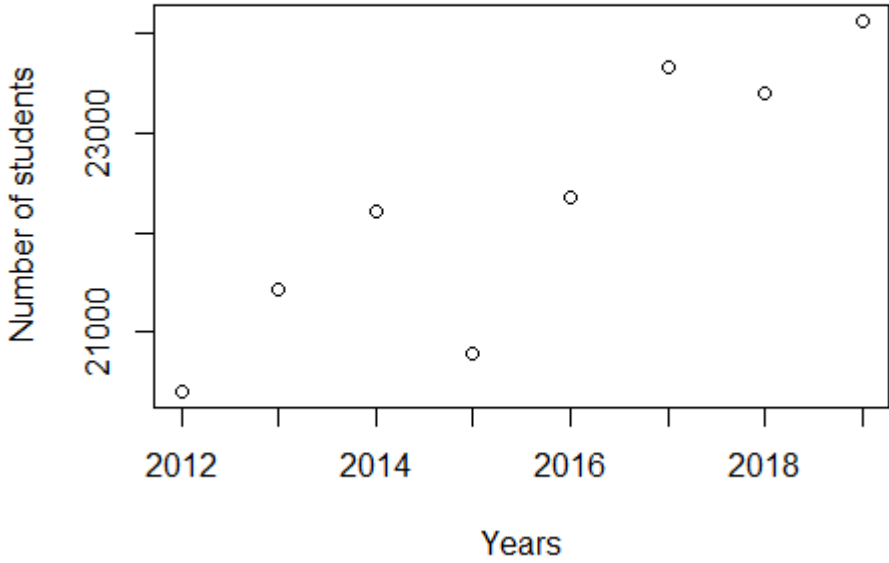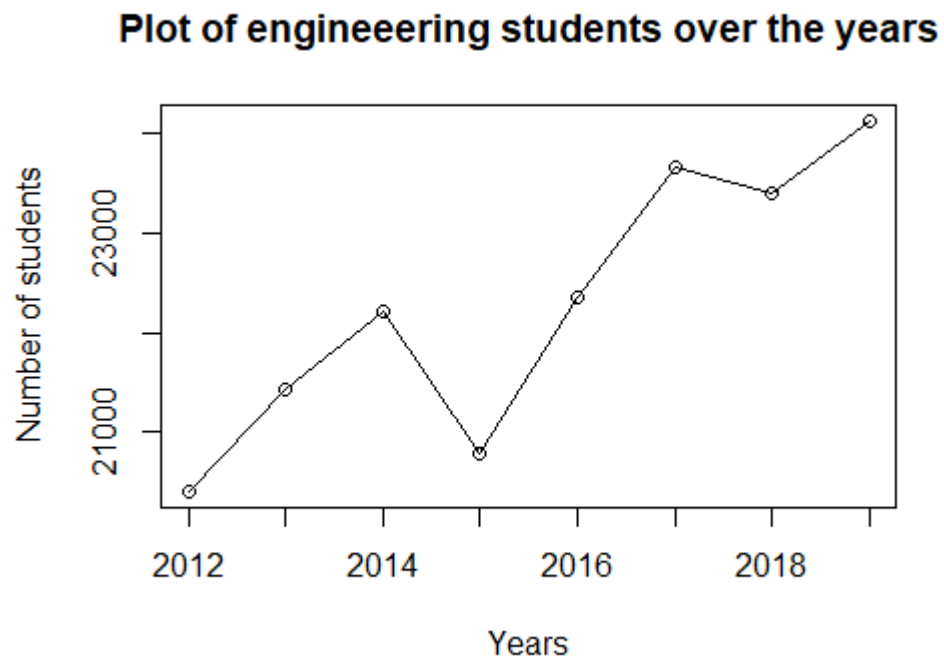## Tutorial 3 sample answer

Question 1

<table>
<tr>
<td>a)</td>
<td>

Command/code:
```
year <- 2012:2019
engineering <- c(20397, 21432, 22206, 20778, 22362,
                 23669, 23400, 24137)
science <- c(10680, 11561, 11690, 10592, 11858,
             13100, 11796, 12267)
technology <- c(5124, 6679, 6828, 6200, 9553, 10809,
                11396, 10682)
```
</td>
</tr>
<tr>
<td>b),
c)</td>
<td>

Command/code:
```
plot(x=year, y=engineering, main="Plot of
engineeering students over the years", ylab="Number
of students", xlab="Years")

#OR
plot(engineering~year)
```

Output:

</td>
</tr>
<tr>
<td>d)</td>
<td>

Command/code:
```
plot(x=year, y=engineering, main="Plot of
engineeering students over the years", ylab="Number
of students", xlab="Years", type="o")
```
</td>
</tr>
</table>
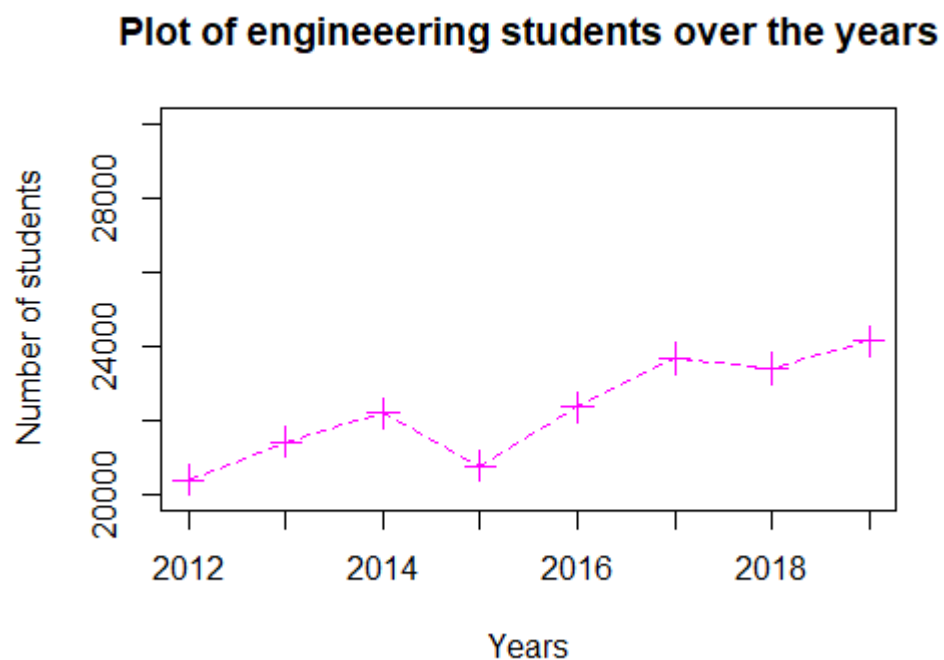
Output:

Plot of engineeering students over the years

e) | Feel free to play around the argument for the plot. For example:

```
plot(x=year, y=engineering, main="Plot of
engineeering students over the years", ylab="Number
of students", xlab="Years", type="o", col="magenta",
pch=3, cex=1.5, lty=2, lwd=1, ylim=c(20000,30000))
```

Output:

Plot of engineeering students over the years

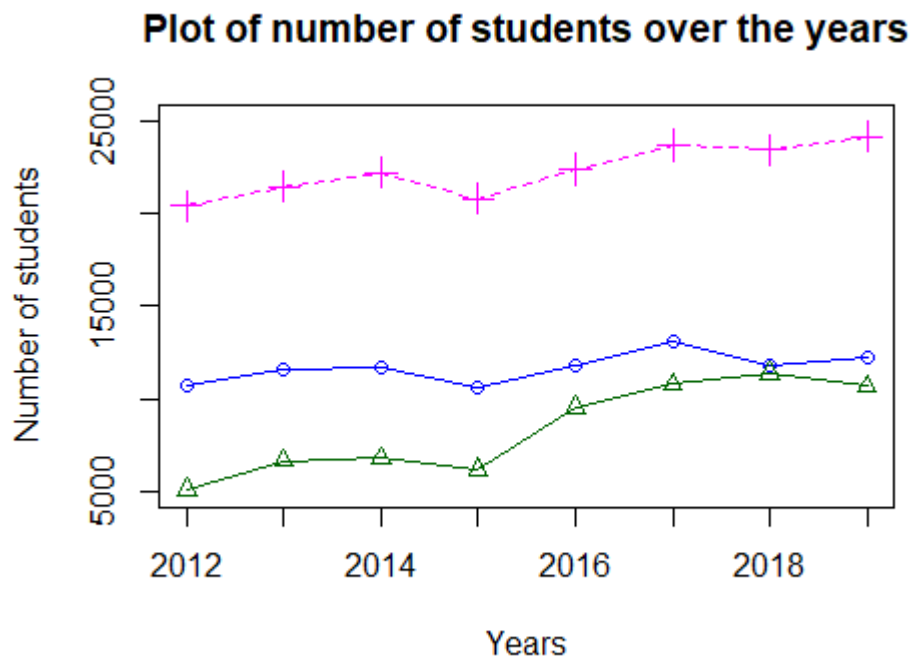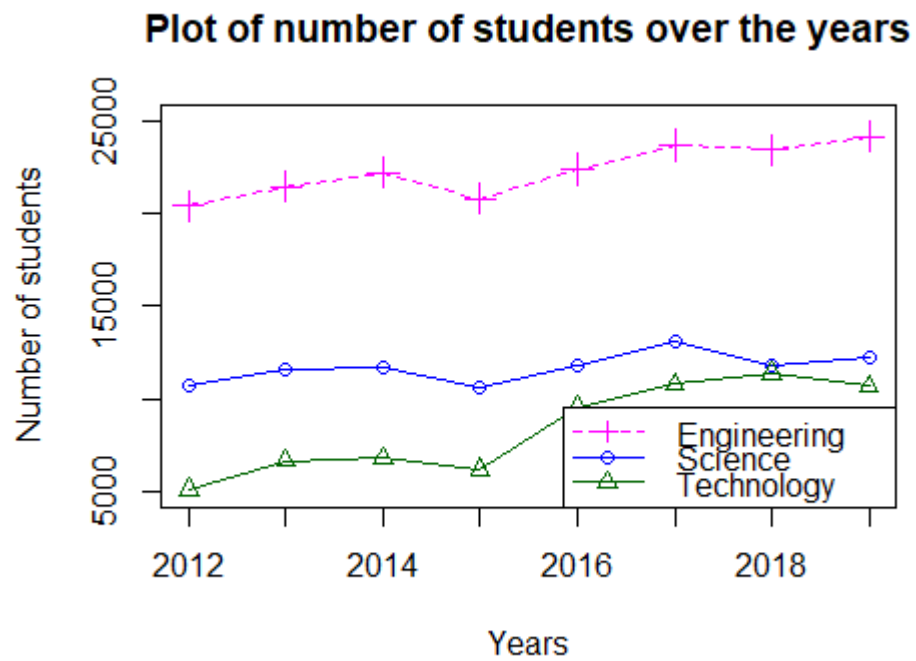|	
f)	Command/code: ``` plot(x=year, y=engineering, main="Plot of number of students over the years", ylab="Number of students", xlab="Years", type="o", col="magenta", pch=3, cex=1.5, lty=2, lwd=1, ylim=c(5000,25000)) points(x=year, y=science, type="o", col="blue") points(x=year, y=technology, type="o", col="darkgreen", pch=2) ``` Output: Plot of number of students over the years
g)	Command/code: ``` plot(x=year, y=engineering, main="Plot of number of students over the years", ylab="Number of students", xlab="Years", type="o", col="magenta", pch=3, cex=1.5, lty=2, lwd=1, ylim=c(5000,25000)) points(x=year, y=science, type="o", col="blue") points(x=year, y=technology, type="o", col="darkgreen", pch=2) legend(x="bottomright", legend=c("Engineering", "Science", "Technology"), pch=c(3,1,2), col=c("magenta","blue","darkgreen"), lty=c(2,1,1)) ```

Output:

Plot of number of students over the years

Legend:
- Engineering
- Science
- Technology

X-axis: Years (2012, 2014, 2016, 2018)
Y-axis: Number of students (5000, 15000, 25000)

Question 2

a)	Command/code:

```
data(mtcars)
hist(mtcars$mpg, main="Histogram of mpg", xlab="mpg")
```

Output:

Histogram of mpg

X-axis: mpg (10, 15, 20, 25, 30, 35)
Y-axis: Frequency (0, 2, 4, 6, 8, 10)
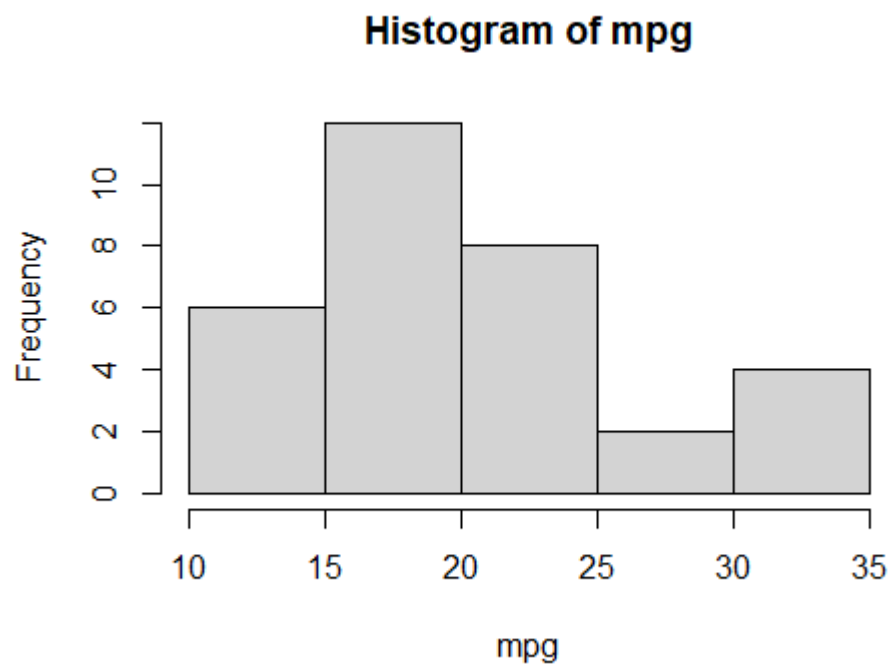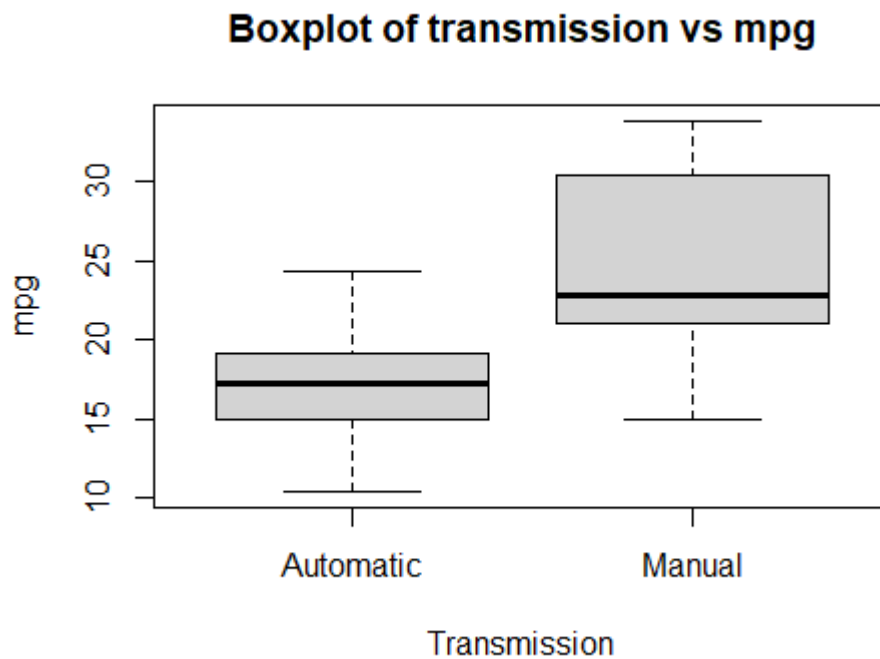
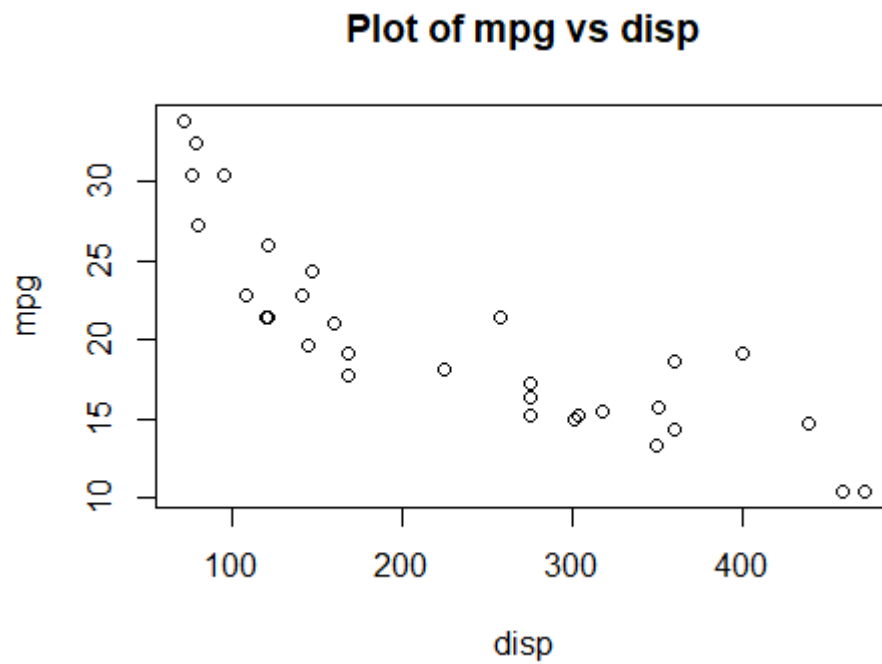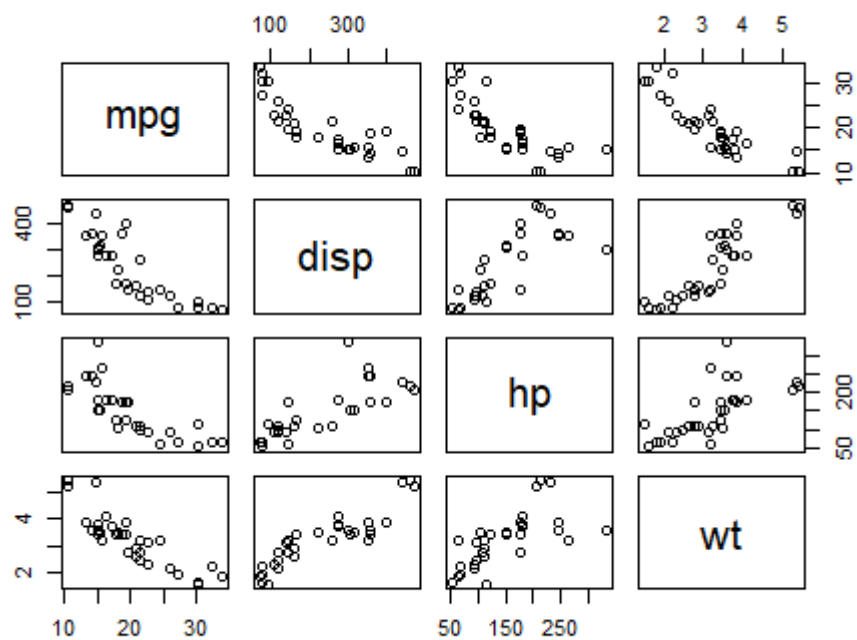|	
b)	**Command/code:** ``` boxplot(mpg~am, data=mtcars, names=c("Automatic","Manual"), xlab="Transmission", main="Boxplot of transmission vs mpg") ``` Output: **Boxplot of transmission vs mpg**
c)	**Command/code:** ``` plot(mpg~disp, data=mtcars, main="Plot of mpg vs disp") #OR plot(x=mtcars$disp, y=mtcars$mpg, main="Plot of mpg vs disp") ```

Output:

Plot of mpg vs disp

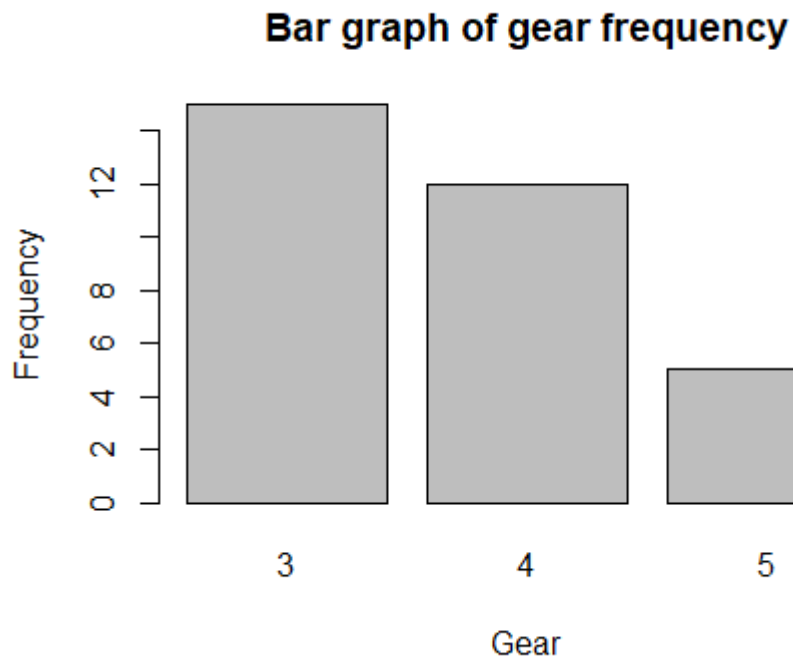| d)	Command/code:

```
pairs(~mpg+disp+hp+wt, mtcars)
```

Output:

e)	Command/code:

```
barplot(table(mtcars$gear), xlab="Gear",
ylab="Frequency", main="Bar graph of gear frequency")
```

Output:

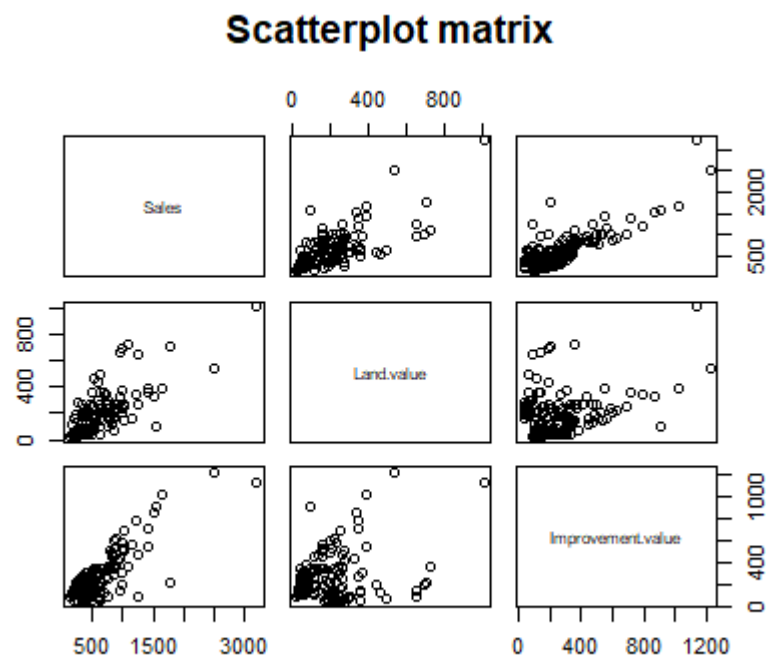**Bar graph of gear frequency**

Question 3

a)	Command/code:

```
property_sales <- read.csv(file.choose())

pairs(~Sales+Land.value+Improvement.value,
      data=property_sales,
      main="Scatterplot matrix")
```
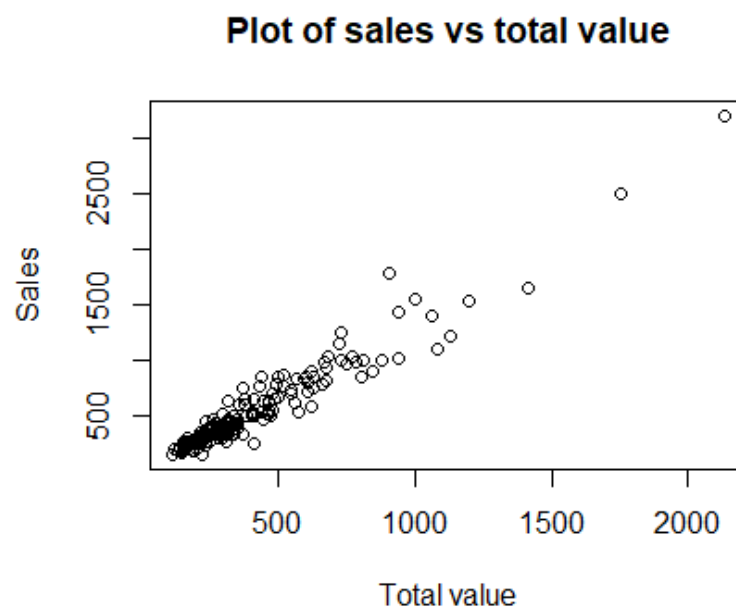
	Output:
	Scatterplot matrix
b)	Command/code:
| | ```
property_sales$total <- property_sales$Land.value +
    property_sales$Improvement.value
plot(x=property_sales$total,
    y=property_sales$Sales,
    main="Plot of sales vs total value",
    xlab="Total value", ylab="Sales")
``` |
	Output:
	Plot of sales vs total value

c)	Command/code:
	
	``
	property_sales$total <- property_sales$Land.value +
	    property_sales$Improvement.value
	plot(x=property_sales$total,
	    y=property_sales$Sales,
	    main="Plot of sales vs total value",
	    xlab="Total value", ylab="Sales")
	curve(-16.5+1.36*x, from=0, to=2500, add=TRUE,
	    col="red", lty=2)
	``
	
	Output:
	
	Plot of sales vs total value

d)	Command/code:
	
	``
	property_sales$total <- property_sales$Land.value +
	    property_sales$Improvement.value
	plot(x=property_sales$total,
	    y=property_sales$Sales,
	    main="Plot of sales vs total value",
	    xlab="Total value", ylab="Sales")
	curve(-16.5+1.36*x, from=0, to=2500, add=TRUE,
	    col="red", lty=2)
	legend("topleft", legend="fitted line", lty=2,
	col="red")
	``

Output:

Plot of sales vs total value

e) | Command/code:

```
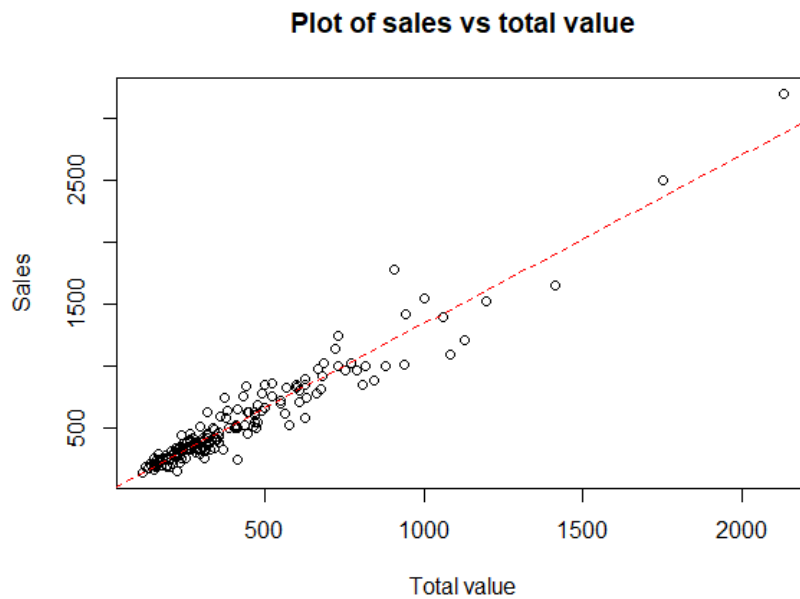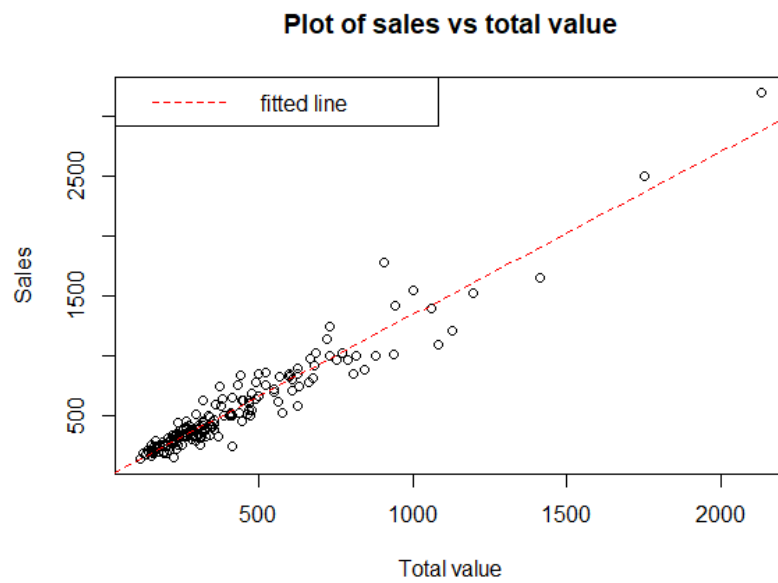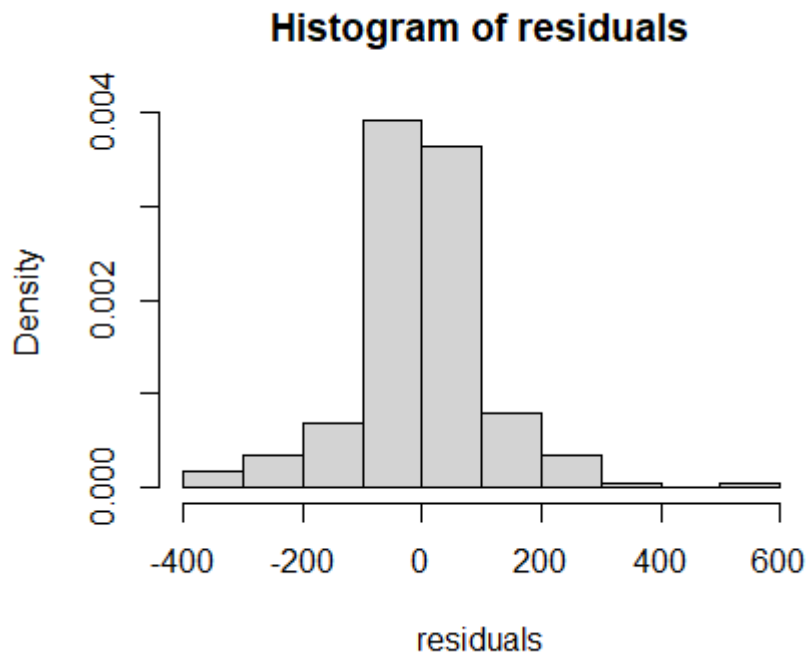residuals <- property_sales$Sales -
            (-16.5+1.36*property_sales$total)
hist(residuals, freq=FALSE)
```

Output:

Histogram of residuals

f)	Command/code:
	
	``
	residuals <- property_sales$Sales –
	            (-16.5+1.36*property_sales$total)
	hist(residuals, freq=FALSE)
	curve(dnorm(x, mean=mean(residuals),
	      sd=sd(residuals)), from=-400, to=600, add=TRUE,
	      col="red")
	``
	
	Output:
	
	Histogram of residuals