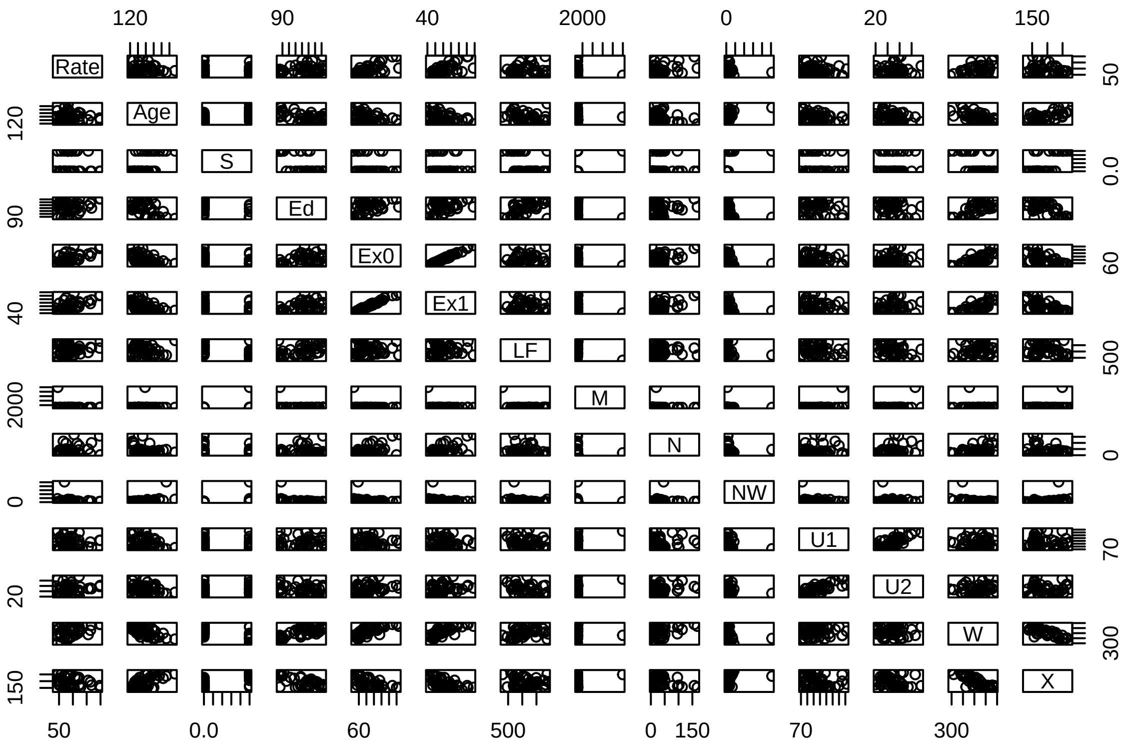
```r
# Zad 1
pairs(data)
```




```r
# Zad 2, 3
M <- cor(data, method = "pearson")
print(M["Rate",])
```

```
##       Rate         Age           S          Ed         Ex0         Ex1
##  1.00000000 -0.08951990 -0.09087073  0.32310629  0.68761660  0.66674511
##         LF           M           N          NW          U1          U2
##  0.18913745 -0.16902237  0.33749589 -0.06372231 -0.05067083  0.17706371
##          W           X
##  0.44149947 -0.18585829
```

Współczyniki dla samego rate

```r
print(M)
```

```
##             Rate          Age           S          Ed         Ex0         Ex1
## Rate  1.00000000 -0.089519902 -0.09087073  0.32310629  0.68761660  0.66674511
## Age  -0.08951990  1.000000000  0.58435534 -0.53023964 -0.50696949 -0.51317336
## S    -0.09087073  0.584355338  1.00000000 -0.70274132 -0.37354720 -0.37616753
## Ed    0.32310629 -0.530239642 -0.70274132  1.00000000  0.48326144  0.49940958
## Ex0   0.68761660 -0.506969490 -0.37354720  0.48326144  1.00000000  0.99359772
## Ex1   0.66674511 -0.513173356 -0.37616753  0.49940958  0.99359772  1.00000000
## LF    0.18913745 -0.160948824 -0.50546948  0.56117795  0.12217106  0.10634960
## M    -0.16902237  0.004461682  0.19845402 -0.22557612 -0.19533933 -0.20932621
## N     0.33749589 -0.280637618 -0.04991832 -0.01722740  0.52608277  0.51378940
## NW   -0.06372231  0.457234083  0.39708823 -0.38365025 -0.18123271 -0.18655758
## U1   -0.05067083 -0.224380599 -0.17241931  0.01810345 -0.04277496 -0.05171199
## U2    0.17706371 -0.244843390  0.07169289 -0.21568155  0.18564957  0.16922422
## W     0.44149947 -0.670055056 -0.63694543  0.73599704  0.78724481  0.79426205
```

```
## X    -0.18585829  0.629962825  0.67496961 -0.69788198 -0.63228425 -0.65072345
##              LF            M           N          NW          U1          U2
## Rate  0.1891374 -0.169022371  0.33749589 -0.06372231 -0.05067083  0.17706371
## Age  -0.1609488  0.004461682 -0.28063762  0.45723408 -0.22438060 -0.24484339
## S    -0.5054695  0.198454020 -0.04991832  0.39708823 -0.17241931  0.07169289
## Ed    0.5611780 -0.225576121 -0.01722740 -0.38365025  0.01810345 -0.21568155
## Ex0   0.1221711 -0.195339325  0.52608277 -0.18123271 -0.04277496  0.18564957
## Ex1   0.1063496 -0.209326206  0.51378940 -0.18655758 -0.05171199  0.16922422
## LF    1.0000000 -0.288299113 -0.12367222 -0.22796997 -0.22939968 -0.42076249
## M    -0.2882991  1.000000000 -0.07853513 -0.04361084  0.33547258  0.33600928
## N    -0.1236722 -0.078535135  1.00000000  0.05942204 -0.03811995  0.27042159
## NW   -0.2279700 -0.043610839  0.05942204  1.00000000 -0.21818218 -0.10460448
## U1   -0.2293997  0.335472578 -0.03811995 -0.21818218  1.00000000  0.74592482
## U2   -0.4207625  0.336009279  0.27042159 -0.10460448  0.74592482  1.00000000
## W     0.2946323 -0.101849407  0.30826271 -0.34330695  0.04485720  0.09207166
## X    -0.1923744  0.213000458 -0.12466424  0.31281286 -0.11491193 -0.05777706
##                W           X
## Rate  0.44149947 -0.18585829
## Age  -0.67005506  0.62996283
## S    -0.63694543  0.67496961
## Ed    0.73599704 -0.69788198
## Ex0   0.78724481 -0.63228425
## Ex1   0.79426205 -0.65072345
## LF    0.29463231 -0.19237444
## M    -0.10184941  0.21300046
## N     0.30826271 -0.12466424
## NW   -0.34330695  0.31281286
## U1    0.04485720 -0.11491193
## U2    0.09207166 -0.05777706
## W     1.00000000 -0.84417172
## X    -0.84417172  1.00000000
```

Wszystkie współczynniki

Zad 3 Namocniejszy wpływ mają EX1, EX0

Pojawia się problem współliniowości w parach: Age S X, W Ed EX0 EX1

```r
# Zad 4
model <- lm(Rate ~ ., data = data)

r_squared <- summary(model)$r.squared
adj_r_squared <- summary(model)$adj.r.squared

cat("R^2: ", r_squared, "\n")
```

```
## R^2:  0.7330418
```

```r
cat("Adjusted R^2: ", adj_r_squared, "\n")
```

```
## Adjusted R^2:  0.6278765
```

```r
coefficients <- summary(model)$coefficients
cat("Równanie regresji:\n")
```

```
## Równanie regresji:
```

```r
cat("Rate = ", coefficients[1, 1], " + ", paste(coefficients[-1, 1], "*", rownames(coefficients)[-1], co
```

```
## Rate =  -514.5976  +  1.07818323651247 * Age + 5.51361819142129 * S + 1.51246416450105 * Ed + 1.87690
```

```r
new_data <- data.frame(Age = 150, S = 1, Ed = 90, Ex0 = 50, Ex1 = 60, LF = 500, M = 950, N = 30, NW = 30

predicted_rate <- predict(model, newdata = new_data)
cat("Prognozowana wartosc Rate: ", predicted_rate, "\n")
```

```
## Prognozowana wartosc Rate:  36.24069
```

```r
# Zad 5
model_a <- lm(Rate ~ Ex1 + X + Ed + Age + U2, data = data)
model_b <- lm(Rate ~ Ex0 + LF + M + N + NW, data = data)

ra_squared <- summary(model_a)$r.squared
rb_squared <- summary(model_b)$r.squared

adj_ra_squared <- summary(model_a)$adj.r.squared
adj_rb_squared <- summary(model_b)$adj.r.squared

cat("Ra^2: ", ra_squared, "\n")
```

```
## Ra^2:  0.6790068
```

```r
cat("Adjusted Ra^2: ", adj_ra_squared, "\n")
```

```
## Adjusted Ra^2:  0.6398613
```

```r
cat("Rb^2: ", rb_squared, "\n")
```

```
## Rb^2:  0.4918136
```

```r
cat("Adjusted Rb^2: ", adj_rb_squared, "\n")
```

```
## Adjusted Rb^2:  0.4298397
```

```r
# Zad 6
best_model <- which.max(c(adj_r_squared, adj_ra_squared, adj_rb_squared))
cat("Best model: Model", best_model, "\n")
```

```
## Best model: Model 2
```

```r
coefficientsa <- summary(model_a)$coefficients
print(coefficientsa[-1, 1])
```

```
##       Ex1         X        Ed       Age        U2 
## 1.2688878 0.5252569 1.6652227 1.1067425 1.1204328
```

```r
# Zad 7
predicted_rate <- predict(model_a, newdata = new_data)
cat("Prognozowana wartosc Rate: ", predicted_rate, "\n")
```

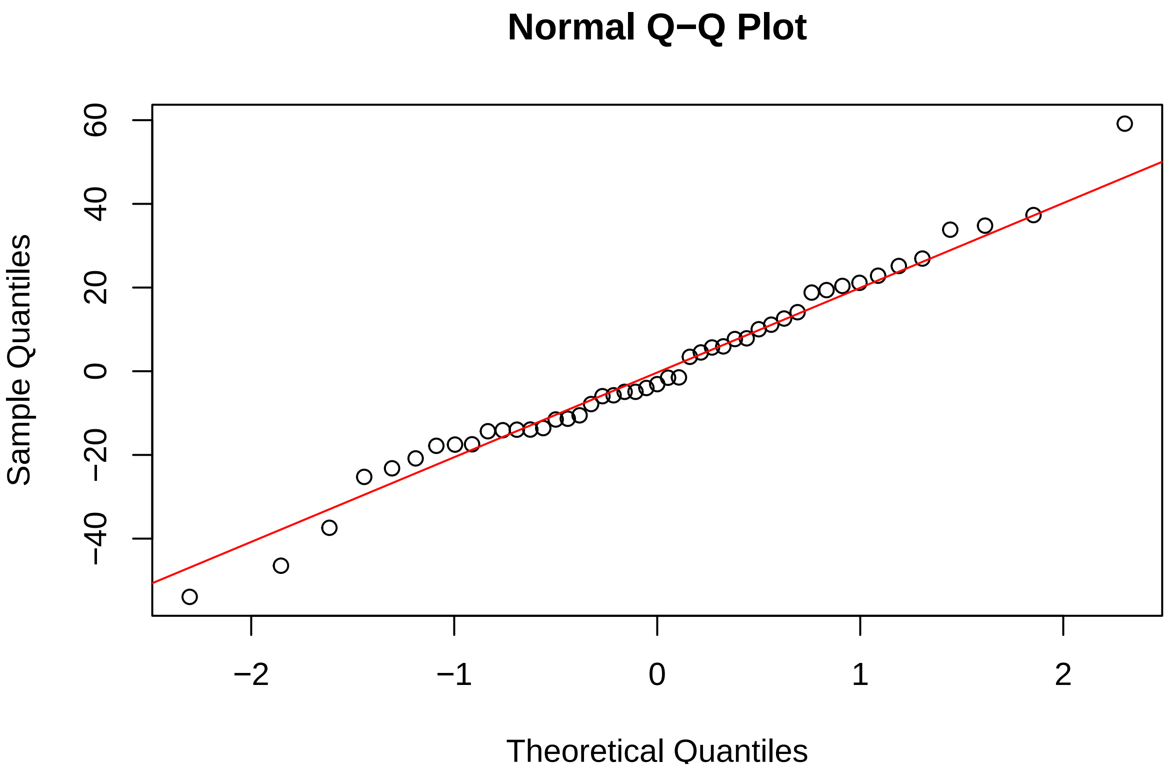
```
## Prognozowana wartosc Rate:  62.33506
```

```r
print(head(data, 1))
```

```
##   Rate Age S Ed Ex0 Ex1  LF   M  N  NW  U1 U2   W   X
## 1 79.1 151 1 91  58  56 510 950 33 301 108 41 394 261
```

Widać że wartoś Rate jest zdecydowanie bliższa faktycznej próbie w modelu a niż w modelu który zawiera wszystkie zmienne objaśniające

```
# Zad 8
residuals <- resid(model_a)
qqnorm(residuals)
qqline(residuals, col = "red")
```



Jest spełnione założenie o normalnosci wektora błędów