lm(formula = final.grade ~ Studytime + as.factor(extra.curricular.activities) +

as.factor(Internet.access.at.home) + log(number.of.school.absences +

1) + workday.alcohol.consumption + weekend.alcohol.consumption +

current.health.status + first.period.grade + second.period.grade +

quality.of.family.relationships + as.factor(wants.to.take.higher.education) +

as.factor(School) + Failures, data = schoolDataMath)

Residuals:

Min 1Q Median 3Q Max

-2.23273 -0.39471 -0.09755 0.57778 2.65733

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.148346 0.408303 0.363 0.716587

Studytime 0.005565 0.015525 0.358 0.720242

as.factor(extra.curricular.activities)yes -0.054943 0.088673 -0.620 0.535920

as.factor(Internet.access.at.home)yes -0.042219 0.121738 -0.347 0.728955

log(number.of.school.absences + 1) -0.030526 0.047912 -0.637 0.524465

workday.alcohol.consumption -0.017795 0.062958 -0.283 0.777612

weekend.alcohol.consumption -0.010430 0.045396 -0.230 0.818426

current.health.status -0.061568 0.031821 -1.935 0.053831 .

first.period.grade 0.111756 0.032388 3.450 0.000629 \*\*\*

second.period.grade 0.882397 0.034082 25.891 < 2e-16 \*\*\*

quality.of.family.relationships 0.151269 0.050647 2.987 0.003023 \*\*

as.factor(wants.to.take.higher.education)yes -0.138796 0.235670 -0.589 0.556289

as.factor(School)MS -0.131879 0.141818 -0.930 0.353066

Failures 0.011361 0.072107 0.158 0.874895

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8214 on 343 degrees of freedom

Multiple R-squared: 0.9376, Adjusted R-squared: 0.9352

F-statistic: 396.4 on 13 and 343 DF, p-value: < 2.2e-16

> AIC(schoolFinalPeriodModel\_Math)

[1] 888.3979

> BIC(schoolFinalPeriodModel\_Math)

[1] 946.564

> library("car")

> vif(schoolFinalPeriodModel\_Math)

Studytime as.factor(extra.curricular.activities) as.factor(Internet.access.at.home)

1.095075 1.039932 1.066921

log(number.of.school.absences + 1) workday.alcohol.consumption weekend.alcohol.consumption

1.228720 1.769569 1.823298

current.health.status first.period.grade second.period.grade

1.051013 5.811539 6.070011

quality.of.family.relationships as.factor(wants.to.take.higher.education) as.factor(School)

1.061712 1.107165 1.104591

Failures

1.237865

> shapiro.test(schoolFinalPeriodModel\_Math$res)

Shapiro-Wilk normality test

data: schoolFinalPeriodModel\_Math$res

W = 0.98471, p-value = 0.0007869

> #Normally Distributed

> #Homoskedasticity

> plot(schoolFirstPeriodModel\_Math)

Error in plot(schoolFirstPeriodModel\_Math) :

object 'schoolFirstPeriodModel\_Math' not found

> bartlett.test(list(schoolFinalPeriodModel\_Math$res, schoolFinalPeriodModel\_Math$fit))

Bartlett test of homogeneity of variances

data: list(schoolFinalPeriodModel\_Math$res, schoolFinalPeriodModel\_Math$fit)

Bartlett's K-squared = 516.31, df = 1, p-value < 2.2e-16

> schoolFinalPeriodModel\_Math\_Inter=lm(final.grade ~ Studytime

+ + as.factor(extra.curricular.activities)

+ + as.factor(Internet.access.at.home)

+ + log(number.of.school.absences+1)

+ + workday.alcohol.consumption

+ + weekend.alcohol.consumption

+ + current.health.status

+ +first.period.grade

+ +second.period.grade

+ + quality.of.family.relationships

+ + as.factor(wants.to.take.higher.education)

+ + as.factor(School)

+ + as.factor(School.educational.support)\*as.factor(Family.educational.support)\*as.factor(extra.paid.classes)

+ + Failures,data = schoolDataMath)

> summary(schoolFinalPeriodModel\_Math\_Inter)

Call:

lm(formula = final.grade ~ Studytime + as.factor(extra.curricular.activities) +

as.factor(Internet.access.at.home) + log(number.of.school.absences +

1) + workday.alcohol.consumption + weekend.alcohol.consumption +

current.health.status + first.period.grade + second.period.grade +

quality.of.family.relationships + as.factor(wants.to.take.higher.education) +

as.factor(School) + as.factor(School.educational.support) \*

as.factor(Family.educational.support) \* as.factor(extra.paid.classes) +

Failures, data = schoolDataMath)

Residuals:

Min 1Q Median 3Q Max

-2.0670 -0.4004 -0.1084 0.5614 2.4697

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.173778 0.417909 0.416 0.67780

Studytime 0.009012 0.015685 0.575 0.56597

as.factor(extra.curricular.activities)yes -0.045656 0.088837 -0.514 0.60764

as.factor(Internet.access.at.home)yes -0.018654 0.121916 -0.153 0.87849

log(number.of.school.absences + 1) -0.030811 0.047964 -0.642 0.52107

workday.alcohol.consumption -0.007936 0.062989 -0.126 0.89982

weekend.alcohol.consumption -0.005815 0.046167 -0.126 0.89984

current.health.status -0.061219 0.031970 -1.915 0.05635 .

first.period.grade 0.099911 0.032900 3.037 0.00258 \*\*

second.period.grade 0.888586 0.034176 26.000 < 2e-16 \*\*\*

quality.of.family.relationships 0.147689 0.050404 2.930 0.00362 \*\*

as.factor(wants.to.take.higher.education)yes -0.114514 0.238114 -0.481 0.63089

as.factor(School)MS -0.128407 0.144131 -0.891 0.37362

as.factor(School.educational.support)yes -0.138898 0.283430 -0.490 0.62441

as.factor(Family.educational.support)yes 0.089600 0.136061 0.659 0.51065

as.factor(extra.paid.classes)yes -0.171796 0.164832 -1.042 0.29805

Failures -0.025686 0.072939 -0.352 0.72494

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes 0.164151 0.354469 0.463 0.64360

as.factor(School.educational.support)yes:as.factor(extra.paid.classes)yes 0.885321 0.571914 1.548 0.12256

as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes 0.075592 0.206736 0.366 0.71486

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes -1.436025 0.651134 -2.205 0.02810 \*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8158 on 336 degrees of freedom

Multiple R-squared: 0.9397, Adjusted R-squared: 0.9361

F-statistic: 261.8 on 20 and 336 DF, p-value: < 2.2e-16

> AIC(schoolFinalPeriodModel\_Math\_Inter)

[1] 890.144

> BIC(schoolFinalPeriodModel\_Math\_Inter)

[1] 975.4542

> library("car")

> vif(schoolFinalPeriodModel\_Math\_Inter)

Studytime

1.133150

as.factor(extra.curricular.activities)

1.058201

as.factor(Internet.access.at.home)

1.084809

log(number.of.school.absences + 1)

1.248396

workday.alcohol.consumption

1.795774

weekend.alcohol.consumption

1.911786

current.health.status

1.075513

first.period.grade

6.079207

second.period.grade

6.187849

quality.of.family.relationships

1.066029

as.factor(wants.to.take.higher.education)

1.145844

as.factor(School)

1.156661

as.factor(School.educational.support)

5.189592

as.factor(Family.educational.support)

2.354633

as.factor(extra.paid.classes)

3.639820

Failures

1.284055

as.factor(School.educational.support):as.factor(Family.educational.support)

6.260978

as.factor(School.educational.support):as.factor(extra.paid.classes)

10.145244

as.factor(Family.educational.support):as.factor(extra.paid.classes)

5.342216

as.factor(School.educational.support):as.factor(Family.educational.support):as.factor(extra.paid.classes)

11.458947

> shapiro.test(schoolFinalPeriodModel\_Math\_Inter$res)

Shapiro-Wilk normality test

data: schoolFinalPeriodModel\_Math\_Inter$res

W = 0.98803, p-value = 0.0049

> #Normally Distributed

> #Homoskedasticity

> plot(schoolFirstPeriodModel\_Math)

Error in plot(schoolFirstPeriodModel\_Math) :

object 'schoolFirstPeriodModel\_Math' not found

> bartlett.test(list(schoolFinalPeriodModel\_Math\_Inter$res, schoolFinalPeriodModel\_Math\_Inter$fit))

Bartlett test of homogeneity of variances

data: list(schoolFinalPeriodModel\_Math\_Inter$res, schoolFinalPeriodModel\_Math\_Inter$fit)

Bartlett's K-squared = 527.71, df = 1, p-value < 2.2e-16

> schoolFinalPeriodModel\_Math\_InterLag=lm(final.grade ~ Studytime

+ + as.factor(extra.curricular.activities)

+ + as.factor(Internet.access.at.home)

+ + log(number.of.school.absences+1)

+ + workday.alcohol.consumption

+ + weekend.alcohol.consumption

+ + current.health.status

+ +first.period.grade

+ +second.period.grade

+ + quality.of.family.relationships

+ + as.factor(wants.to.take.higher.education)

+ + as.factor(School)

+ + as.factor(School.educational.support\_Lag1)

+ + as.factor(School.educational.support\_Lag2)

+ + as.factor(Family.educational.support\_Lag1)

+ + as.factor(Family.educational.support\_Lag2)

+ + as.factor(extra.paid.classes\_Lag1)

+ + as.factor(extra.paid.classes\_Lag2)

+ + as.factor(School.educational.support)\*as.factor(Family.educational.support)\*as.factor(extra.paid.classes)

+ + Failures,data = schoolDataMath)

> summary(schoolFinalPeriodModel\_Math\_InterLag)

Call:

lm(formula = final.grade ~ Studytime + as.factor(extra.curricular.activities) +

as.factor(Internet.access.at.home) + log(number.of.school.absences +

1) + workday.alcohol.consumption + weekend.alcohol.consumption +

current.health.status + first.period.grade + second.period.grade +

quality.of.family.relationships + as.factor(wants.to.take.higher.education) +

as.factor(School) + as.factor(School.educational.support\_Lag1) +

as.factor(School.educational.support\_Lag2) + as.factor(Family.educational.support\_Lag1) +

as.factor(Family.educational.support\_Lag2) + as.factor(extra.paid.classes\_Lag1) +

as.factor(extra.paid.classes\_Lag2) + as.factor(School.educational.support) \*

as.factor(Family.educational.support) \* as.factor(extra.paid.classes) +

Failures, data = schoolDataMath)

Residuals:

Min 1Q Median 3Q Max

-2.0595 -0.4213 -0.1006 0.5705 2.6333

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.241482 0.434923 0.555 0.57912

Studytime 0.009986 0.015969 0.625 0.53220

as.factor(extra.curricular.activities)yes -0.050869 0.090871 -0.560 0.57600

as.factor(Internet.access.at.home)yes -0.016822 0.124588 -0.135 0.89268

log(number.of.school.absences + 1) -0.031907 0.048723 -0.655 0.51302

workday.alcohol.consumption -0.007548 0.063843 -0.118 0.90596

weekend.alcohol.consumption -0.010067 0.046821 -0.215 0.82988

current.health.status -0.063366 0.032550 -1.947 0.05242 .

first.period.grade 0.100577 0.033828 2.973 0.00317 \*\*

second.period.grade 0.890992 0.035253 25.274 < 2e-16 \*\*\*

quality.of.family.relationships 0.139942 0.051309 2.727 0.00673 \*\*

as.factor(wants.to.take.higher.education)yes -0.093187 0.245089 -0.380 0.70403

as.factor(School)MS -0.150064 0.148257 -1.012 0.31219

as.factor(School.educational.support\_Lag1)yes 0.007409 0.138508 0.053 0.95737

as.factor(School.educational.support\_Lag2)yes 0.075311 0.133981 0.562 0.57443

as.factor(Family.educational.support\_Lag1)yes -0.096892 0.098534 -0.983 0.32617

as.factor(Family.educational.support\_Lag2)yes -0.106553 0.098946 -1.077 0.28233

as.factor(extra.paid.classes\_Lag1)yes 0.086997 0.094362 0.922 0.35723

as.factor(extra.paid.classes\_Lag2)yes -0.009115 0.095683 -0.095 0.92417

as.factor(School.educational.support)yes -0.123655 0.304239 -0.406 0.68468

as.factor(Family.educational.support)yes 0.079665 0.138987 0.573 0.56691

as.factor(extra.paid.classes)yes -0.175536 0.167661 -1.047 0.29588

Failures -0.021615 0.073885 -0.293 0.77005

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes 0.157096 0.377756 0.416 0.67778

as.factor(School.educational.support)yes:as.factor(extra.paid.classes)yes 0.911676 0.586253 1.555 0.12089

as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes 0.089053 0.210205 0.424 0.67210

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes -1.429042 0.663022 -2.155 0.03186 \*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8217 on 328 degrees of freedom

(2 observations deleted due to missingness)

Multiple R-squared: 0.9393, Adjusted R-squared: 0.9345

F-statistic: 195.2 on 26 and 328 DF, p-value: < 2.2e-16

> AIC(schoolFinalPeriodModel\_Math\_InterLag)

[1] 895.9277

> BIC(schoolFinalPeriodModel\_Math\_InterLag)

[1] 1004.347

> library("car")

> vif(schoolFinalPeriodModel\_Math\_InterLag)

Studytime

1.151510

as.factor(extra.curricular.activities)

1.085202

as.factor(Internet.access.at.home)

1.100012

log(number.of.school.absences + 1)

1.269236

workday.alcohol.consumption

1.815562

weekend.alcohol.consumption

1.926765

current.health.status

1.098118

first.period.grade

6.201899

second.period.grade

6.362428

quality.of.family.relationships

1.084686

as.factor(wants.to.take.higher.education)

1.196424

as.factor(School)

1.205526

as.factor(School.educational.support\_Lag1)

1.200114

as.factor(School.educational.support\_Lag2)

1.142114

as.factor(Family.educational.support\_Lag1)

1.206456

as.factor(Family.educational.support\_Lag2)

1.216561

as.factor(extra.paid.classes\_Lag1)

1.169684

as.factor(extra.paid.classes\_Lag2)

1.202658

as.factor(School.educational.support)

5.790295

as.factor(Family.educational.support)

2.407005

as.factor(extra.paid.classes)

3.692610

Failures

1.297656

as.factor(School.educational.support):as.factor(Family.educational.support)

7.004965

as.factor(School.educational.support):as.factor(extra.paid.classes)

10.504861

as.factor(Family.educational.support):as.factor(extra.paid.classes)

5.426465

as.factor(School.educational.support):as.factor(Family.educational.support):as.factor(extra.paid.classes)

11.708543

> shapiro.test(schoolFinalPeriodModel\_Math\_InterLag$res)

Shapiro-Wilk normality test

data: schoolFinalPeriodModel\_Math\_InterLag$res

W = 0.98814, p-value = 0.005416

> #Normally Distributed

> #Homoskedasticity

> plot(schoolFirstPeriodModel\_Math)

Error in plot(schoolFirstPeriodModel\_Math) :

object 'schoolFirstPeriodModel\_Math' not found

> bartlett.test(list(schoolFinalPeriodModel\_Math\_InterLag$res, schoolFinalPeriodModel\_Math\_InterLag$fit))

Bartlett test of homogeneity of variances

data: list(schoolFinalPeriodModel\_Math\_InterLag$res, schoolFinalPeriodModel\_Math\_InterLag$fit)

Bartlett's K-squared = 522.46, df = 1, p-value < 2.2e-16

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lm(formula = final.grade ~ Studytime + as.factor(extra.curricular.activities) +

as.factor(Internet.access.at.home) + log(number.of.school.absences +

1) + workday.alcohol.consumption + first.period.grade + second.period.grade +

weekend.alcohol.consumption + current.health.status + quality.of.family.relationships +

as.factor(wants.to.take.higher.education) + as.factor(School) +

Failures, data = schoolDataMath)

Residuals:

Min 1Q Median 3Q Max

-3.6533 -0.5287 -0.0757 0.5351 5.5654

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.218029 0.290070 4.199 3.07e-05 \*\*\*

Studytime 0.002386 0.012468 0.191 0.8483

as.factor(extra.curricular.activities)yes -0.040256 0.068315 -0.589 0.5559

as.factor(Internet.access.at.home)yes 0.134489 0.083888 1.603 0.1094

log(number.of.school.absences + 1) -0.013768 0.037272 -0.369 0.7120

workday.alcohol.consumption -0.023140 0.047784 -0.484 0.6284

first.period.grade 0.196869 0.029316 6.715 4.26e-11 \*\*\*

second.period.grade 0.749739 0.028755 26.074 < 2e-16 \*\*\*

weekend.alcohol.consumption -0.026731 0.034482 -0.775 0.4385

current.health.status -0.038765 0.023912 -1.621 0.1055

quality.of.family.relationships -0.020763 0.036658 -0.566 0.5713

as.factor(wants.to.take.higher.education)yes 0.200867 0.121709 1.650 0.0994 .

as.factor(School)MS -0.049178 0.077564 -0.634 0.5263

Failures -0.105171 0.064282 -1.636 0.1023

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8459 on 618 degrees of freedom

Multiple R-squared: 0.9008, Adjusted R-squared: 0.8988

F-statistic: 431.9 on 13 and 618 DF, p-value: < 2.2e-16

> AIC(schoolFinalPeriodModel\_Math)

[1] 1597.879

> BIC(schoolFinalPeriodModel\_Math)

[1] 1664.612

> library("car")

> vif(schoolFinalPeriodModel\_Math)

Studytime as.factor(extra.curricular.activities) as.factor(Internet.access.at.home)

1.097783 1.029603 1.088105

log(number.of.school.absences + 1) workday.alcohol.consumption first.period.grade

1.131529 1.678164 5.303445

second.period.grade weekend.alcohol.consumption current.health.status

5.049277 1.722616 1.059160

quality.of.family.relationships as.factor(wants.to.take.higher.education) as.factor(School)

1.063040 1.190690 1.184493

Failures

1.223305

> shapiro.test(schoolFinalPeriodModel\_Math$res)

Shapiro-Wilk normality test

data: schoolFinalPeriodModel\_Math$res

W = 0.96893, p-value = 2.576e-10

> #Normally Distributed

> #Homoskedasticity

> plot(schoolFirstPeriodModel\_Math)

Error in plot(schoolFirstPeriodModel\_Math) :

object 'schoolFirstPeriodModel\_Math' not found

> bartlett.test(list(schoolFinalPeriodModel\_Math$res, schoolFinalPeriodModel\_Math$fit))

Bartlett test of homogeneity of variances

data: list(schoolFinalPeriodModel\_Math$res, schoolFinalPeriodModel\_Math$fit)

Bartlett's K-squared = 648.89, df = 1, p-value < 2.2e-16

> schoolFinalPeriodModel\_Math\_Inter=lm(final.grade ~ Studytime

+ + as.factor(extra.curricular.activities)

+ + as.factor(Internet.access.at.home)

+ + log(number.of.school.absences+1)

+ + workday.alcohol.consumption

+ + weekend.alcohol.consumption

+ + current.health.status

+ +first.period.grade

+ +second.period.grade

+ + quality.of.family.relationships

+ + as.factor(wants.to.take.higher.education)

+ + as.factor(School)

+ + as.factor(School.educational.support)\*as.factor(Family.educational.support)\*as.factor(extra.paid.classes)

+ + Failures,data = schoolDataMath)

> summary(schoolFinalPeriodModel\_Math\_Inter)

Call:

lm(formula = final.grade ~ Studytime + as.factor(extra.curricular.activities) +

as.factor(Internet.access.at.home) + log(number.of.school.absences +

1) + workday.alcohol.consumption + weekend.alcohol.consumption +

current.health.status + first.period.grade + second.period.grade +

quality.of.family.relationships + as.factor(wants.to.take.higher.education) +

as.factor(School) + as.factor(School.educational.support) \*

as.factor(Family.educational.support) \* as.factor(extra.paid.classes) +

Failures, data = schoolDataMath)

Residuals:

Min 1Q Median 3Q Max

-3.2354 -0.5394 -0.0473 0.5414 5.7151

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.294459 0.296680 4.363 1.5e-05 \*\*\*

Studytime 0.003768 0.012496 0.301 0.7631

as.factor(extra.curricular.activities)yes -0.045119 0.068572 -0.658 0.5108

as.factor(Internet.access.at.home)yes 0.136668 0.084473 1.618 0.1062

log(number.of.school.absences + 1) -0.020973 0.037610 -0.558 0.5773

workday.alcohol.consumption -0.014330 0.047776 -0.300 0.7643

weekend.alcohol.consumption -0.032868 0.034868 -0.943 0.3462

current.health.status -0.035950 0.023984 -1.499 0.1344

first.period.grade 0.191225 0.029389 6.507 1.6e-10 \*\*\*

second.period.grade 0.749312 0.028823 25.997 < 2e-16 \*\*\*

quality.of.family.relationships -0.023347 0.036617 -0.638 0.5240

as.factor(wants.to.take.higher.education)yes 0.242725 0.122646 1.979 0.0483 \*

as.factor(School)MS -0.078369 0.078435 -0.999 0.3181

as.factor(School.educational.support)yes -0.453239 0.223275 -2.030 0.0428 \*

as.factor(Family.educational.support)yes 0.018748 0.075725 0.248 0.8045

as.factor(extra.paid.classes)yes 0.084677 0.385604 0.220 0.8263

Failures -0.096581 0.064498 -1.497 0.1348

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes 0.214013 0.260175 0.823 0.4111

as.factor(School.educational.support)yes:as.factor(extra.paid.classes)yes 0.553641 0.750517 0.738 0.4610

as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes -0.409017 0.420288 -0.973 0.3308

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes -0.253213 0.893026 -0.284 0.7769

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8435 on 611 degrees of freedom

Multiple R-squared: 0.9025, Adjusted R-squared: 0.8993

F-statistic: 282.8 on 20 and 611 DF, p-value: < 2.2e-16

> AIC(schoolFinalPeriodModel\_Math\_Inter)

[1] 1601.094

> BIC(schoolFinalPeriodModel\_Math\_Inter)

[1] 1698.969

> library("car")

> vif(schoolFinalPeriodModel\_Math\_Inter)

Studytime

1.109052

as.factor(extra.curricular.activities)

1.043289

as.factor(Internet.access.at.home)

1.109588

log(number.of.school.absences + 1)

1.158702

workday.alcohol.consumption

1.687200

weekend.alcohol.consumption

1.771428

current.health.status

1.071612

first.period.grade

5.360114

second.period.grade

5.102227

quality.of.family.relationships

1.066680

as.factor(wants.to.take.higher.education)

1.215959

as.factor(School)

1.218107

as.factor(School.educational.support)

4.141200

as.factor(Family.educational.support)

1.197710

as.factor(extra.paid.classes)

7.463423

Failures

1.238578

as.factor(School.educational.support):as.factor(Family.educational.support)

4.219600

as.factor(School.educational.support):as.factor(extra.paid.classes)

4.704699

as.factor(Family.educational.support):as.factor(extra.paid.classes)

7.318401

as.factor(School.educational.support):as.factor(Family.educational.support):as.factor(extra.paid.classes)

4.454857

> shapiro.test(schoolFinalPeriodModel\_Math\_Inter$res)

Shapiro-Wilk normality test

data: schoolFinalPeriodModel\_Math\_Inter$res

W = 0.96776, p-value = 1.453e-10

> #Normally Distributed

> #Homoskedasticity

> plot(schoolFirstPeriodModel\_Math)

Error in plot(schoolFirstPeriodModel\_Math) :

object 'schoolFirstPeriodModel\_Math' not found

> bartlett.test(list(schoolFinalPeriodModel\_Math\_Inter$res, schoolFinalPeriodModel\_Math\_Inter$fit))

Bartlett test of homogeneity of variances

data: list(schoolFinalPeriodModel\_Math\_Inter$res, schoolFinalPeriodModel\_Math\_Inter$fit)

Bartlett's K-squared = 658.48, df = 1, p-value < 2.2e-16

> schoolFinalPeriodModel\_Math\_InterLag=lm(final.grade ~ Studytime

+ + as.factor(extra.curricular.activities)

+ + as.factor(Internet.access.at.home)

+ + log(number.of.school.absences+1)

+ + workday.alcohol.consumption

+ + weekend.alcohol.consumption

+ + current.health.status

+ +first.period.grade

+ +second.period.grade

+ + quality.of.family.relationships

+ + as.factor(wants.to.take.higher.education)

+ + as.factor(School)

+ + as.factor(School.educational.support\_Lag1)

+ + as.factor(School.educational.support\_Lag2)

+ + as.factor(Family.educational.support\_Lag1)

+ + as.factor(Family.educational.support\_Lag2)

+ + as.factor(extra.paid.classes\_Lag1)

+ + as.factor(extra.paid.classes\_Lag2)

+ + as.factor(School.educational.support)\*as.factor(Family.educational.support)\*as.factor(extra.paid.classes)

+ + Failures,data = schoolDataMath)

> AIC(schoolFinalPeriodModel\_Math\_InterLag)

[1] 1605.633

> summary(schoolFinalPeriodModel\_Math\_InterLag)

Call:

lm(formula = final.grade ~ Studytime + as.factor(extra.curricular.activities) +

as.factor(Internet.access.at.home) + log(number.of.school.absences +

1) + workday.alcohol.consumption + weekend.alcohol.consumption +

current.health.status + first.period.grade + second.period.grade +

quality.of.family.relationships + as.factor(wants.to.take.higher.education) +

as.factor(School) + as.factor(School.educational.support\_Lag1) +

as.factor(School.educational.support\_Lag2) + as.factor(Family.educational.support\_Lag1) +

as.factor(Family.educational.support\_Lag2) + as.factor(extra.paid.classes\_Lag1) +

as.factor(extra.paid.classes\_Lag2) + as.factor(School.educational.support) \*

as.factor(Family.educational.support) \* as.factor(extra.paid.classes) +

Failures, data = schoolDataMath)

Residuals:

Min 1Q Median 3Q Max

-3.2265 -0.5592 -0.0374 0.5266 5.6905

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.351217 0.305998 4.416 1.19e-05 \*\*\*

Studytime 0.003851 0.012513 0.308 0.7584

as.factor(extra.curricular.activities)yes -0.033647 0.068974 -0.488 0.6259

as.factor(Internet.access.at.home)yes 0.138291 0.084797 1.631 0.1034

log(number.of.school.absences + 1) -0.019308 0.037672 -0.513 0.6085

workday.alcohol.consumption -0.011395 0.048052 -0.237 0.8126

weekend.alcohol.consumption -0.034748 0.035080 -0.991 0.3223

current.health.status -0.038969 0.024125 -1.615 0.1068

first.period.grade 0.195015 0.029584 6.592 9.47e-11 \*\*\*

second.period.grade 0.747014 0.028954 25.800 < 2e-16 \*\*\*

quality.of.family.relationships -0.024800 0.036815 -0.674 0.5008

as.factor(wants.to.take.higher.education)yes 0.247750 0.123017 2.014 0.0445 \*

as.factor(School)MS -0.092727 0.079114 -1.172 0.2416

as.factor(School.educational.support\_Lag1)yes -0.088818 0.114298 -0.777 0.4374

as.factor(School.educational.support\_Lag2)yes -0.151628 0.112846 -1.344 0.1796

as.factor(Family.educational.support\_Lag1)yes -0.061709 0.071366 -0.865 0.3876

as.factor(Family.educational.support\_Lag2)yes -0.038406 0.071477 -0.537 0.5912

as.factor(extra.paid.classes\_Lag1)yes 0.274916 0.146195 1.880 0.0605 .

as.factor(extra.paid.classes\_Lag2)yes 0.047340 0.145364 0.326 0.7448

as.factor(School.educational.support)yes -0.400059 0.226945 -1.763 0.0784 .

as.factor(Family.educational.support)yes 0.022829 0.076213 0.300 0.7646

as.factor(extra.paid.classes)yes 0.037341 0.386493 0.097 0.9231

Failures -0.098872 0.064986 -1.521 0.1287

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes 0.161301 0.263358 0.612 0.5405

as.factor(School.educational.support)yes:as.factor(extra.paid.classes)yes 0.600875 0.752124 0.799 0.4247

as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes -0.386814 0.421073 -0.919 0.3587

as.factor(School.educational.support)yes:as.factor(Family.educational.support)yes:as.factor(extra.paid.classes)yes -0.273474 0.894433 -0.306 0.7599

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.8427 on 605 degrees of freedom

Multiple R-squared: 0.9037, Adjusted R-squared: 0.8995

F-statistic: 218.3 on 26 and 605 DF, p-value: < 2.2e-16

> BIC(schoolFinalPeriodModel\_Math\_InterLag)

[1] 1730.202

> library("car")

> vif(schoolFinalPeriodModel\_Math\_InterLag)

Studytime

1.114158

as.factor(extra.curricular.activities)

1.057599

as.factor(Internet.access.at.home)

1.120289

log(number.of.school.absences + 1)

1.164789

workday.alcohol.consumption

1.710036

weekend.alcohol.consumption

1.796496

current.health.status

1.086277

first.period.grade

5.442107

second.period.grade

5.158731

quality.of.family.relationships

1.080341

as.factor(wants.to.take.higher.education)

1.225696

as.factor(School)

1.241703

as.factor(School.educational.support\_Lag1)

1.087337

as.factor(School.educational.support\_Lag2)

1.059890

as.factor(Family.educational.support\_Lag1)

1.065871

as.factor(Family.educational.support\_Lag2)

1.069174

as.factor(extra.paid.classes\_Lag1)

1.074883

as.factor(extra.paid.classes\_Lag2)

1.062699

as.factor(School.educational.support)

4.286766

as.factor(Family.educational.support)

1.215559

as.factor(extra.paid.classes)

7.512434

Failures

1.259821

as.factor(School.educational.support):as.factor(Family.educational.support)

4.331866

as.factor(School.educational.support):as.factor(extra.paid.classes)

4.734035

as.factor(Family.educational.support):as.factor(extra.paid.classes)

7.360011

as.factor(School.educational.support):as.factor(Family.educational.support):as.factor(extra.paid.classes)

4.477569

> shapiro.test(schoolFinalPeriodModel\_Math\_InterLag$res)

Shapiro-Wilk normality test

data: schoolFinalPeriodModel\_Math\_InterLag$res

W = 0.96718, p-value = 1.097e-10

> #Normally Distributed

> #Homoskedasticity

> plot(schoolFirstPeriodModel\_Math)

Error in plot(schoolFirstPeriodModel\_Math) :

object 'schoolFirstPeriodModel\_Math' not found

> bartlett.test(list(schoolFinalPeriodModel\_Math\_InterLag$res, schoolFinalPeriodModel\_Math\_InterLag$fit))

Bartlett test of homogeneity of variances

data: list(schoolFinalPeriodModel\_Math\_InterLag$res, schoolFinalPeriodModel\_Math\_InterLag$fit)

Bartlett's K-squared = 665.12, df = 1, p-value < 2.2e-16