Question_2

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Question 2

First we will fit the Linear regression model.

```
library(faraway)
library(MASS)

# Load the dataset
data(savings)
# View the structure of the dataset
str(savings)
```

```
## 'data.frame':    50 obs. of  5 variables:
##  $ sr   : num  11.43 12.07 13.17 5.75 12.88 ...
##  $ pop15: num  29.4 23.3 23.8 41.9 42.2 ...
##  $ pop75: num  2.87 4.41 4.43 1.67 0.83 2.85 1.34 0.67 1.06 1.14 ...
##  $ dpi  : num  2330 1508 2108 189 728 ...
##  $ ddpi : num  2.87 3.93 3.82 0.22 4.56 2.43 2.67 6.51 3.08 2.8 ...
```

```
# (1) Fit a linear regression model
model <- lm(sr ~ pop15 + pop75 + dpi + ddpi, data = savings)
model
```

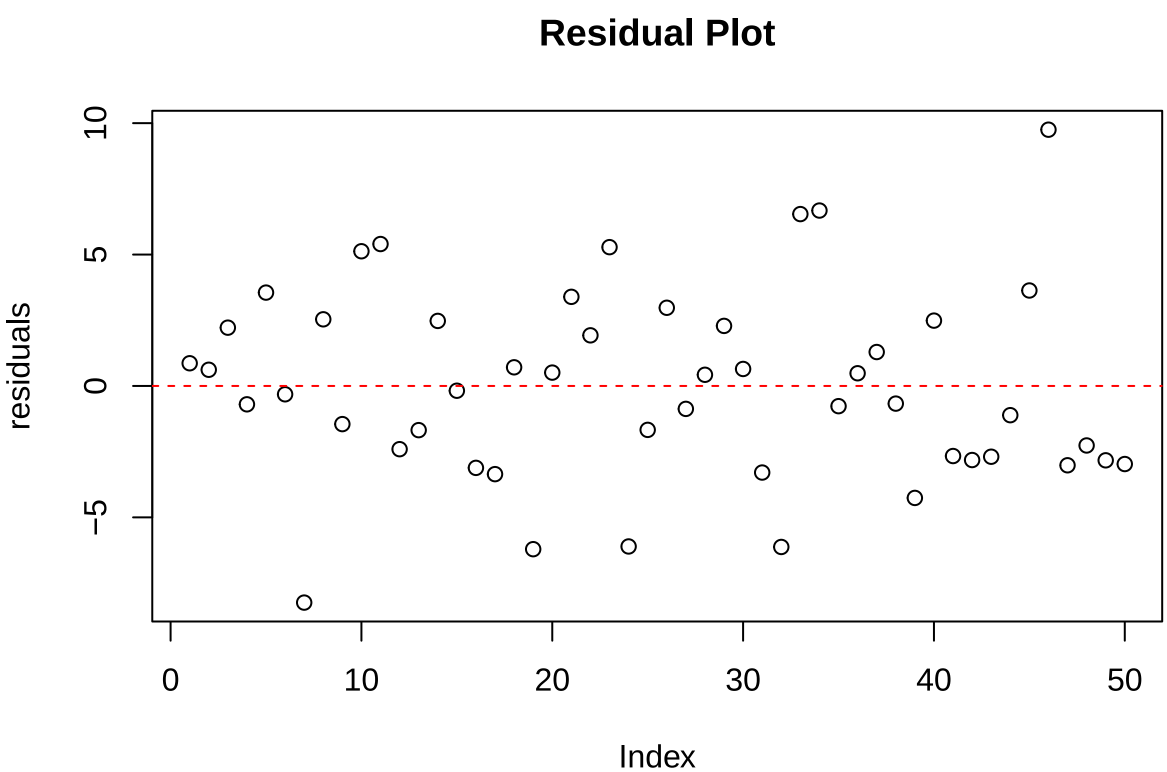
```
##
## Call:
## lm(formula = sr ~ pop15 + pop75 + dpi + ddpi, data = savings)
##
## Coefficients:
## (Intercept)        pop15        pop75          dpi         ddpi
##  28.5660865   -0.4611931   -1.6914977   -0.0003369    0.4096949
```

```
summary(model)
```

```
##
## Call:
## lm(formula = sr ~ pop15 + pop75 + dpi + ddpi, data = savings)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
```

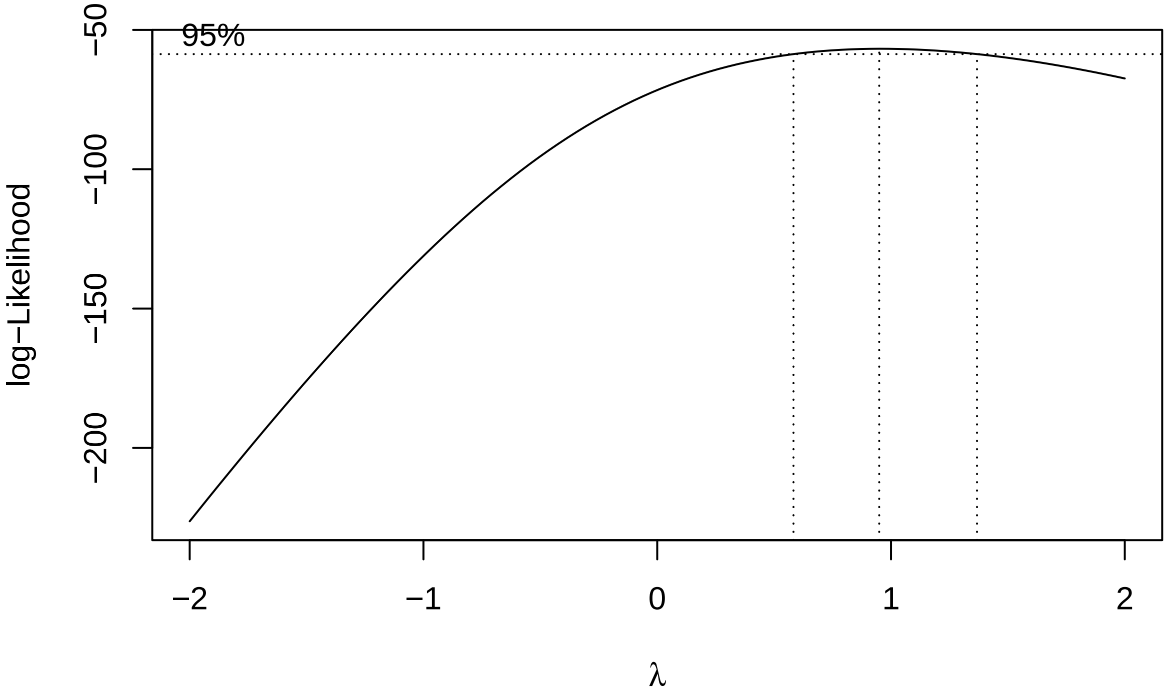
```
## -8.2422 -2.6857 -0.2488  2.4280  9.7509
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) 28.5660865  7.3545161   3.884 0.000334 ***
## pop15       -0.4611931  0.1446422  -3.189 0.002603 **
## pop75       -1.6914977  1.0835989  -1.561 0.125530
## dpi         -0.0003369  0.0009311  -0.362 0.719173
## ddpi         0.4096949  0.1961971   2.088 0.042471 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.803 on 45 degrees of freedom
## Multiple R-squared:  0.3385, Adjusted R-squared:  0.2797
## F-statistic: 5.756 on 4 and 45 DF,  p-value: 0.0007904
```

```r
#Examining the residuals
residuals <- residuals(model)
plot(residuals)
abline(h = 0, col = "red", lty = 2)
title("Residual Plot")
```

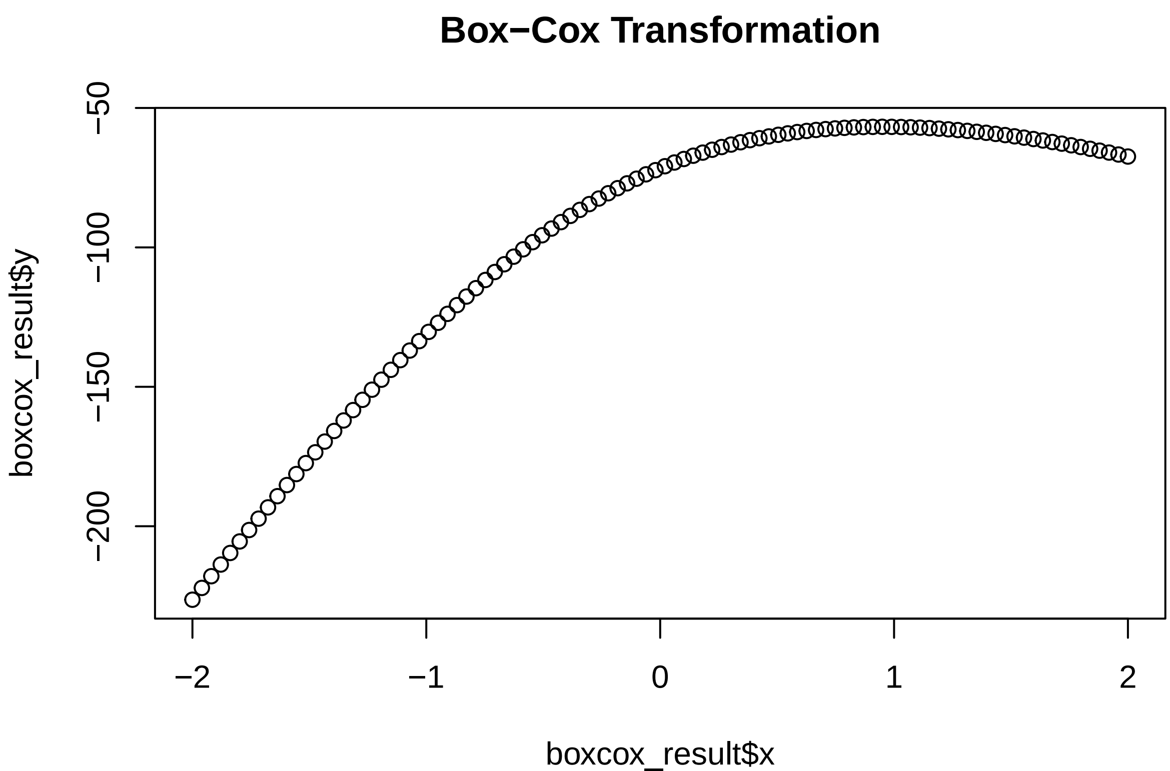


The residuals are as follows: Min -8.2422
1Q -2.6857
Median -0.2488
3Q 2.4280
Max 9.7509

Including Plots




```
## Optimal lambda: 0.9494949
```



The optimal lambda comes out to be: 0.9494949

##Part(c): The main purpose of the Box-Cox plot is to help us identify the value of lambda that maximizes the log-likelihood. The optimal lambda corresponds to the peak of the plot, and it indicates the best power transformation for stabilizing the variance and improving the fit of the linear regression model. The plot provides a visual representation of how the log-likelihood changes across different lambda values. Examining the shape of the curve can give you insights into the nature of the transformation and its impact on the model's goodness of fit.