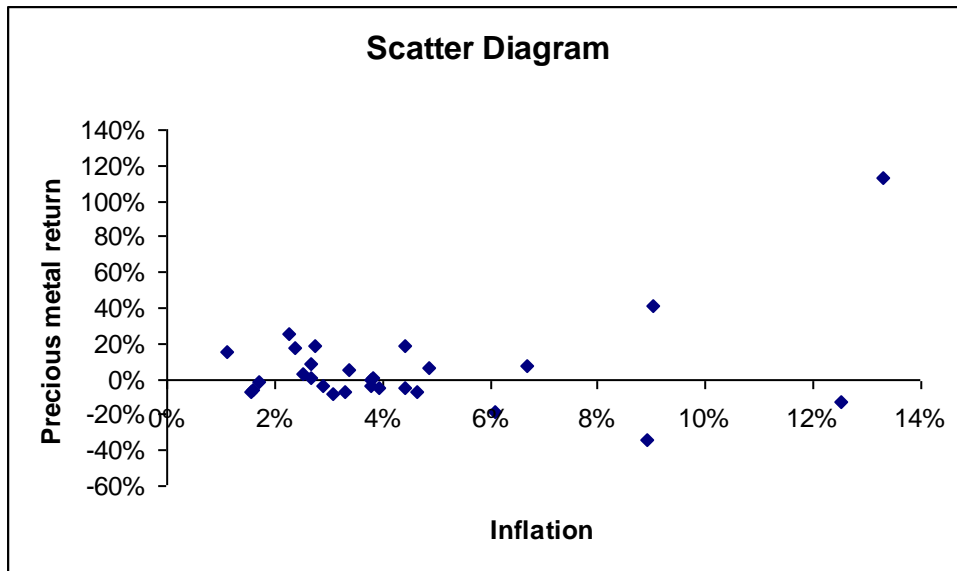Gas mileage has steadily improved over the past 31 years.

2.85
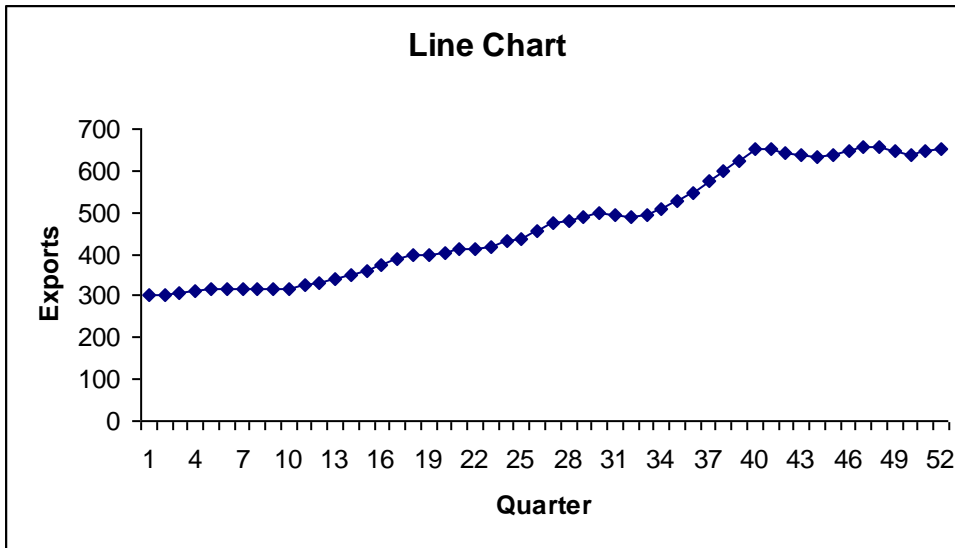
Exports have steadily increased until quarter 41, at which point it leveled off.

2.86
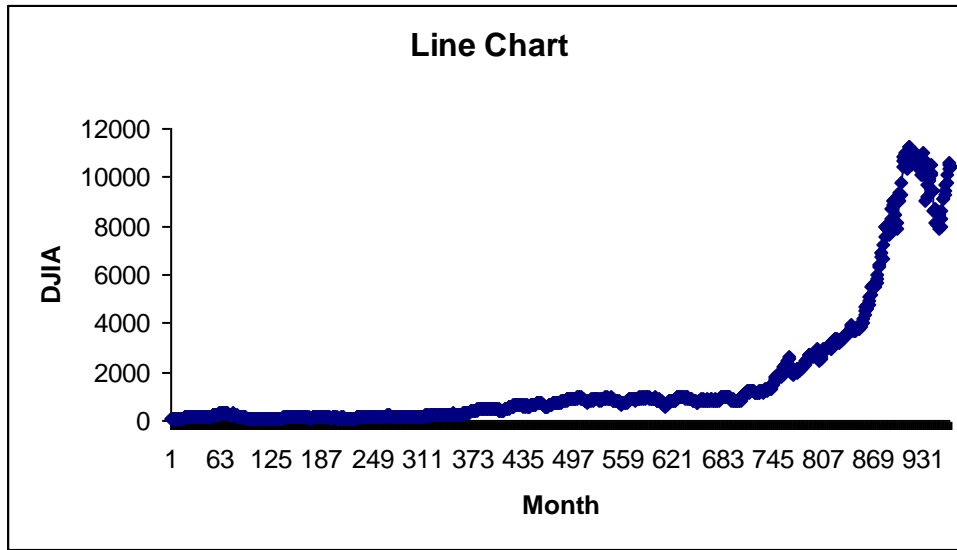
The trend until month 700 (1982) was slow but steady. Then the index grew exponentially until month 900, (1999), at which point there was a significant decrease and recovery.
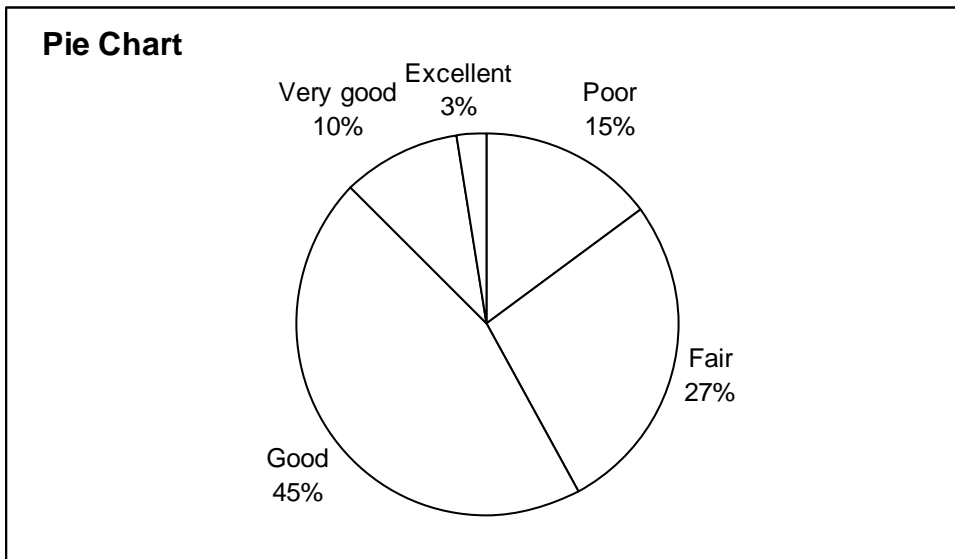
2.87

There is a weak linear relationship between inflation rate and precious metal returns.
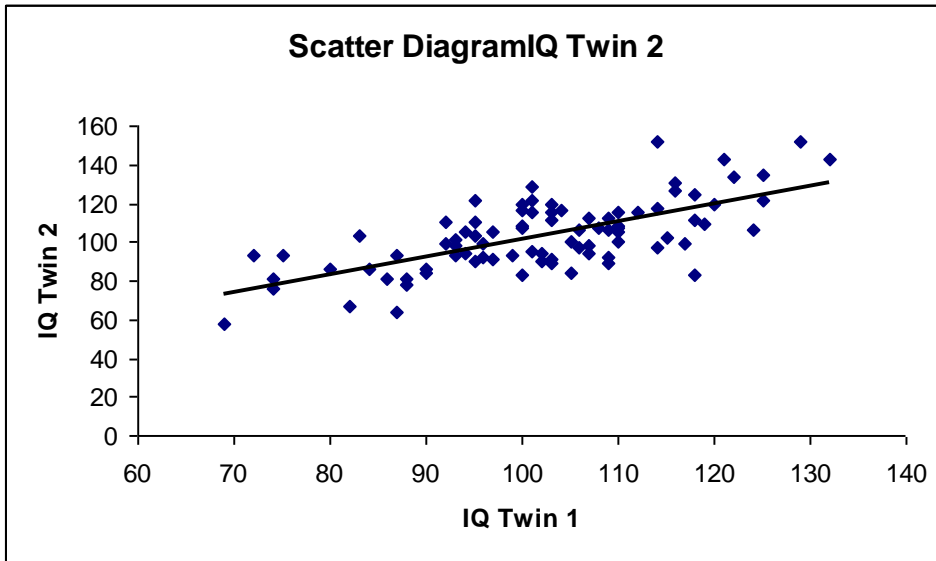
2.88

Scatter DiagramPrice/gallon
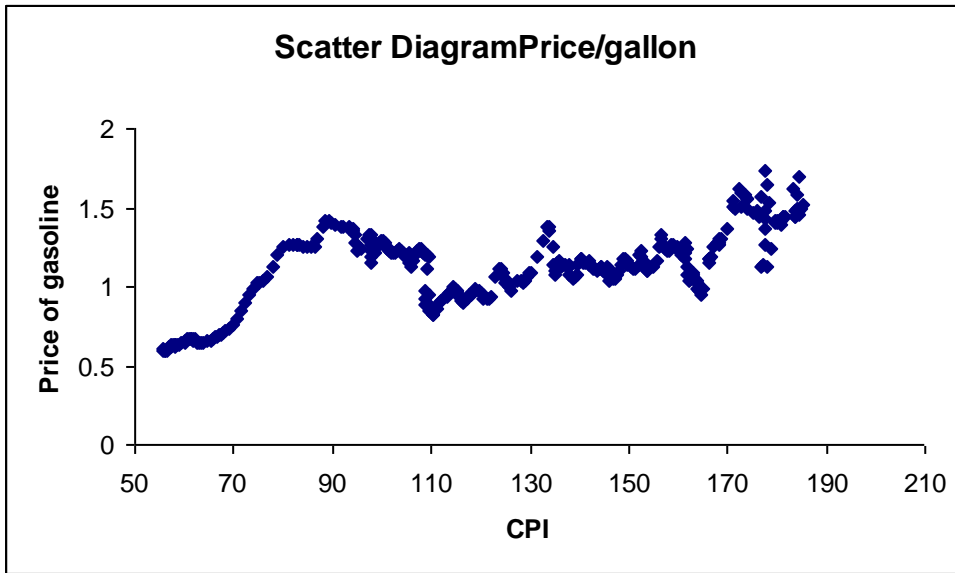
There is a moderately strong linear relationship suggesting that the some of the price increase is due to inflation.
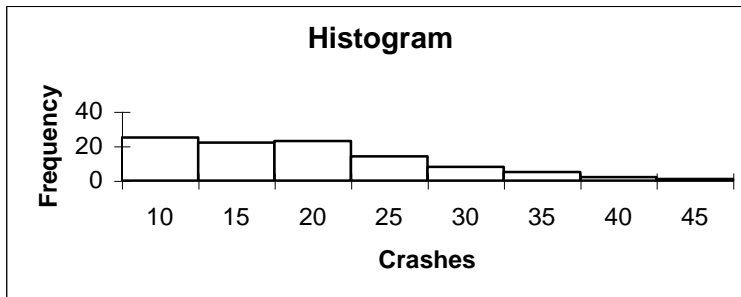
2.89

Pie Chart

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

2.90

Scatter DiagramIQ Twin 2

IQ Twin 2 vs IQ Twin 1

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

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

Histogram

Frequency vs Crashes

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

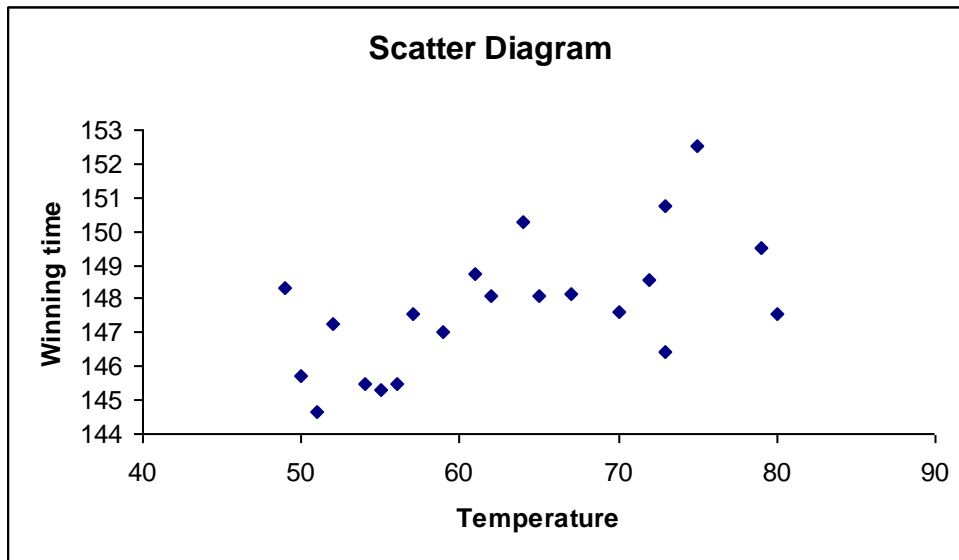**Line Chart**
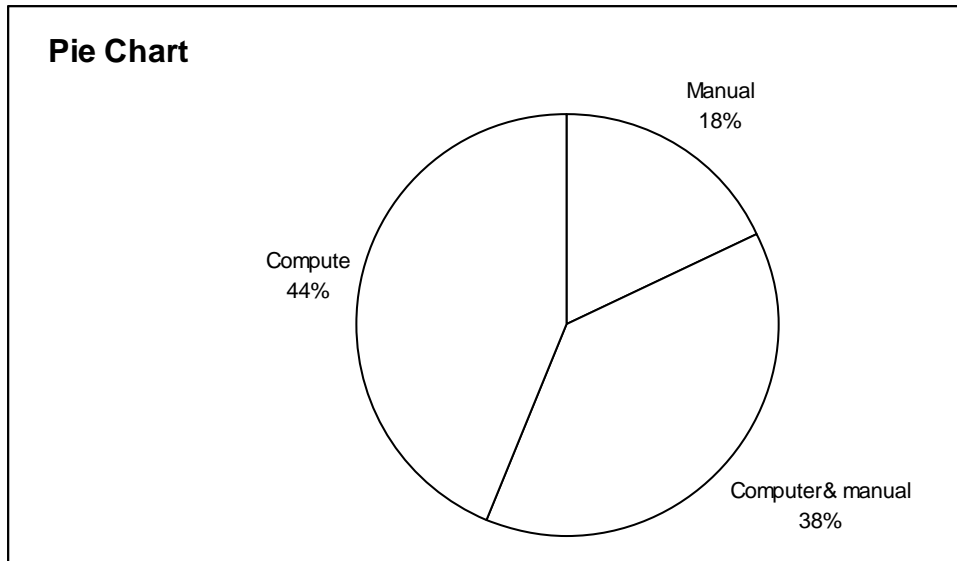
Winning time vs Year

2.93

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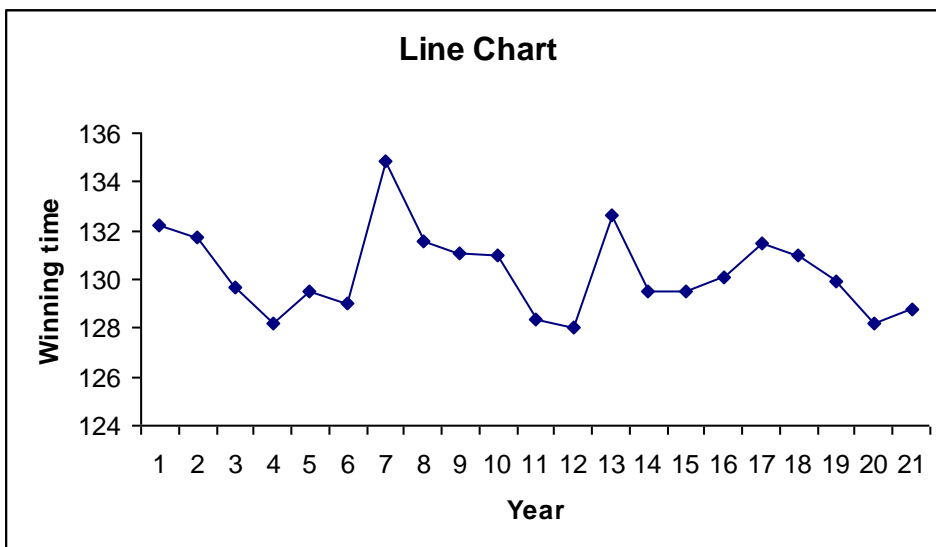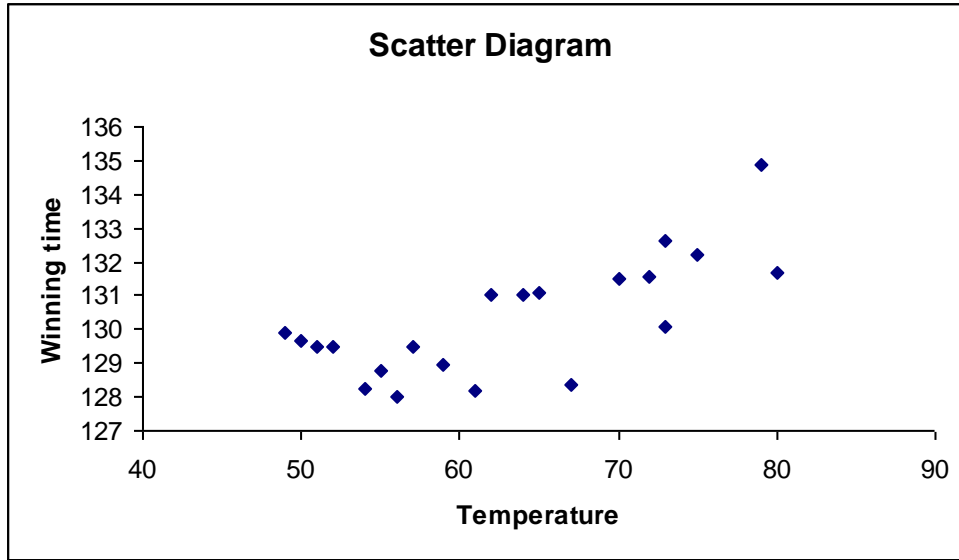
There is a strong positive linear relationship between temperature and winning times. This explains some of the fluctuations in the line chart in Exercise 2.92.

2.94

Scatter Diagram

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

2.95

Pie Chart

Manual
18%

Compute
44%

Computer& manual
38%

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.
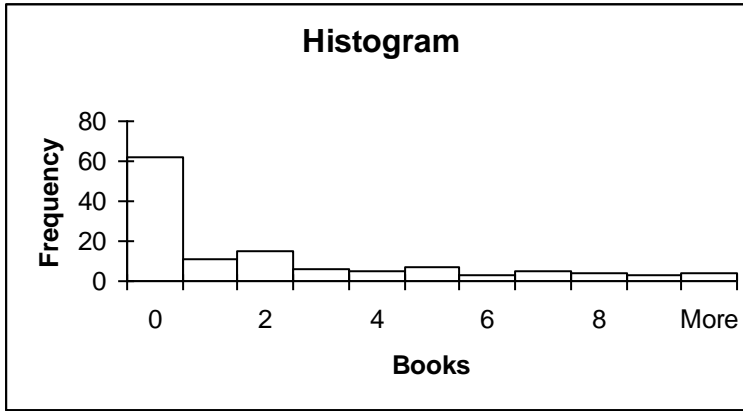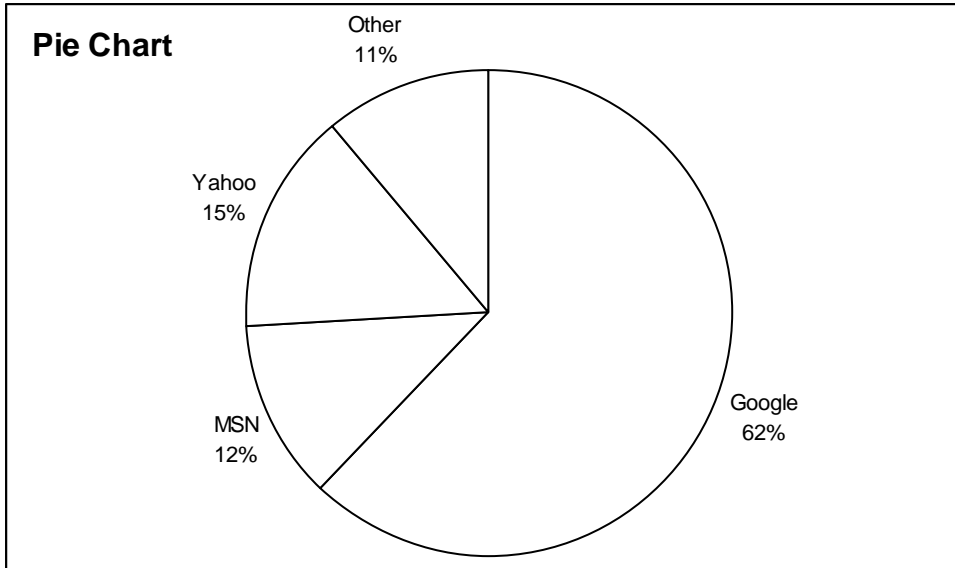
2.96a

Scatter Diagram

Son's height

Father's height
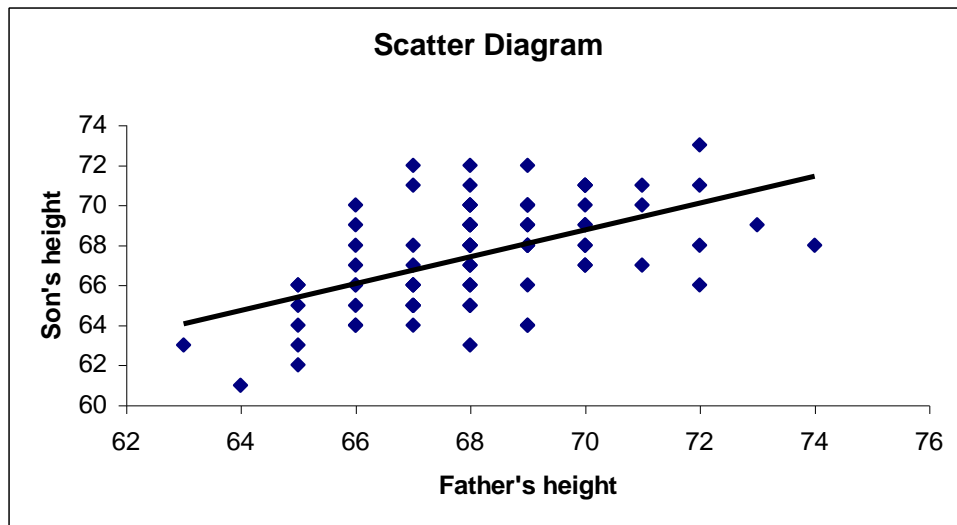
b The direction is positive.

c There does appear to be a linear relationship.

2.97

Most students borrowed no books.

2.98 Canada

U.S.

Pie Chart

Other
18%

Google
36%

Yahoo
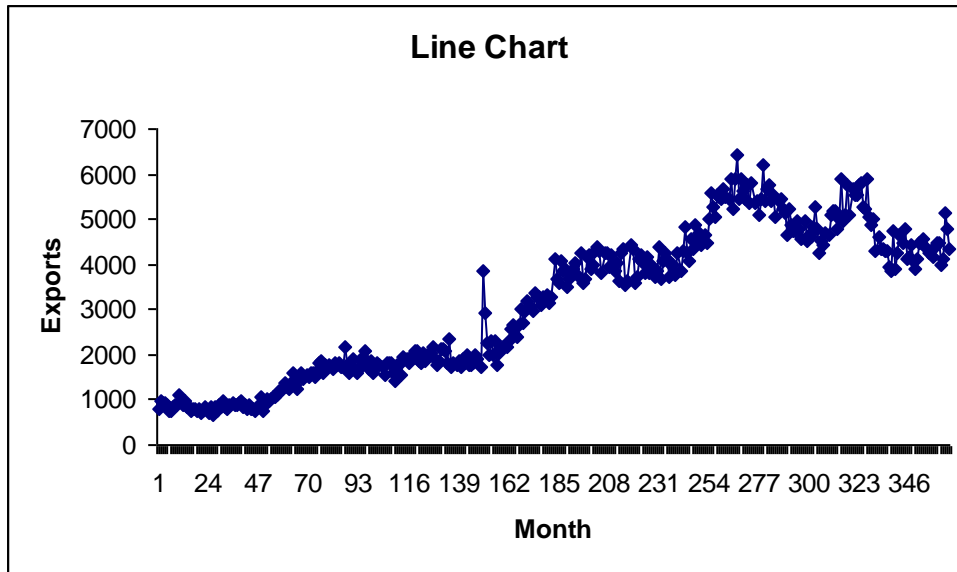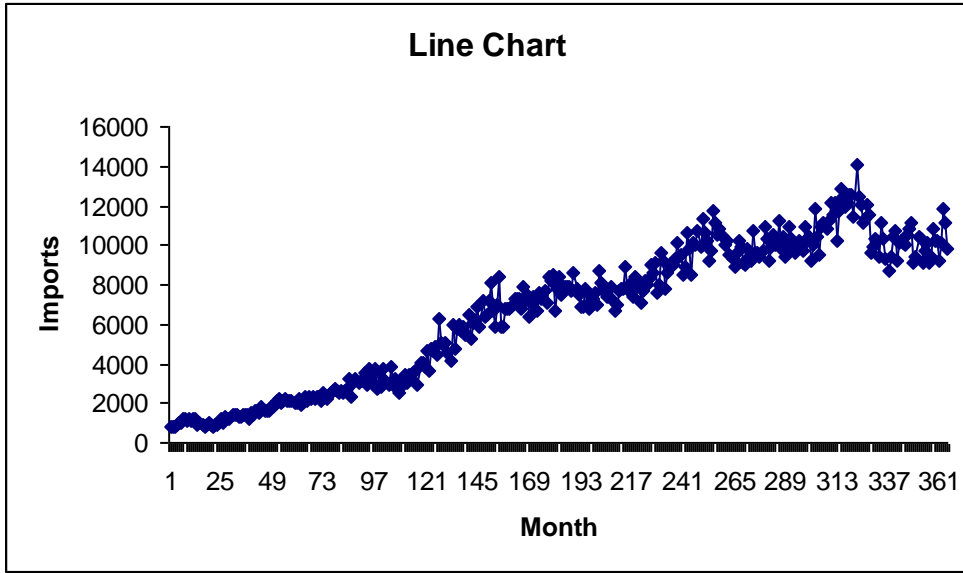30%

MSN
16%
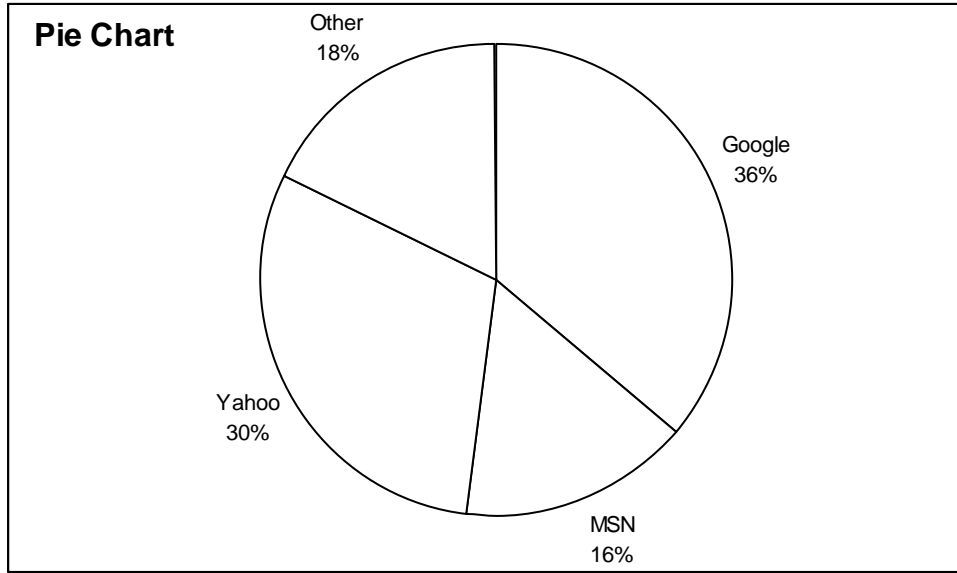
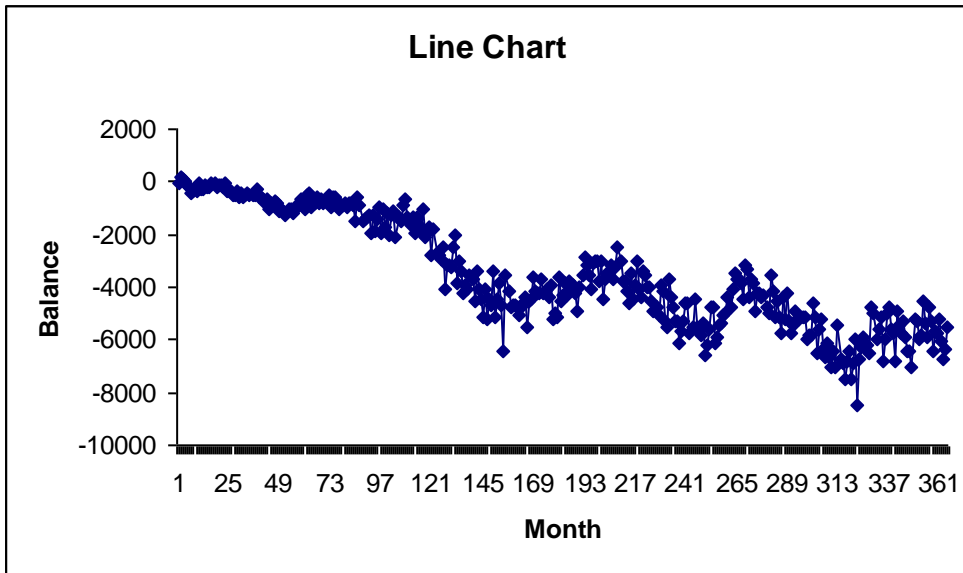In Canada Google is the most popular by a wide margin. In the United States Google and Yahoo are the leaders.

2.99a

Line Chart

Exports

7000
6000
5000
4000
3000
2000
1000
0

1   24   47   70   93   116 139 162 185 208 231 254 277 300 323 346
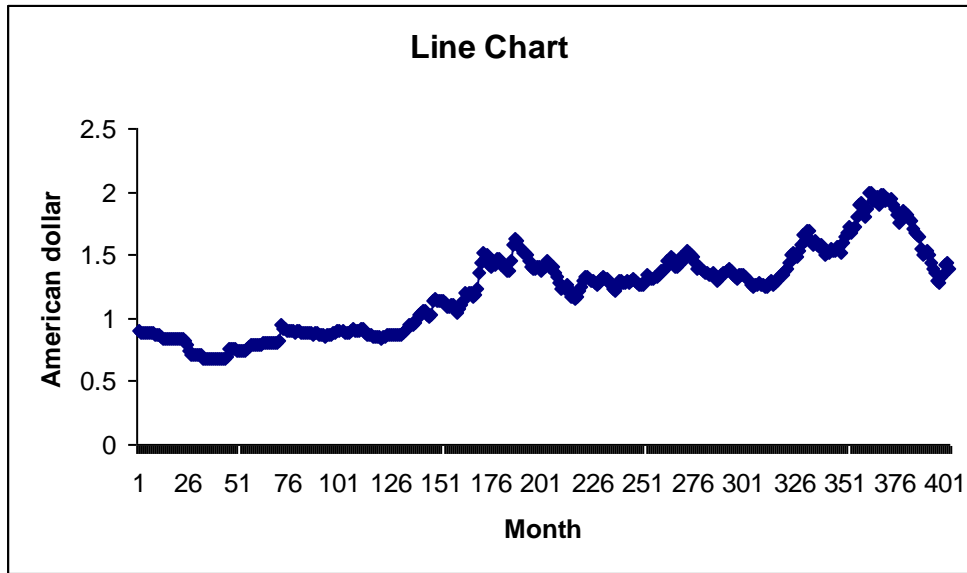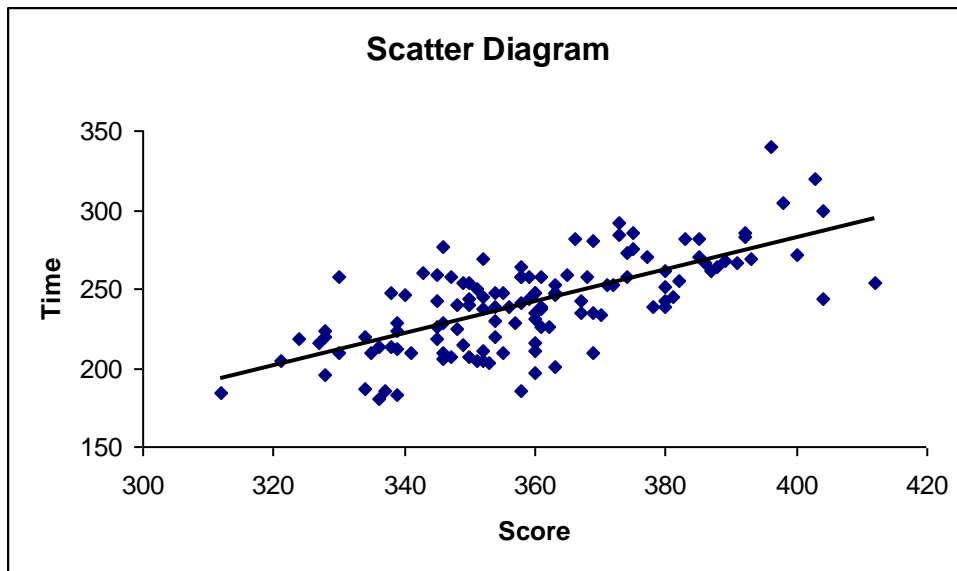
Month

b

Line Chart

c

Line Chart

d Imports to Japan and exports from Japan have grown over the past 28 years. However, imports have grown much more quickly.
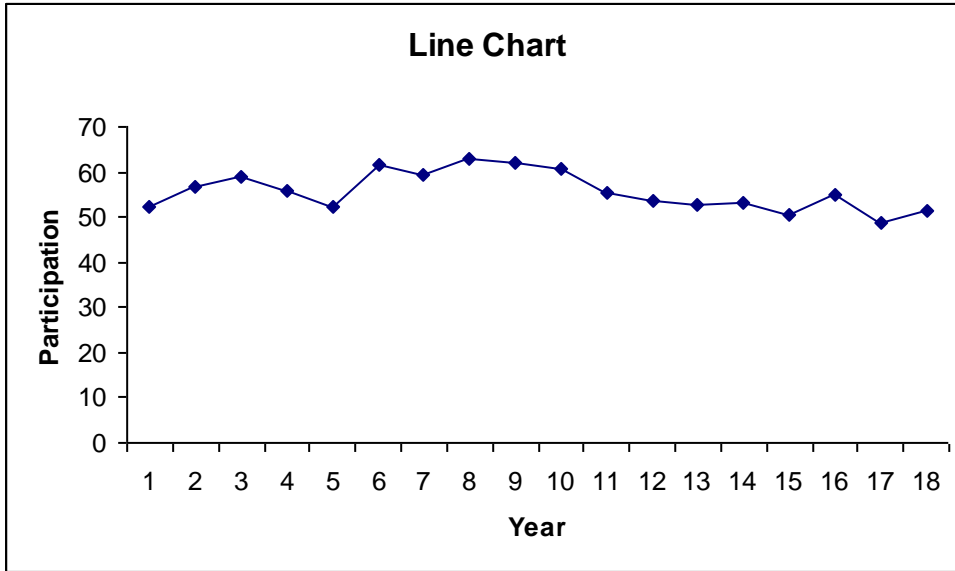
2.100

Line Chart

The value of the American dollar has risen over the years.
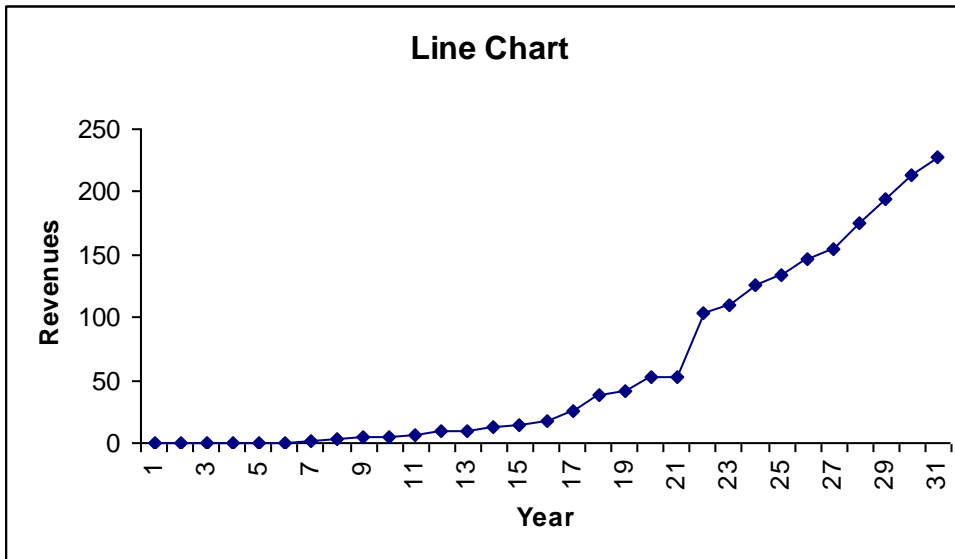
2.101

Scatter Diagram

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

2.102
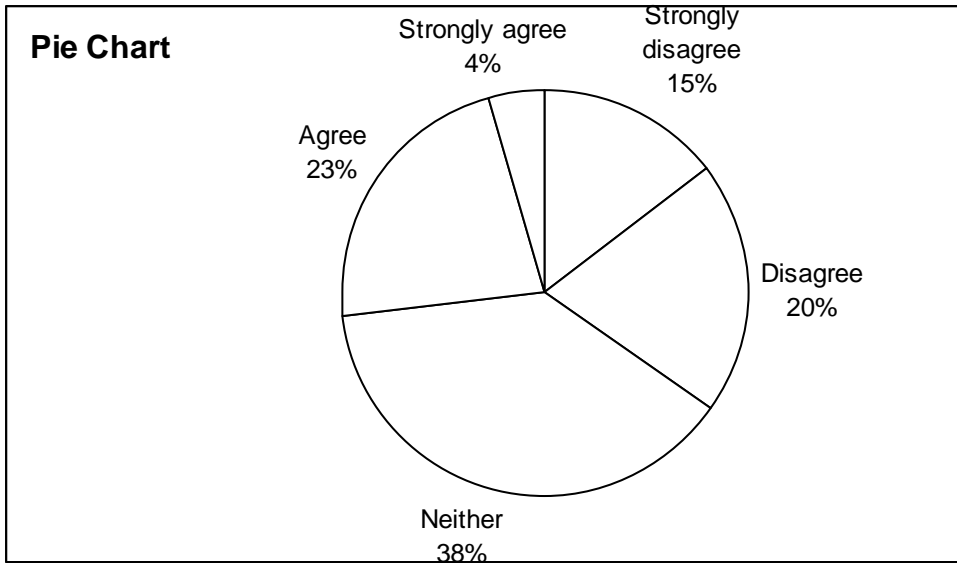

The participation rate varies between 50 and 60%.

2.103

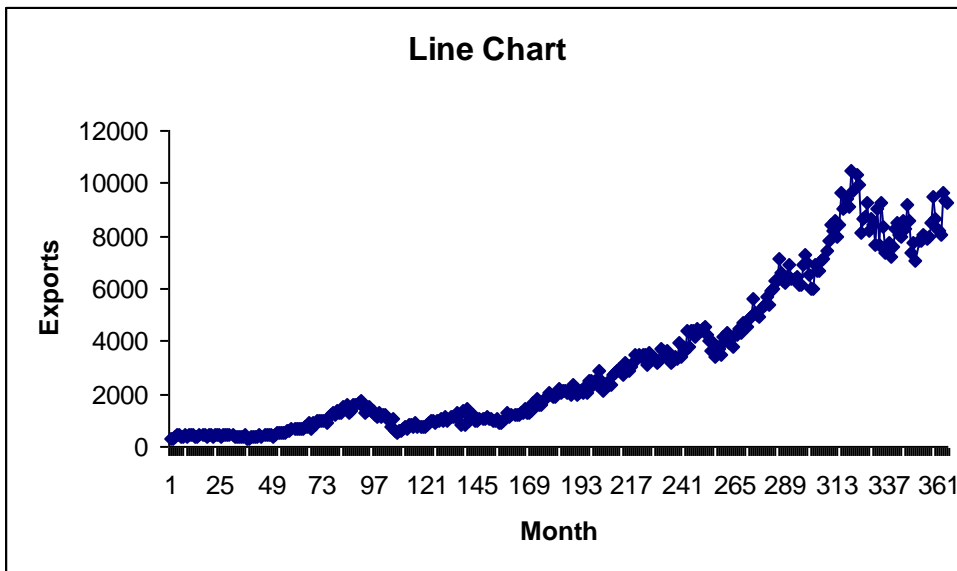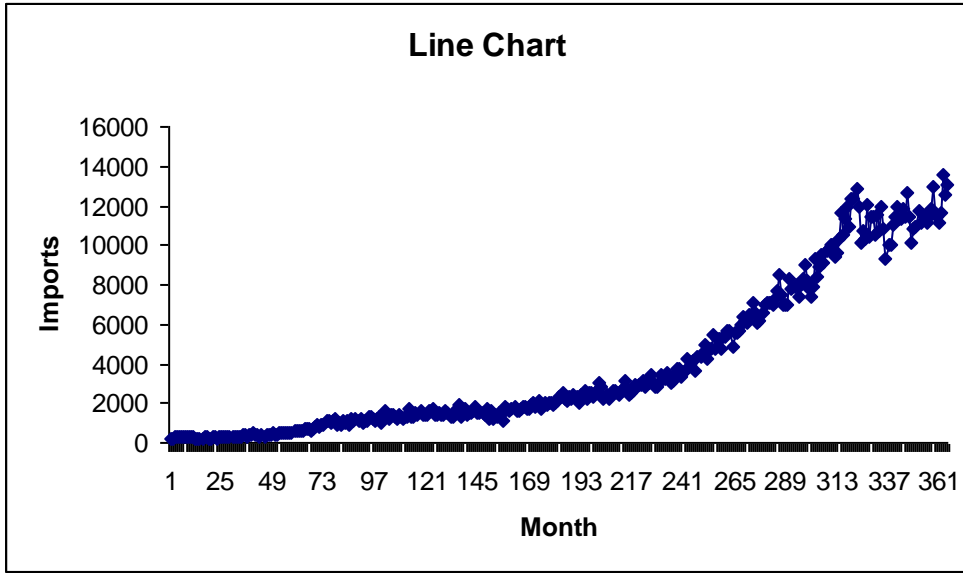Growth in revenues has increased exponentially.

2.104

Pie Chart

Strongly agree
4%

Strongly disagree
15%

Agree
23%

Disagree
20%

Neither
38%

Most students would not agree.

2.105a

Line Chart

Exports

12000
10000
8000
6000
4000
2000
0

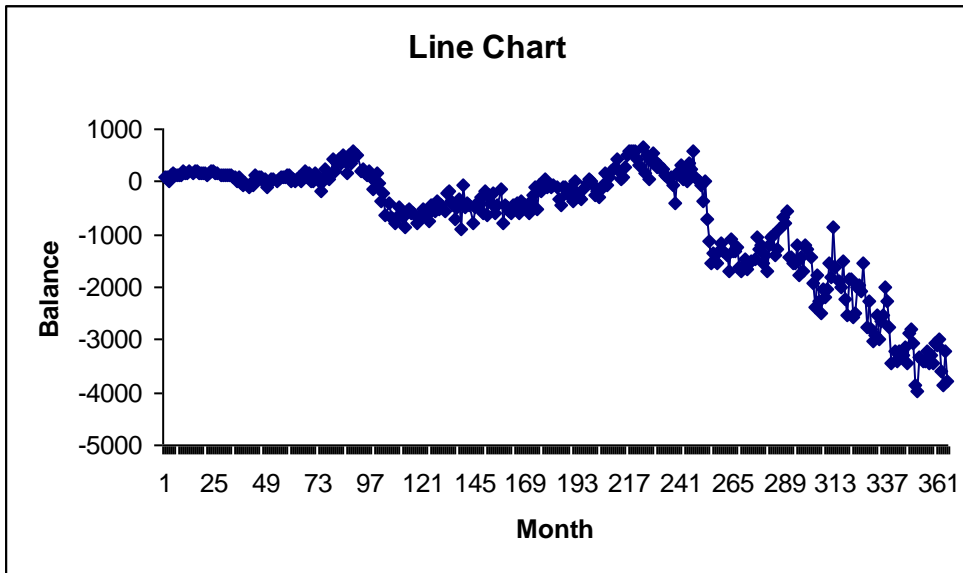1   25   49   73   97   121 145 169 193 217 241 265 289 313 337 361
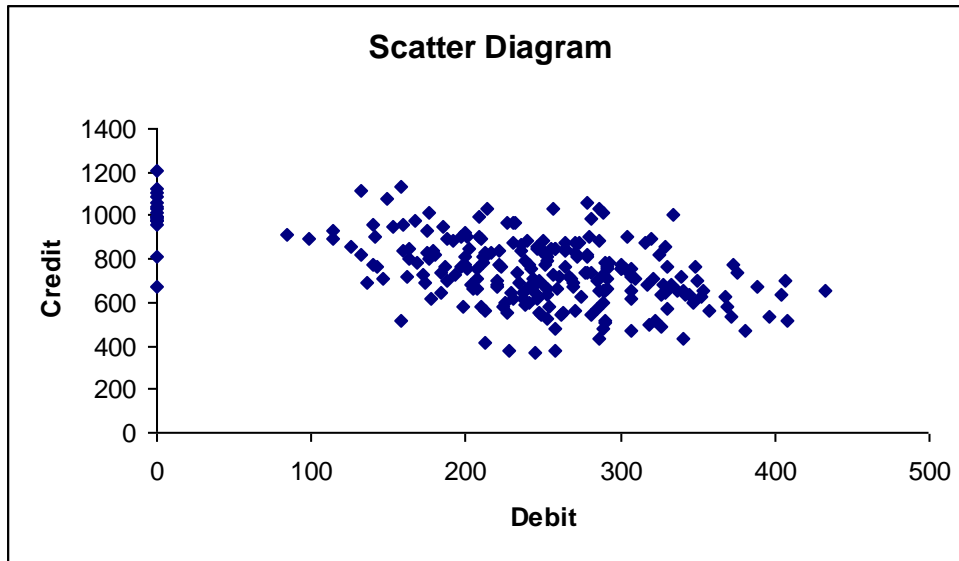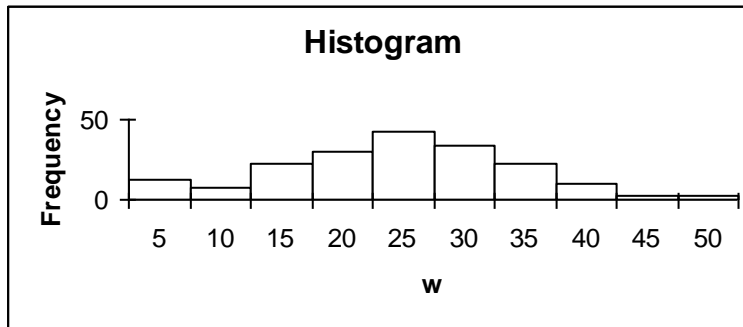
Month

b

c

d Trade has been increasing but imports have increased faster than exports to Mexico.
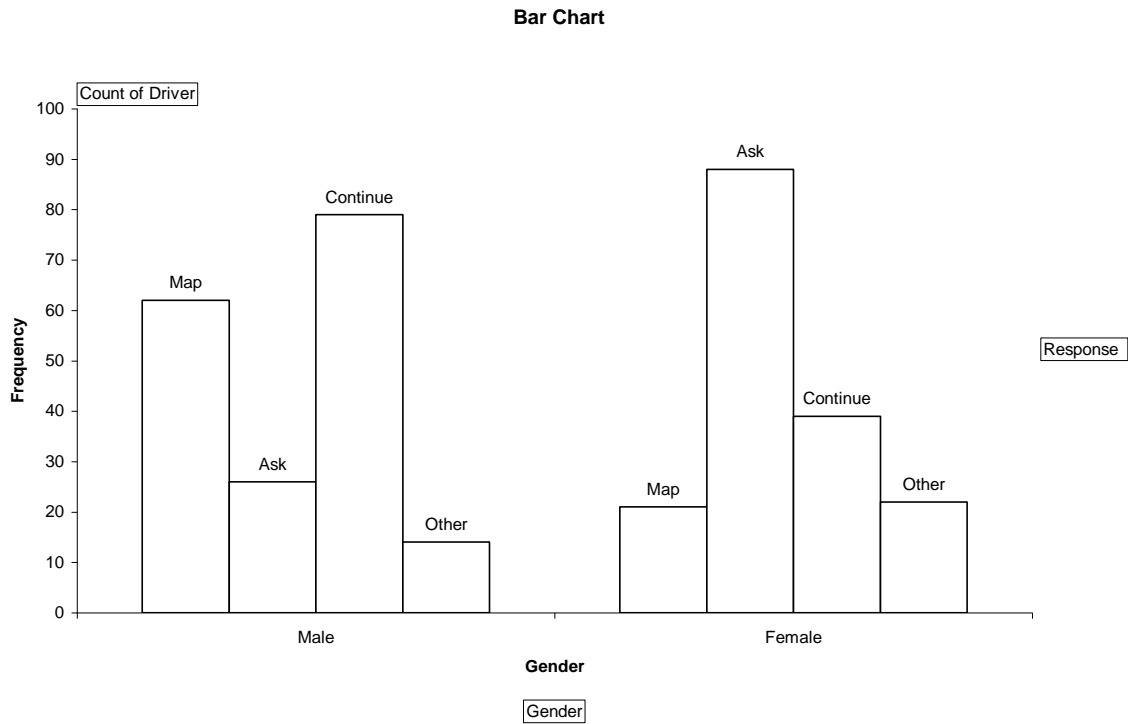
2.106

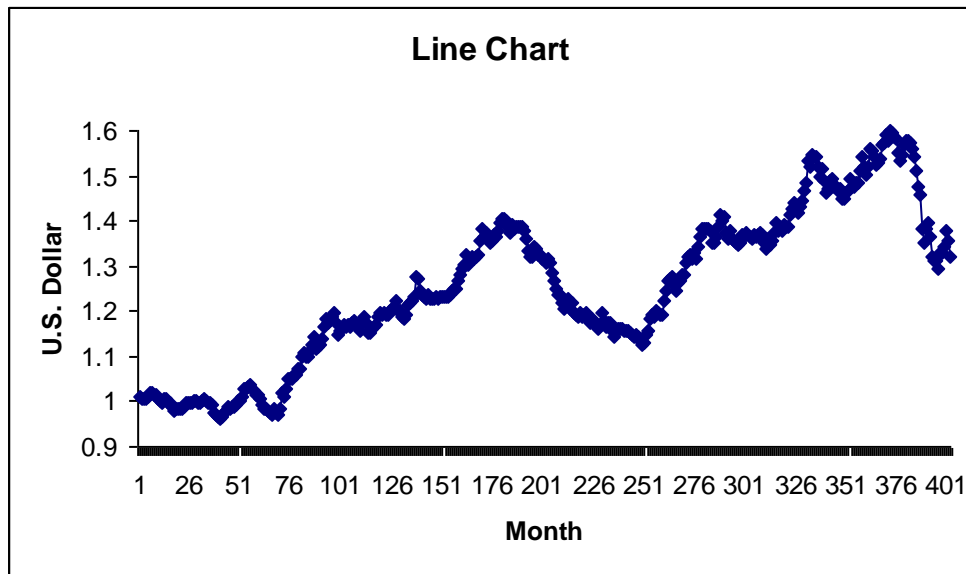There is a moderately strong negative linear relationship.

2.107

The histogram is almost bell shaped (slightly bimodal). Many people gain between 10 and 35 pounds.
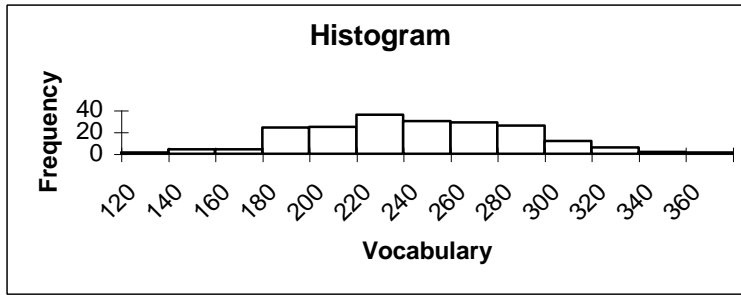
2.108

Bar Chart

There are large differences between male and female responses. There is a strong relationship between gender and what drivers do when lost.
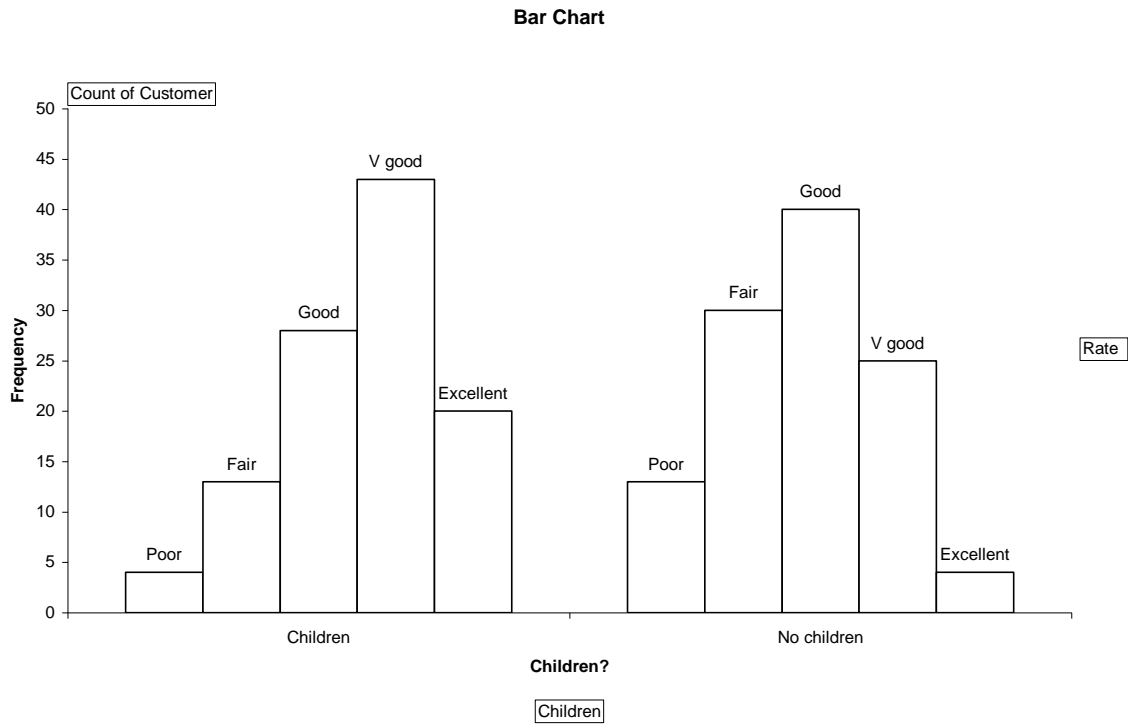
2.109

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.
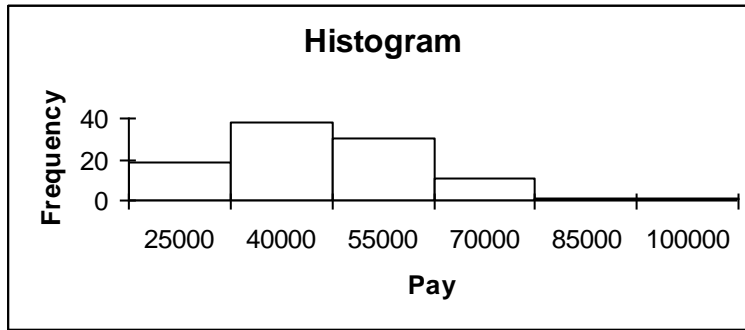
2.110

Histogram

Frequency vs Vocabulary

Most vocabularies lie between 160 and 280 words.

2.111

Bar Chart

Count of Customer

Frequency vs Children?

Children: Poor, Fair, Good, V good, Excellent

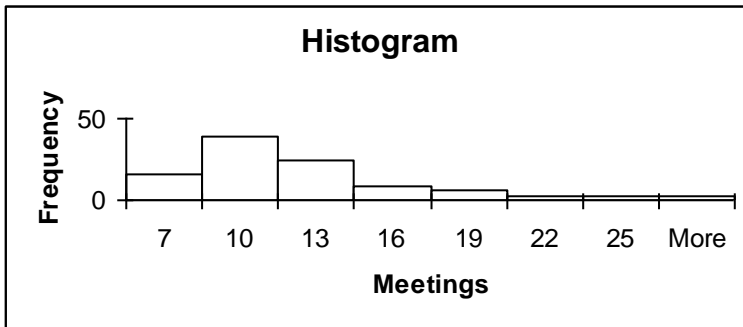No children: Poor, Fair, Good, V good, Excellent

Rate

Children

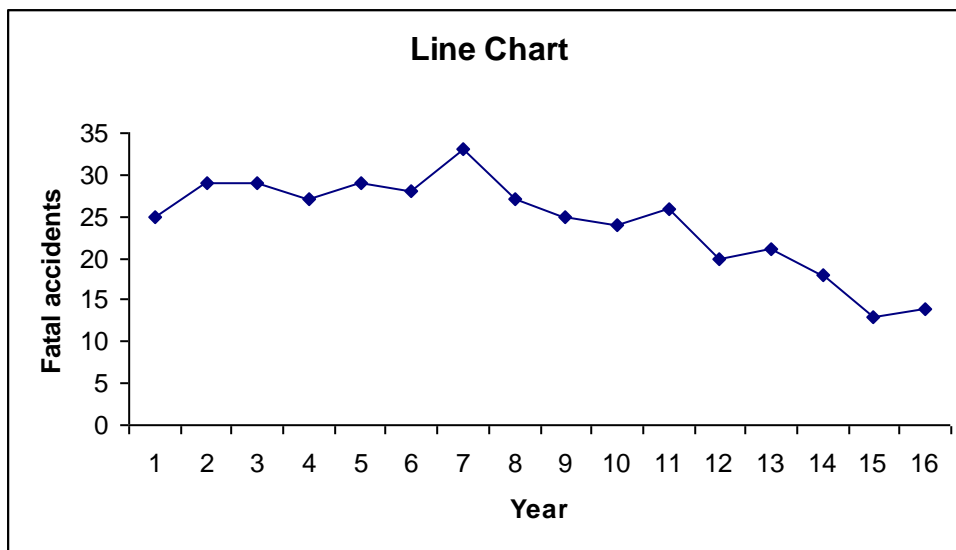The rating and whether the children of customers accompanied them are related.

2.112

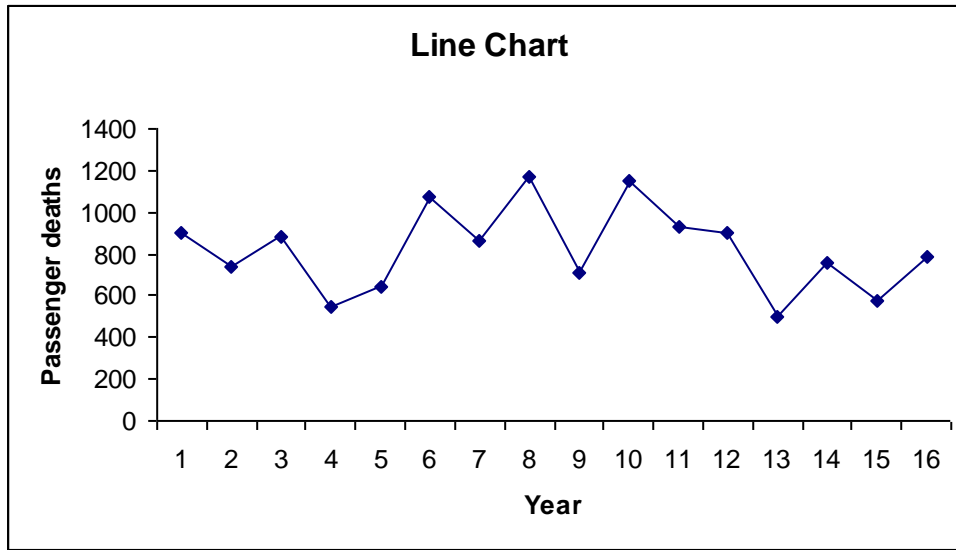
Most directors earned between $25,000 and $55,000.

2.113

Most directors attended less than 13 meetings.

2.114 Fatal accidents

Passenger deaths

Line Chart
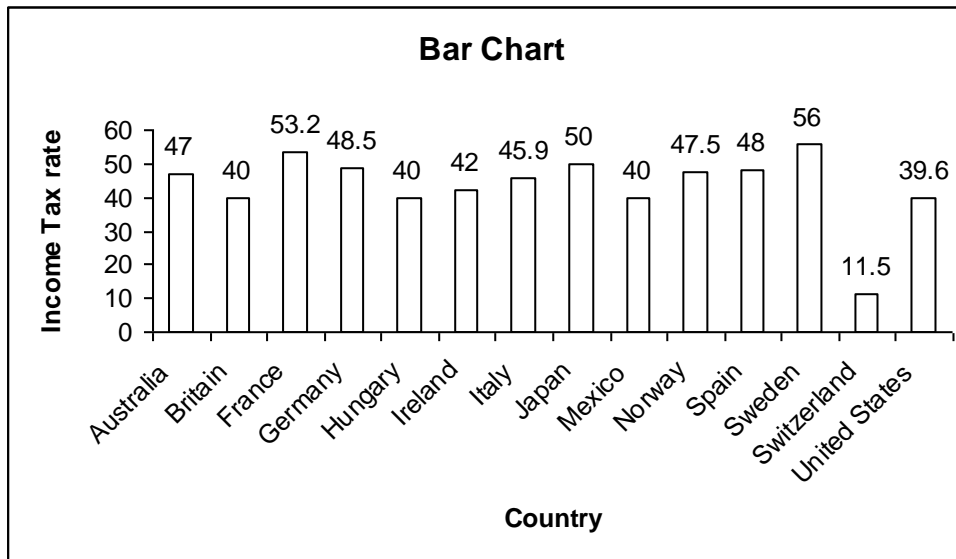

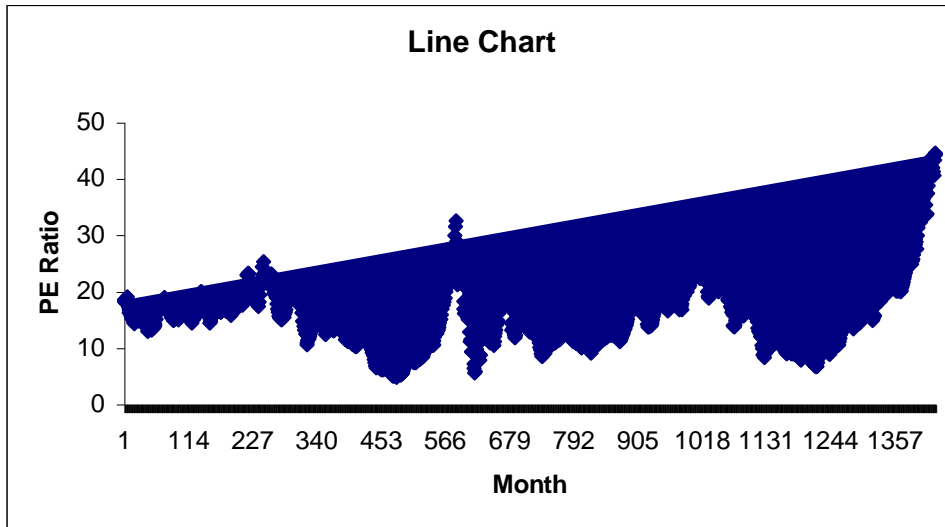
Safety has not improved using the number of passenger deaths. However, using the number of fatal accidents, safety has improved.
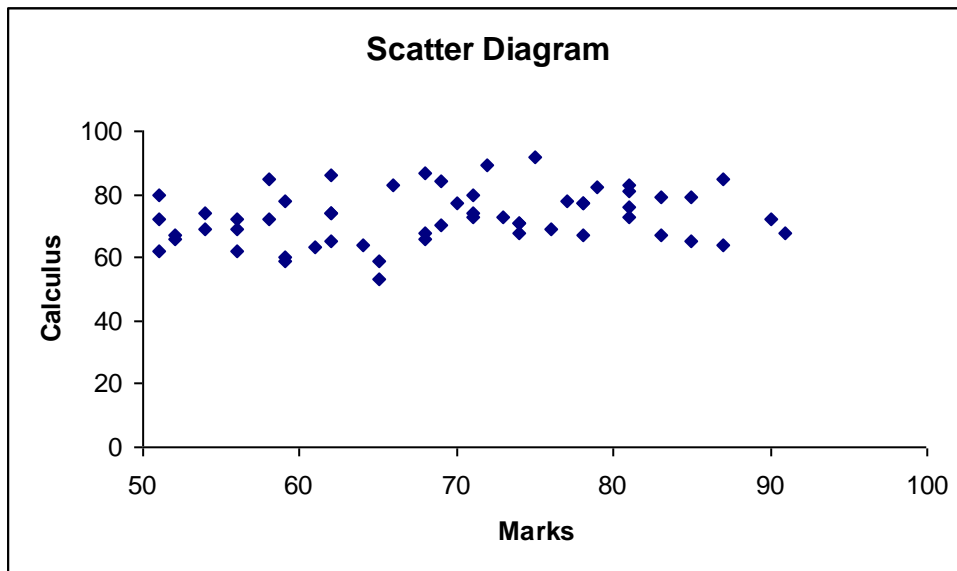

2.115

Bar Chart

All countries, except Switzerland set their highest income tax rate at about 40% or higher.
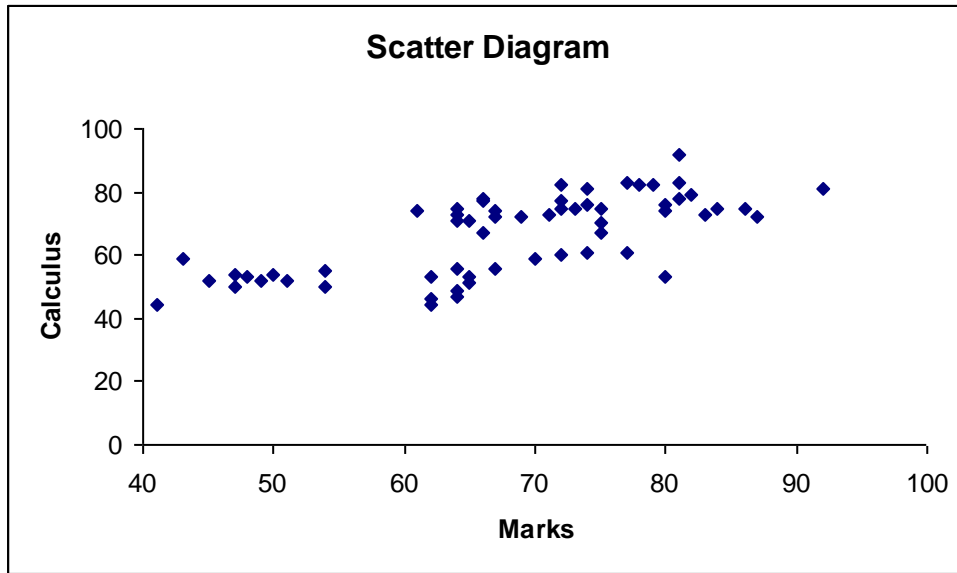
2.116

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.

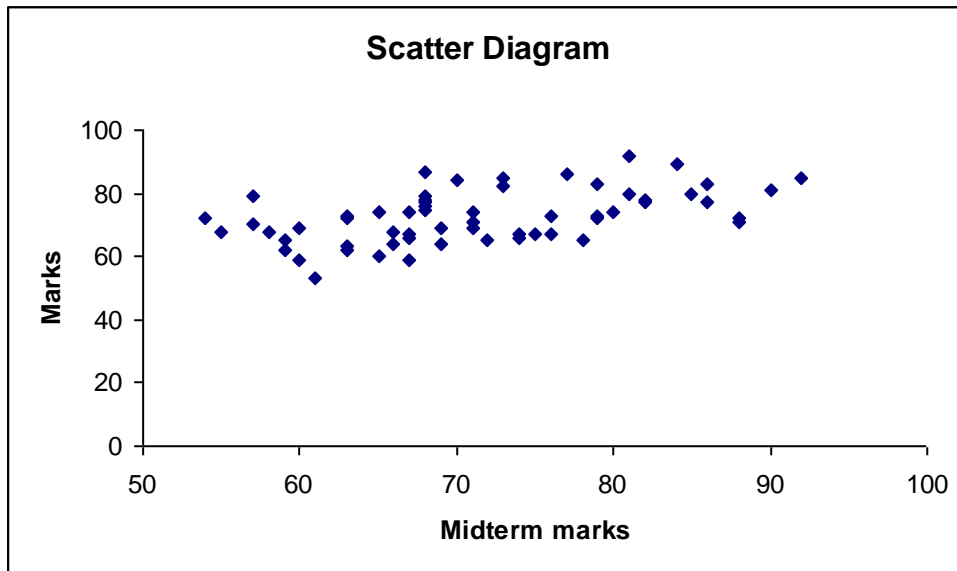2.117 Business Statistics course (Example 2.6)

Mathematical Statistics course (Example 2.7)

Scatter Diagram

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)

Scatter Diagram

Mathematical Statistics course (Example 2.7)

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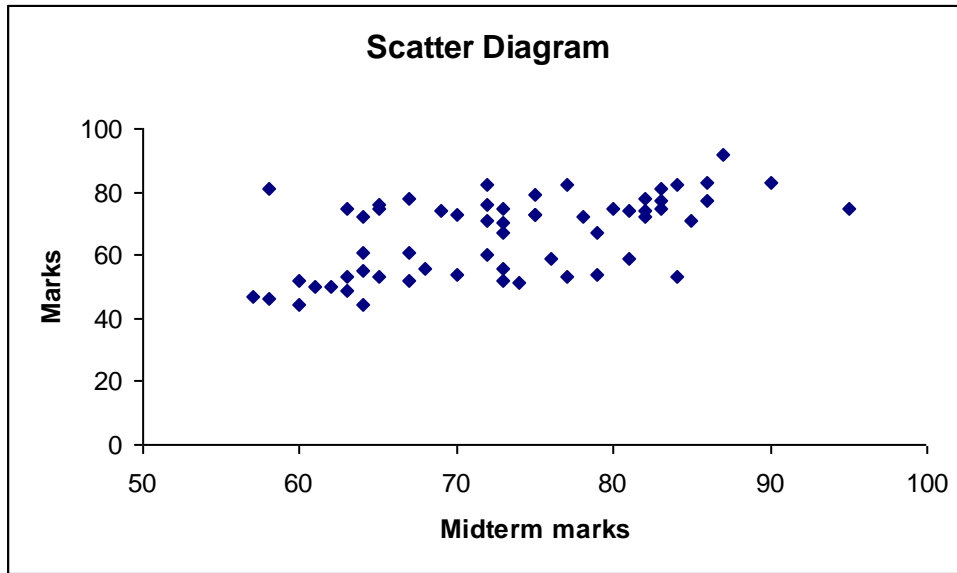
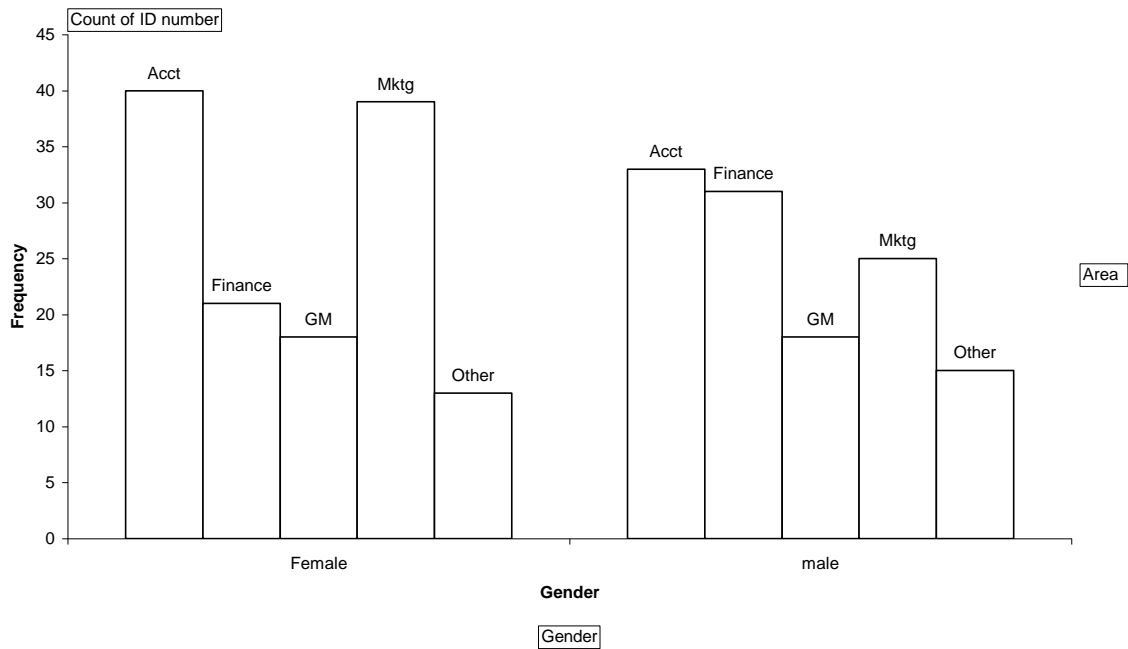The relationship between midterm marks and final marks appear to be similar for both statistics courses.

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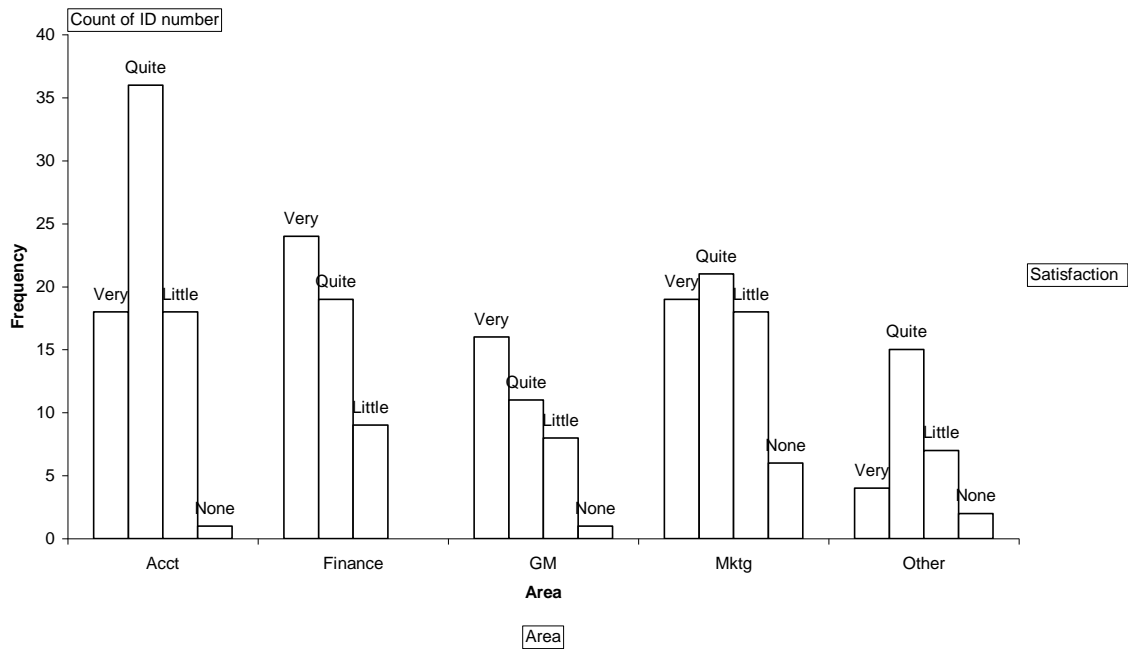
Area and job satisfaction are related. Graduates who work in finance and general management appear to be more satisfied than those in accounting, marketing/sales, and others.

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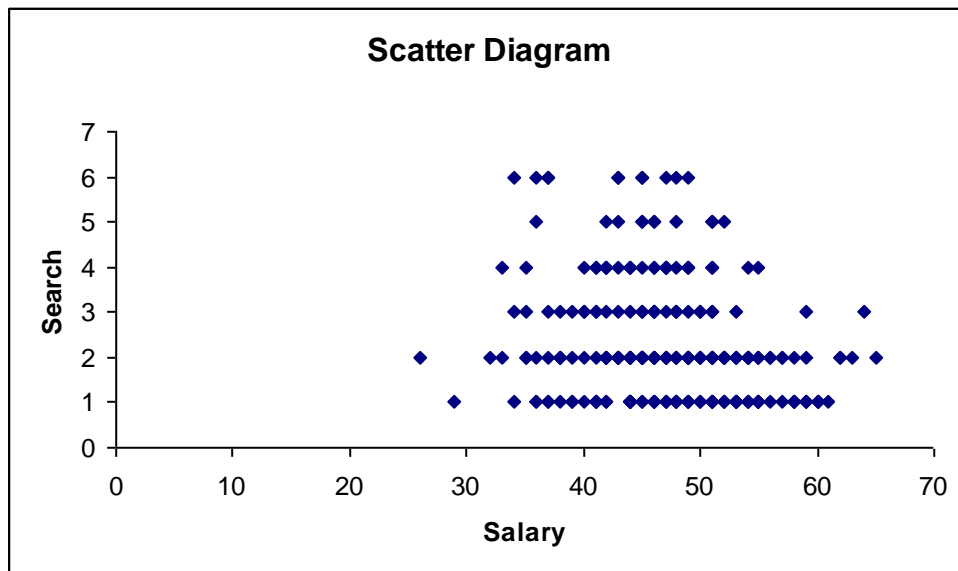
There is no linear relationship between salary and the time needed to land a job.