Зачет

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Задача №1

```
library(Ecdat)
```

```
## Loading required package: Ecfun
```

```
##
## Attaching package: 'Ecfun'
```

```
## The following object is masked from 'package:base':
##
##     sign
```

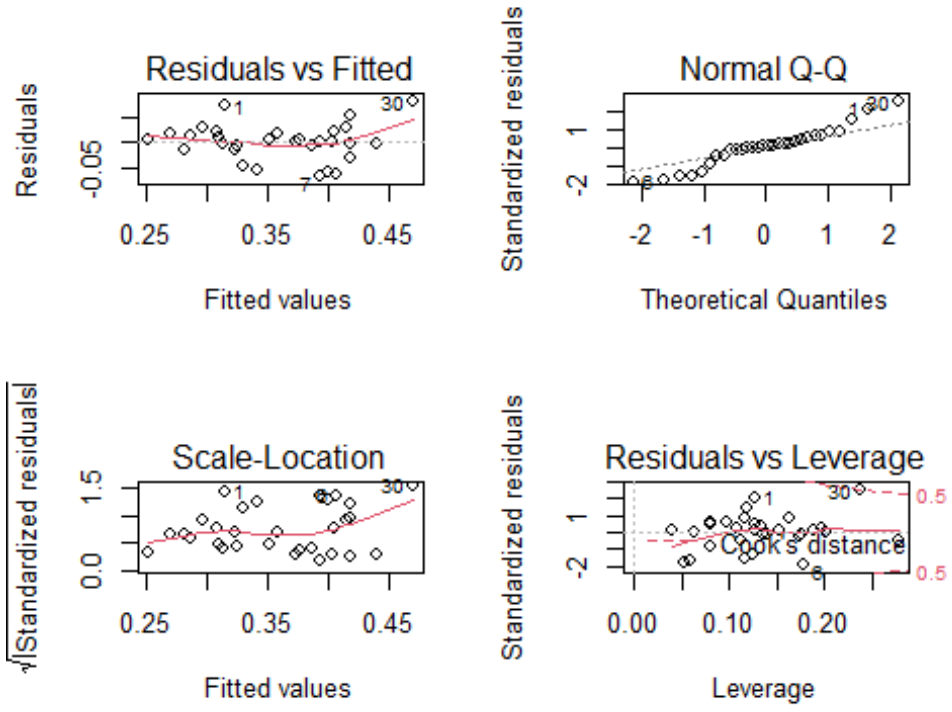
```
##
## Attaching package: 'Ecdat'
```

```
## The following object is masked from 'package:datasets':
##
##     Orange
```

```
data(Icecream)
fit <- lm(cons ~ price + income + temp, data = Icecream)
summary(fit)
```

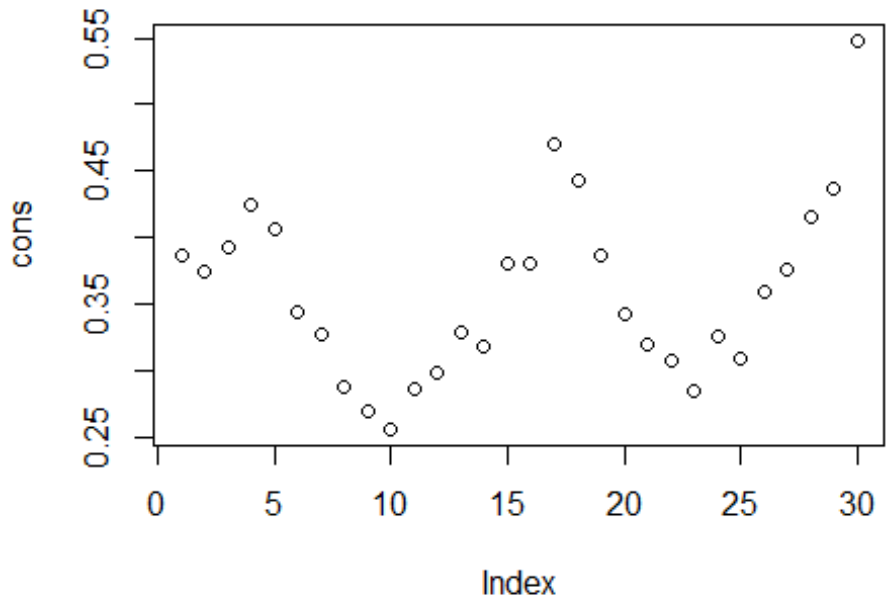
```
##
## Call:
## lm(formula = cons ~ price + income + temp, data = Icecream)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.065302 -0.011873  0.002737  0.015953  0.078986
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1973151  0.2702162   0.730  0.47179
## price       -1.0444140  0.8343573  -1.252  0.22180
## income       0.0033078  0.0011714   2.824  0.00899 **
## temp         0.0034584  0.0004455   7.762  3.1e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03683 on 26 degrees of freedom
## Multiple R-squared:  0.719,  Adjusted R-squared:  0.6866
## F-statistic: 22.17 on 3 and 26 DF,  p-value: 2.451e-07
```

```r
par(mfrow = c(2,2))
plot(fit)
```

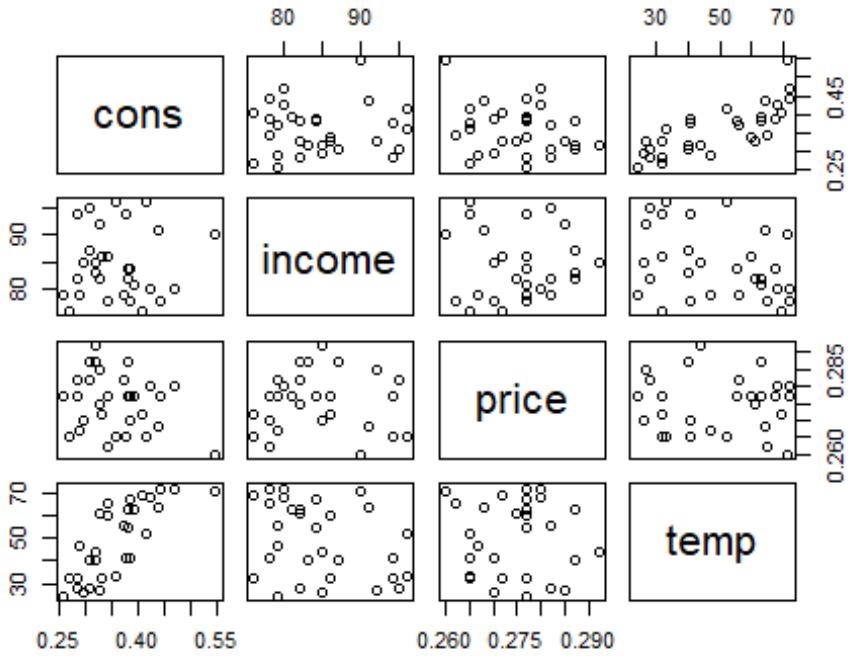


Чтобы построить доверительные и прогнозые интервалы (по умолчанию 95%) для заданных значений регрессоров, их необходимо задать в табличном виде data.frame:

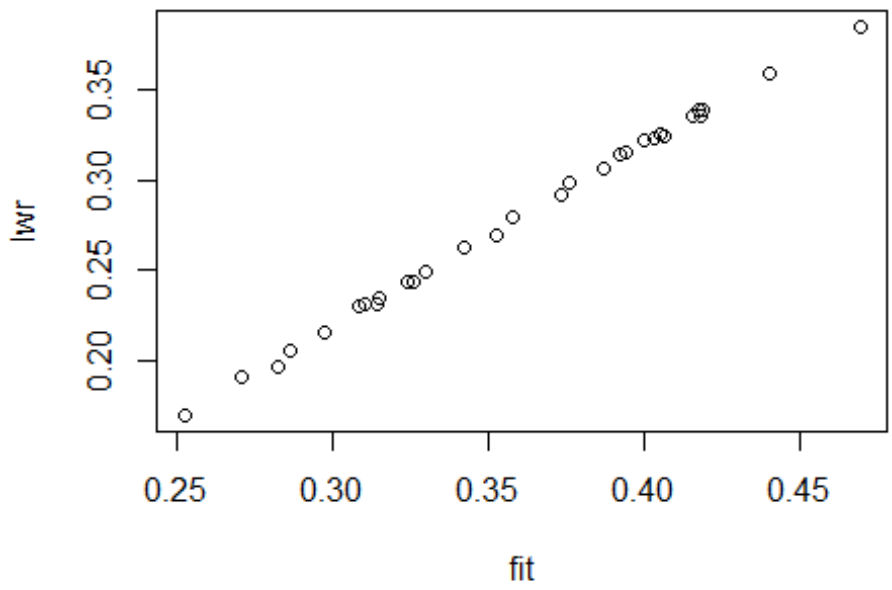
```r
dataIce <- data.frame(Icecream)
confs <- predict(fit, dataIce, interval = "confidence")
preds <- predict(fit, dataIce, interval = "prediction")
plot(cons ~ 1, data = Icecream)
```



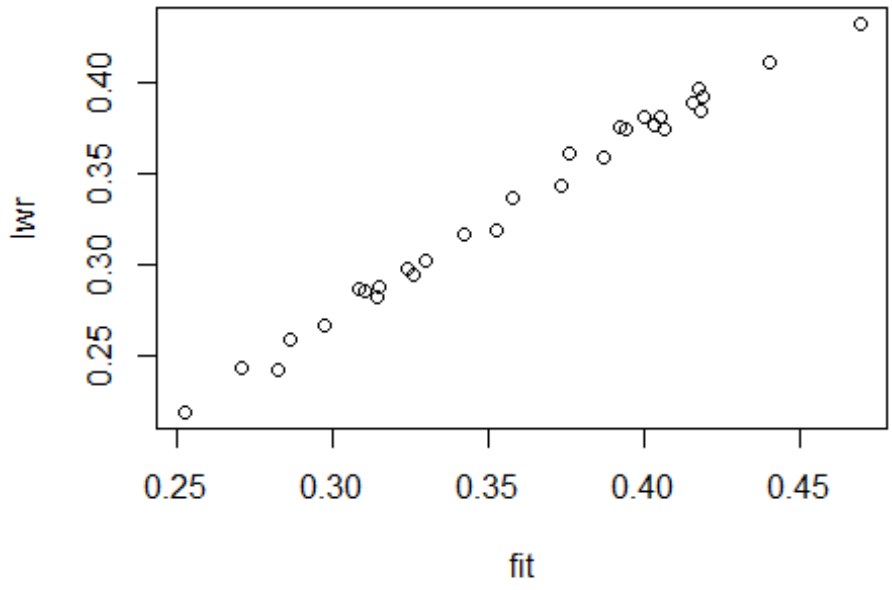

```
plot(dataIce)
```




```
plot(preds)
```




```
plot(confs)
```



Проведем тест на автокорреляцию:

```
library(lmtest)

## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

bgtest(fit, order = 2)

##
##  Breusch-Godfrey test for serial correlation of order up to 2
##
## data:  fit
## LM test = 4.4872, df = 2, p-value = 0.1061
```

Процедура Кохрейна-Оркутта:

```
library(orcutt)
fit_orcutt = cochrane.orcutt(fit, max.iter = 1000)
fit_orcutt

## Cochrane-orcutt estimation for first order autocorrelation
##
## Call:
## lm(formula = cons ~ price + income + temp, data = Icecream)
##
##  number of interaction: 11
##  rho 0.400926
##
## Durbin-Watson statistic
## (original):    1.02117 , p-value: 3.024e-04
## (transformed): 1.54884 , p-value: 5.061e-02
##
##  coefficients:
## (Intercept)       price      income        temp
##    0.157148   -0.892396    0.003203    0.003558

coefficients(fit)

## (Intercept)       price      income        temp
##  0.19731507 -1.04441399  0.00330776  0.00345843
```

Проверяем гипотезу о незначительности price:

```
library(sandwich)
NeweyWest(fit)

##                (Intercept)         price        income          temp
## (Intercept)  1.030769e-01 -0.3015182861 -2.496457e-04  7.269565e-05
## price       -3.015183e-01  0.9230633344  6.296449e-04 -2.800484e-04
## income      -2.496457e-04  0.0006296449  8.769416e-07 -6.511207e-08
## temp         7.269565e-05 -0.0002800484 -6.511207e-08  2.931894e-07

coefficients(fit)
```

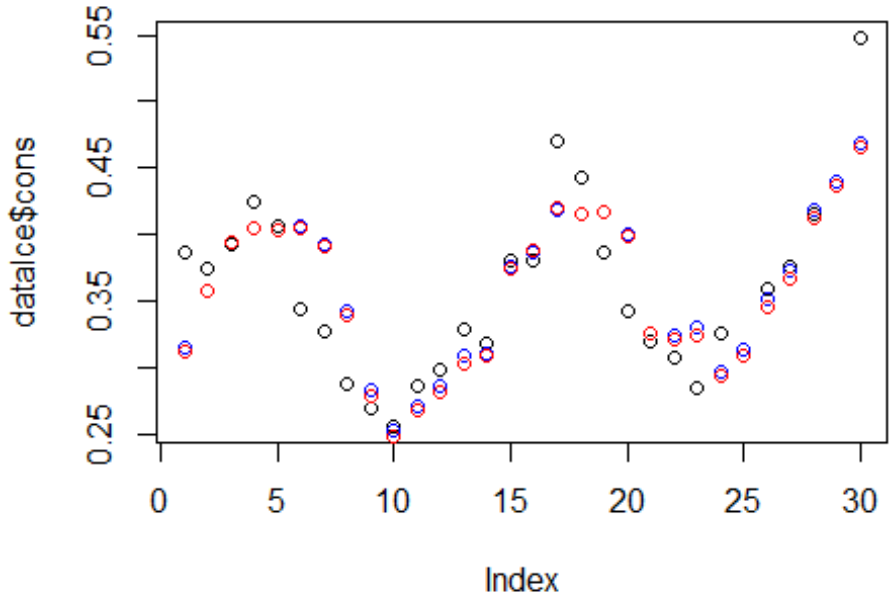
```
## (Intercept)       price      income        temp
##  0.19731507 -1.04441399  0.00330776  0.00345843
```

```
pt(-1.0444140 / sqrt(0.9230633344), 30-3-1)*2
```

```
## [1] 0.286982
```

Добавим полученные данные на график:

```
preds <- predict(fit, dataIce)
predsOrc <- predict(fit_orcutt, dataIce)
plot(dataIce$cons)
points(preds, col = "blue")
points(predsOrc, col = "red")
```



Задача №2

```
library(AER)
```

```
## Loading required package: car
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'carData'
```

```
## The following object is masked from 'package:Ecdat':
##
##     Mroz
```

```
## Loading required package: survival
```

```
data(HousePrices)
dataHouse <- data.frame(HousePrices)
dataHouse$price = log(dataHouse$price)
dataHouse$lotsize = log(dataHouse$lotsize)
min.model = lm(price ~ 1, data=HousePrices)
biggest <- formula(lm(price~.,HousePrices))
summary(HousePrices)
```

```
##      price           lotsize         bedrooms       bathrooms
##  Min.   : 25000   Min.   : 1650   Min.   :1.000   Min.   :1.000
##  1st Qu.: 49125   1st Qu.: 3600   1st Qu.:2.000   1st Qu.:1.000
##  Median : 62000   Median : 4600   Median :3.000   Median :1.000
##  Mean   : 68122   Mean   : 5150   Mean   :2.965   Mean   :1.286
##  3rd Qu.: 82000   3rd Qu.: 6360   3rd Qu.:3.000   3rd Qu.:2.000
##  Max.   :190000   Max.   :16200   Max.   :6.000   Max.   :4.000
##     stories      driveway  recreation fullbase  gasheat   aircon
##  Min.   :1.000   no : 77   no :449    no :355   no :521   no :373
##  1st Qu.:1.000   yes:469   yes: 97    yes:191   yes: 25   yes:173
##  Median :2.000
##  Mean   :1.808
##  3rd Qu.:2.000
##  Max.   :4.000
##      garage       prefer
##  Min.   :0.0000   no :418
##  1st Qu.:0.0000   yes:128
##  Median :0.0000
##  Mean   :0.6923
##  3rd Qu.:1.0000
##  Max.   :3.0000
```

Далее строим модели

Акайке:

```
library(MASS)
```

```
##
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:Ecdat':
##
##     SP500
```

```
lm_a = stepAIC(min.model, direction = "forward", k=2, scope=biggest, trace =
FALSE)
lm_a
```

```
##
## Call:
## lm(formula = price ~ lotsize + bathrooms + aircon + stories +
##     prefer + garage + fullbase + gasheat + driveway + recreation +
##     bedrooms, data = HousePrices)
##
## Coefficients:
```

```
##   (Intercept)        lotsize      bathrooms      airconyes        stories
##     -4038.350          3.546      14335.558      12632.890       6556.946
##     preferyes         garage    fullbaseyes     gasheatyes    drivewayyes
##      9369.513       4244.829       5452.386      12831.406       6687.779
## recreationyes       bedrooms
##      4511.284       1832.003
```

Шварц:

```
lm_b = stepAIC(min.model, direction = "forward", k=log(nrow(HousePrices)),
scope=biggest, trace = FALSE)
lm_b

##
## Call:
## lm(formula = price ~ lotsize + bathrooms + aircon + stories +
##     prefer + garage + fullbase + gasheat + driveway, data = HousePrices)
##
## Coefficients:
## (Intercept)      lotsize    bathrooms    airconyes      stories    preferyes
##   -1123.144        3.666    15072.868    12875.657     7241.264     9595.888
##      garage  fullbaseyes   gasheatyes  drivewayyes
##    4265.862     7134.099    12954.080     6428.566
```

Коэффициент детерминации

Акайке:

```
summary(lm_a)$r.squared

## [1] 0.6731236
```

Шварц:

```
summary(lm_b)$r.squared

## [1] 0.6679045
```

Тест Рамси

Акайке:

```
resettest(lm_a)

##
##  RESET test
##
## data:  lm_a
## RESET = 13.481, df1 = 2, df2 = 532, p-value = 1.944e-06
```

Шварц:

```
resettest(lm_b)

##
##  RESET test
##
## data:  lm_b
## RESET = 11.2, df1 = 2, df2 = 534, p-value = 1.719e-05
```

В обоих случаях гипотеза о том, что в модели нет отсутствующих переменных или модель линейная, отвергается.