1. The following table gives the daily wages in rupees in a commercial organisation:

Daily wages (Rs.)	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50
No. of persons	3	8	24	31	50	61	38	21	12	2

Find the mean, median, mode, standard deviation and quartile deviation.

```
> low = seq(30, 48, 2)
> high = seq(32, 50, 2)
> x = (high + low) / 2
> f = c(3, 8, 24, 31, 50, 61, 38, 21, 12, 2)
> data = data.frame(x, f)
> mean = mean(rep(x, f))
>
> cf = cumsum(f)
> n = sum(f)
> mc = min(which(cf >= n/2))
> h = 2
> fr = f[mc]
> c = cf[mc - 1]
> l = x[mc] - h/2
> median = l + ((n/2 - c) / fr) * h
>
> m = which(f == max(f))
> fm = f[m]
> f1 = f[m - 1]
> f2 = f[m + 1]
> l = x[m] - h/2
> mode = l + (fm - f1)/(2*fm - f1 - f2) * h
>
> sd = sd(rep(x, f))
>
> q = c()
> cr = c()
> h = c()
> l = c()
> qdata = c()
> for(i in c(1, 2, 3)) {
+ q = c(q, min(which(cf >= i*n/4)))
+ cr = c(cr, cf[q[i] - 1])
+ h = c(h, high[q[i]] - low[q[i]])
+ l = c(l, x[q[i]] - h[i]/2)
+ qdata = c(qdata, l[i] + (h[i] / f[q[i]]) * ((i*n/4) - cr[i]))
+ }
>
> qd = (qdata[3] - qdata[1]) / 2
>
> data
```

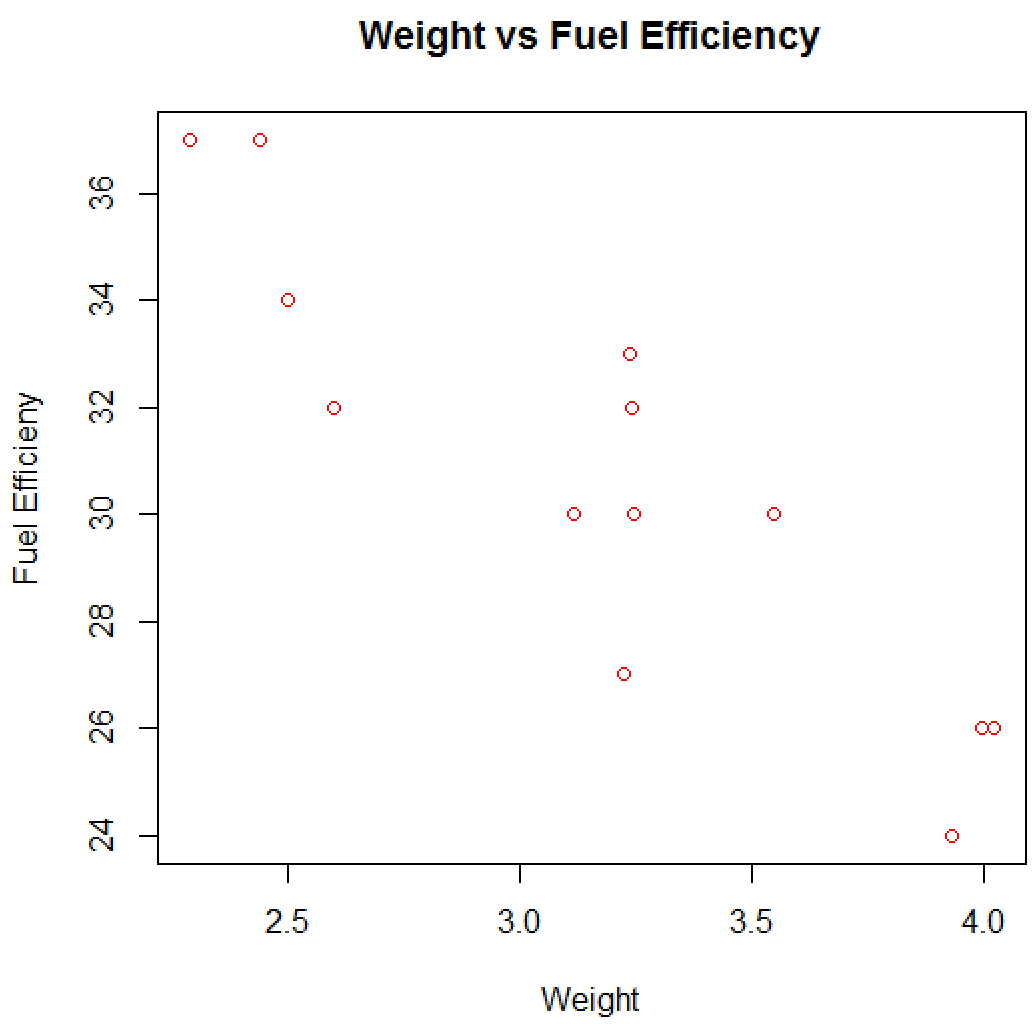
```
    x  f
1  31  3
2  33  8
3  35 24
4  37 31
5  39 50
6  41 61
7  43 38
8  45 21
9  47 12
10 49  2
> mean
[1] 40.144
> median
[1] 40.29508
> mode
[1] 40.64706
> sd
[1] 3.605449
> qd
[1] 2.389219
```

2. The following table gives the weight(x) (in 1000 lbs.) and highway fuel efficiency (y) (in miles/gallon) for a sample of 13 cars. Calculate the correlation coefficient between weight and fuel efficiency of the vehicles.

Vehicle	X	Y
Chevrolet Camaro	3.545	30
Dodge Neon	2.6	32
Honda Accord	3.245	30
Lincoln Continental	3.93	24
Oldsmobile Aurora	3.995	26
Pontiac Grand Am	3.115	30
Mitsubishi Eclipse	3.235	33
BMW 3-Series	3.225	27
Honda Civic	2.44	37
Toyota Camry	3.24	32
Hyundai Accent	2.29	37
Mazda Protégé	2.5	34
Cadillac DeVille	4.02	26

```
> x = c(3.545, 2.6, 3.245, 3.93, 3.995, 3.115, 3.235, 3.225, 2.44, 3.24,
2.29, 2.5, 4.02)
> y = c(30, 32, 30, 24, 26, 30, 33, 27, 37, 32, 37, 34, 26)
> data = data.frame(x, y)
> varx = var(x)
> vary = var(y)
> varxy = var(x, y)
> cor = varxy / sqrt(varx * vary)
> data
      x  y
1  3.545 30
```

```
2  2.600 32
3  3.245 30
4  3.930 24
5  3.995 26
6  3.115 30
7  3.235 33
8  3.225 27
9  2.440 37
10 3.240 32
11 2.290 37
12 2.500 34
13 4.020 26
> cor
[1] -0.8977642
plot(x, y, main="Weight vs Fuel Efficiency", xlab="Weight", ylab="Fuel
Efficieny", col="red")
```



3.

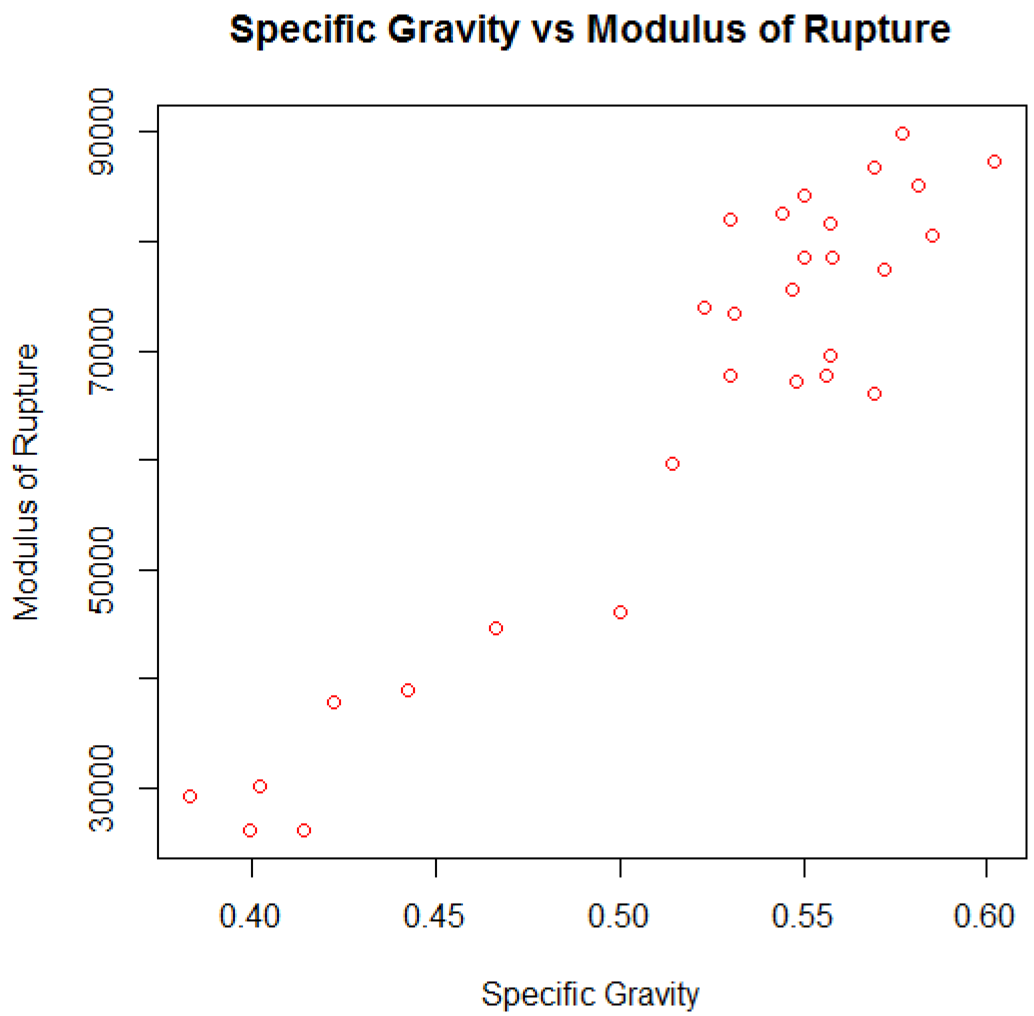
It is important that scientific researchers in the area of forest products be able to study correlation among the anatomy and mechanical properties of trees. For the study *Quantitative Anatomical Characteristics of Plantation Grown Loblolly Pine (Pinus Taeda L.) and Cottonwood (Populus deltoides Bart. Ex Marsh.) and Their Relationships to Mechanical Properties*, conducted by the Department of Forestry and Forest Products at Virginia Tech, 29 loblolly pines were randomly selected for investigation. Table 11.9 shows the resulting data on the specific gravity in grams/cm^3 and the modulus of rupture in kilopascals (kPa). Compute and interpret the sample correlation coefficient.

Specific Gravity, x **(g/cm^3)**	**Modulus of Rupture,** y **(kPa)**	**Specific Gravity,** x **(g/cm^3)**	**Modulus of Rupture,** y **(kPa)**
0.414	29,186	0.581	85,156
0.383	29,266	0.557	69,571
0.399	26,215	0.550	84,160
0.402	30,162	0.531	73,466
0.442	38,867	0.550	78,610
0.422	37,831	0.556	67,657
0.466	44,576	0.523	74,017
0.500	46,097	0.602	87,291
0.514	59,698	0.569	86,836
0.530	67,705	0.544	82,540
0.569	66,088	0.557	81,699
0.558	78,486	0.530	82,096
0.577	89,869	0.547	75,657
0.572	77,369	0.585	80,490
0.548	67,095		

```
> x = c(0.414, 0.383, 0.399, 0.402, 0.442, 0.422, 0.466, 0.5, 0.514, 0.530,
0.569, 0.558, 0.577, 0.572, 0.548, 0.581, 0.557, 0.550, 0.531, 0.55, 0.556,
0.523, 0.602, 0.569, 0.544, 0.557, 0.530, 0.547, 0.585)

> y = c(26186, 29266, 26215, 30162, 38867, 37831, 44576, 46097, 59698,
67705, 66088, 78486, 89869, 77369, 67095, 85156, 69571, 84160, 73466,
78610, 67657, 74017, 87291, 86836, 82540, 81699, 82096, 75657, 80490)

> data = data.frame(x, y)

> data

      x     y

1  0.414 26186

2  0.383 29266

3  0.399 26215

4  0.402 30162

5  0.442 38867

6  0.422 37831
```

```
7  0.466 44576
8  0.500 46097
9  0.514 59698
10 0.530 67705
11 0.569 66088
12 0.558 78486
13 0.577 89869
14 0.572 77369
15 0.548 67095
16 0.581 85156
17 0.557 69571
18 0.550 84160
19 0.531 73466
20 0.550 78610
21 0.556 67657
22 0.523 74017
23 0.602 87291
24 0.569 86836
25 0.544 82540
26 0.557 81699
27 0.530 82096
28 0.547 75657
29 0.585 80490
> cor(x, y)
[1] 0.9432149
```

```
plot(x, y, main="Specific Gravity vs Modulus of Rupture", xlab="Specific Gravity", ylab="Modulus of Rupture", col="red")
```


Specific Gravity vs Modulus of Rupture
Modulus of Rupture
30000
50000
70000
90000
0.40
0.45
0.50
0.55
0.60
Specific Gravity

4. Calculate the Spearman's rank correlation coefficient between advertisement cost and sales from the following data:

Advertisement Cost(Rs.in 1000)	39 65 62 90 82 75 25 98 36 78
Sales (Rs. in lakhs)	47 53 58 86 62 68 60 91 51 84

```
> x = c(39, 65, 62, 90, 82, 75, 25, 98, 36, 78)
> y = c(47, 53, 58, 86, 62, 68, 60, 91, 51, 84)
> cor.test(x, y, method="spearman")

        Spearman's rank correlation rho

data:  x and y
S = 30, p-value = 0.006811
alternative hypothesis: true rho is not equal to 0
sample estimates:
      rho
0.8181818
```