

# ACM Preliminary Analysis

*Alyster Alcudia, Cynthia Gan, Mihai Sirbu*

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## Read in Data

```
data = as.tbl(read.csv("student-por.csv", sep=";", stringsAsFactors=TRUE))
```

## Rename the Variables

```
rename_cols <- c(4:12,16:21,23:24,26:28,31:33)

colnames(data)[rename_cols] = c("urban_rural",
                                "fam_size",
                                "parents_cohabit",
                                "mom_edu",
                                "dad_edu",
                                "mom_job",
                                "dad_job",
                                "school_reason",
                                "student_guardian",
                                "extra_school_support",
                                "fam_edu_support",
                                "paid_extra_classes",
                                "extracurricular_activities",
                                "attended_nursery",
                                "wants_higher_education",
                                "has_romantic_partner",
                                "family_relationship",
                                "going_out_amount",
                                "weekday_alcohol_cons",
                                "weekend_alcohol_cons",
                                "grade_one",
                                "grade_two",
                                "final_grade")
```

## Meaningful Variable Values

```
data <- data %>%
  mutate(school = ifelse(school=='GP', 'Gabriel Pereira', 'Mousinho da Silveira')) %>%
  mutate(urban_rural = ifelse(urban_rural=='R', 'Rural', 'Urban')) %>%
  mutate(fam_size = ifelse(fam_size=='GT3', '>3', '<=3')) %>%
  mutate(parents_cohabit = ifelse(parents_cohabit=='A', 'Apart', 'Together')) %>%
  mutate_each(funs(ifelse(.,=='yes', TRUE, FALSE)),
              c("extra_school_support", "fam_edu_support", "paid_extra_classes",
                "extracurricular_activities", "attended_nursery",
                "wants_higher_education", "internet", "has_romantic_partner"))
```

## Regression Using Sex as a Variable

```
lm_sex <- lm(final_grade ~ sex, data = data)
```

```
summary(lm_sex)
```

```
##
## Call:
## lm(formula = final_grade ~ sex, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.2533  -1.4060  -0.2533   1.7467   7.5940
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  12.2533     0.1638   74.795 < 2e-16 ***
## sexM         -0.8472     0.2559  -3.311 0.000982 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.206 on 647 degrees of freedom
## Multiple R-squared:  0.01666,    Adjusted R-squared:  0.01514
## F-statistic: 10.96 on 1 and 647 DF,  p-value: 0.0009815
```

The average grade for females is 12.25 whereas the average grade for Males is 11.40. The difference between the two is significant ( $p < 0.001$ ); the R-squared is 0.015.

## Regression Using Family/Home Attributes

```
lm_family <- lm(final_grade ~ fam_size + parents_cohabit + fam_edu_support + family_relationship + mom_
```

```
summary(lm_family)
```

```
##
## Call:
## lm(formula = final_grade ~ fam_size + parents_cohabit + fam_edu_support +
##      family_relationship + mom_edu + mom_job, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.3384  -1.6538   0.0319   2.0203   7.4870
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      9.3701     0.7137  13.129 < 2e-16 ***
## fam_size>3       -0.3588     0.2796  -1.283 0.199911
## parents_cohabitTogether  0.1837     0.3892   0.472 0.637060
## fam_edu_supportTRUE  0.2188     0.2558   0.855 0.392604
## family_relationship  0.1953     0.1294   1.510 0.131569
```

```
## mom_edu                0.5132      0.1416    3.624 0.000314 ***
## mom_jobhealth          1.0470      0.5903    1.774 0.076597 .
## mom_jobother           0.3878      0.3418    1.134 0.257024
## mom_jobservices        0.4969      0.4124    1.205 0.228669
## mom_jobteacher         0.8951      0.5599    1.599 0.110407
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.137 on 639 degrees of freedom
## Multiple R-squared:  0.07044, Adjusted R-squared:  0.05734
## F-statistic:  5.38 on 9 and 639 DF, p-value: 4.05e-07
```

Note that `dad_edu` and `dad_job` were not used since they are highly correlated to `mom_edu` and `mom_job`, respectively.

Out of the variables used, it looks like `mom_edu` has the only significant estimate. The estimate of 0.5132 suggests that each additional level of education reached by the mother corresponds with an additional 0.5132 points in the student's final grade in Portuguese.

## Regression with Student Behaviors

```
lm_habits <- lm(final_grade ~ paid_extra_classes + extracurricular_activities + attended_nursery + wants_higher_education + has_romantic_partner + going_out_amount + weekday_alcohol_cons + weekend_alcohol_cons, data = data)
summary(lm_habits)
```

```
##
## Call:
## lm(formula = final_grade ~ paid_extra_classes + extracurricular_activities + attended_nursery + wants_higher_education + has_romantic_partner + going_out_amount + weekday_alcohol_cons + weekend_alcohol_cons, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -13.1748  -1.6646   0.1527   1.8600   6.5574
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    10.231070   0.588339  17.390 < 2e-16 ***
## paid_extra_classesTRUE  -0.800661   0.497388  -1.610  0.1079
## extracurricular_activitiesTRUE  0.386926   0.237758   1.627  0.1041
## attended_nurseryTRUE    -0.003662   0.297699  -0.012  0.9902
## wants_higher_educationTRUE   3.174917   0.387856   8.186 1.47e-15 ***
## has_romantic_partnerTRUE  -0.401965   0.246684  -1.629  0.1037
## going_out_amount    -0.041095   0.109327  -0.376  0.7071
## weekday_alcohol_cons  -0.369190   0.163366  -2.260  0.0242 *
## weekend_alcohol_cons   -0.204184   0.122994  -1.660  0.0974 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.997 on 640 degrees of freedom
## Multiple R-squared:  0.1502, Adjusted R-squared:  0.1396
## F-statistic: 14.14 on 8 and 640 DF, p-value: < 2.2e-16
```

Out of the variables used, it seems that only wanting a higher education (i.e. `wants_higher_education`) and weekday alcohol consumption (i.e. `weekday_alcohol_cons`) were significant.

```
lm_habits2 <- lm(final_grade ~ wants_higher_education + weekday_alcohol_cons, data = data)
summary(lm_habits2)
```

```
##
## Call:
## lm(formula = final_grade ~ wants_higher_education + weekday_alcohol_cons,
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.5393  -1.5393   0.2858   1.7498   6.6052
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      9.8587     0.4337  22.732 < 2e-16 ***
## wants_higher_educationTRUE  3.2529     0.3862   8.423 2.38e-16 ***
## weekday_alcohol_cons    -0.5723     0.1288  -4.442 1.05e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.006 on 646 degrees of freedom
## Multiple R-squared:  0.1367, Adjusted R-squared:  0.134
## F-statistic: 51.15 on 2 and 646 DF,  p-value: < 2.2e-16
```

The combined adjusted R-Squared is about 0.134 which is very low. However, the p-values for the two variables are both very low, suggesting that it is very unlikely that there is no relationship and the final score and either of those two variables. The strength of wanting higher education both has a larger slope estimate and a more significant p-value compared to weekday alcohol consumption. It is heartening to see that academic ambition corresponds strongly to academic achievement.

## Regression with Hybrid Step-Wise Abroach

```
fit = lm(final_grade ~ .-grade_one-grade_two, data=data)
step = stepAIC(fit, direction="both")
```

```
## Start:  AIC=1311.16
## final_grade ~ (school + sex + age + urban_rural + fam_size +
##   parents_cohabit + mom_edu + dad_edu + mom_job + dad_job +
##   school_reason + student_guardian + traveltime + studytime +
##   failures + extra_school_support + fam_edu_support + paid_extra_classes +
##   extracurricular_activities + attended_nursery + wants_higher_education +
##   internet + has_romantic_partner + family_relationship + freetime +
##   going_out_amount + weekday_alcohol_cons + weekend_alcohol_cons +
##   health + absences + grade_one + grade_two) - grade_one -
##   grade_two
##
##              Df Sum of Sq    RSS    AIC
```

```

## - mom_job 4 28.27 4354.4 1307.4
## - school_reason 3 17.47 4343.6 1307.8
## - fam_edu_support 1 0.06 4326.2 1309.2
## - mom_edu 1 0.39 4326.6 1309.2
## - traveltime 1 1.10 4327.3 1309.3
## - parents_cohabit 1 1.85 4328.0 1309.4
## - student_guardian 2 16.00 4342.2 1309.5
## - going_out_amount 1 2.68 4328.9 1309.6
## - weekend_alcohol_cons 1 3.36 4329.5 1309.7
## - attended_nursery 1 4.50 4330.7 1309.8
## - paid_extra_classes 1 4.61 4330.8 1309.8
## - internet 1 5.95 4332.1 1310.0
## - extracurricular_activities 1 6.84 4333.0 1310.2
## - dad_edu 1 10.42 4336.6 1310.7
## - freetime 1 10.68 4336.9 1310.8
## - urban_rural 1 10.79 4337.0 1310.8
## - fam_size 1 10.83 4337.0 1310.8
## - dad_job 4 52.76 4378.9 1311.0
## - weekday_alcohol_cons 1 12.72 4338.9 1311.1
## <none> 4326.2 1311.2
## - family_relationship 1 13.75 4339.9 1311.2
## - age 1 16.59 4342.8 1311.6
## - absences 1 16.65 4342.8 1311.7
## - has_romantic_partner 1 25.18 4351.4 1312.9
## - health 1 41.88 4368.1 1315.4
## - sex 1 45.54 4371.7 1316.0
## - studytime 1 59.99 4386.2 1318.1
## - extra_school_support 1 92.14 4418.3 1322.8
## - school 1 143.23 4469.4 1330.3
## - wants_higher_education 1 145.64 4471.8 1330.7
## - failures 1 338.75 4664.9 1358.1
##
## Step: AIC=1307.38
## final_grade ~ school + sex + age + urban_rural + fam_size + parents_cohabit +
## mom_edu + dad_edu + dad_job + school_reason + student_guardian +
## traveltime + studytime + failures + extra_school_support +
## fam_edu_support + paid_extra_classes + extracurricular_activities +
## attended_nursery + wants_higher_education + internet + has_romantic_partner +
## family_relationship + freetime + going_out_amount + weekday_alcohol_cons +
## weekend_alcohol_cons + health + absences
##
## Df Sum of Sq RSS AIC
## - school_reason 3 17.69 4372.1 1304.0
## - fam_edu_support 1 0.00 4354.4 1305.4
## - traveltime 1 1.04 4355.5 1305.5
## - student_guardian 2 14.94 4369.4 1305.6
## - parents_cohabit 1 2.12 4356.6 1305.7
## - weekend_alcohol_cons 1 2.19 4356.6 1305.7
## - going_out_amount 1 2.54 4357.0 1305.8
## - attended_nursery 1 4.04 4358.5 1306.0
## - dad_job 4 44.81 4399.3 1306.0
## - paid_extra_classes 1 5.63 4360.1 1306.2
## - extracurricular_activities 1 7.08 4361.5 1306.4
## - dad_edu 1 8.12 4362.6 1306.6

```

```

## - freetime          1      9.75 4364.2 1306.8
## - internet          1      9.86 4364.3 1306.8
## - mom_edu           1     10.06 4364.5 1306.9
## - family_relationship 1     11.44 4365.9 1307.1
## - urban_rural       1     12.56 4367.0 1307.2
## - fam_size          1     12.77 4367.2 1307.3
## <none>              4354.4 1307.4
## - age               1     14.21 4368.7 1307.5
## - weekday_alcohol_cons 1     15.98 4370.4 1307.8
## - absences          1     20.21 4374.6 1308.4
## - has_romantic_partner 1     25.93 4380.4 1309.2
## - health            1     36.28 4390.7 1310.8
## + mom_job           4     28.27 4326.2 1311.2
## - sex               1     43.82 4398.3 1311.9
## - studytime         1     55.81 4410.2 1313.7
## - extra_school_support 1    100.28 4454.7 1320.2
## - school            1    150.86 4505.3 1327.5
## - wants_higher_education 1    154.58 4509.0 1328.0
## - failures          1    328.04 4682.5 1352.5
##
## Step: AIC=1304.02
## final_grade ~ school + sex + age + urban_rural + fam_size + parents_cohabit +
## mom_edu + dad_edu + dad_job + student_guardian + traveltime +
## studytime + failures + extra_school_support + fam_edu_support +
## paid_extra_classes + extracurricular_activities + attended_nursery +
## wants_higher_education + internet + has_romantic_partner +
## family_relationship + freetime + going_out_amount + weekday_alcohol_cons +
## weekend_alcohol_cons + health + absences
##
##              Df Sum of Sq   RSS   AIC
## - fam_edu_support      1      0.10 4372.2 1302.0
## - traveltime           1      0.73 4372.9 1302.1
## - weekend_alcohol_cons   1      1.63 4373.8 1302.3
## - parents_cohabit       1      1.64 4373.8 1302.3
## - going_out_amount      1      2.62 4374.8 1302.4
## - student_guardian       2     17.30 4389.4 1302.6
## - attended_nursery      1      4.00 4376.1 1302.6
## - dad_job               4     45.90 4418.0 1302.8
## - paid_extra_classes     1      7.39 4379.5 1303.1
## - dad_edu               1      8.07 4380.2 1303.2
## - freetime              1      9.05 4381.2 1303.4
## - internet              1     10.54 4382.7 1303.6
## - extracurricular_activities 1     10.57 4382.7 1303.6
## - mom_edu               1     10.84 4383.0 1303.6
## - family_relationship    1     11.25 4383.4 1303.7
## - urban_rural           1     11.48 4383.6 1303.7
## <none>                  4372.1 1304.0
## - fam_size              1     14.75 4386.9 1304.2
## - age                   1     15.71 4387.8 1304.3
## - absences              1     18.39 4390.5 1304.7
## - weekday_alcohol_cons   1     20.76 4392.9 1305.1
## - has_romantic_partner   1     29.07 4401.2 1306.3
## + school_reason          3     17.69 4354.4 1307.4
## + mom_job                4     28.49 4343.6 1307.8

```

```

## - health 1 41.35 4413.5 1308.1
## - sex 1 44.49 4416.6 1308.6
## - studytime 1 63.36 4435.5 1311.3
## - extra_school_support 1 101.65 4473.8 1316.9
## - wants_higher_education 1 159.55 4531.7 1325.3
## - school 1 176.15 4548.3 1327.7
## - failures 1 336.69 4708.8 1350.2
##
## Step: AIC=1302.03
## final_grade ~ school + sex + age + urban_rural + fam_size + parents_cohabit +
## mom_edu + dad_edu + dad_job + student_guardian + traveltime +
## studytime + failures + extra_school_support + paid_extra_classes +
## extracurricular_activities + attended_nursery + wants_higher_education +
## internet + has_romantic_partner + family_relationship + freetime +
## going_out_amount + weekday_alcohol_cons + weekend_alcohol_cons +
## health + absences
##
## Df Sum of Sq RSS AIC
## - traveltime 1 0.74 4373.0 1300.1
## - weekend_alcohol_cons 1 1.67 4373.9 1300.3
## - parents_cohabit 1 1.67 4373.9 1300.3
## - going_out_amount 1 2.58 4374.8 1300.4
## - student_guardian 2 17.45 4389.7 1300.6
## - attended_nursery 1 3.99 4376.2 1300.6
## - dad_job 4 45.92 4418.1 1300.8
## - paid_extra_classes 1 7.31 4379.5 1301.1
## - dad_edu 1 8.19 4380.4 1301.2
## - freetime 1 9.03 4381.3 1301.4
## - extracurricular_activities 1 10.51 4382.7 1301.6
## - internet 1 10.67 4382.9 1301.6
## - mom_edu 1 10.96 4383.2 1301.7
## - family_relationship 1 11.30 4383.5 1301.7
## - urban_rural 1 11.43 4383.7 1301.7
## <none> 4372.2 1302.0
## - fam_size 1 14.74 4387.0 1302.2
## - age 1 15.65 4387.9 1302.3
## - absences 1 18.30 4390.5 1302.7
## - weekday_alcohol_cons 1 20.68 4392.9 1303.1
## + fam_edu_support 1 0.10 4372.1 1304.0
## - has_romantic_partner 1 29.17 4401.4 1304.3
## + school_reason 3 17.79 4354.4 1305.4
## + mom_job 4 28.57 4343.7 1305.8
## - health 1 41.27 4413.5 1306.1
## - sex 1 45.80 4418.0 1306.8
## - studytime 1 64.64 4436.9 1309.5
## - extra_school_support 1 101.57 4473.8 1314.9
## - wants_higher_education 1 160.06 4532.3 1323.4
## - school 1 176.37 4548.6 1325.7
## - failures 1 337.36 4709.6 1348.3
##
## Step: AIC=1300.14
## final_grade ~ school + sex + age + urban_rural + fam_size + parents_cohabit +
## mom_edu + dad_edu + dad_job + student_guardian + studytime +
## failures + extra_school_support + paid_extra_classes + extracurricular_activities +

```

```

## attended_nursery + wants_higher_education + internet + has_romantic_partner +
## family_relationship + freetime + going_out_amount + weekday_alcohol_cons +
## weekend_alcohol_cons + health + absences
##
## Df Sum of Sq RSS AIC
## - weekend_alcohol_cons 1 1.69 4374.7 1298.4
## - parents_cohabit 1 1.71 4374.7 1298.4
## - going_out_amount 1 2.41 4375.4 1298.5
## - attended_nursery 1 3.87 4376.8 1298.7
## - student_guardian 2 17.98 4390.9 1298.8
## - dad_job 4 46.64 4419.6 1299.0
## - paid_extra_classes 1 7.51 4380.5 1299.2
## - dad_edu 1 8.02 4381.0 1299.3
## - freetime 1 9.32 4382.3 1299.5
## - internet 1 10.24 4383.2 1299.7
## - mom_edu 1 10.44 4383.4 1299.7
## - extracurricular_activities 1 10.48 4383.4 1299.7
## - urban_rural 1 10.69 4383.7 1299.7
## - family_relationship 1 11.31 4384.3 1299.8
## <none> 4373.0 1300.1
## - fam_size 1 14.85 4387.8 1300.3
## - age 1 15.38 4388.3 1300.4
## - absences 1 18.17 4391.1 1300.8
## - weekday_alcohol_cons 1 20.35 4393.3 1301.2
## + traveltime 1 0.74 4372.2 1302.0
## + fam_edu_support 1 0.10 4372.9 1302.1
## - has_romantic_partner 1 29.33 4402.3 1302.5
## + school_reason 3 17.48 4355.5 1303.5
## + mom_job 4 28.49 4344.5 1303.9
## - health 1 42.00 4415.0 1304.3
## - sex 1 45.18 4418.1 1304.8
## - studytime 1 64.88 4437.8 1307.7
## - extra_school_support 1 102.16 4475.1 1313.1
## - wants_higher_education 1 160.85 4533.8 1321.6
## - school 1 175.97 4548.9 1323.7
## - failures 1 336.67 4709.6 1346.3
##
## Step: AIC=1298.39
## final_grade ~ school + sex + age + urban_rural + fam_size + parents_cohabit +
## mom_edu + dad_edu + dad_job + student_guardian + studytime +
## failures + extra_school_support + paid_extra_classes + extracurricular_activities +
## attended_nursery + wants_higher_education + internet + has_romantic_partner +
## family_relationship + freetime + going_out_amount + weekday_alcohol_cons +
## health + absences
##
## Df Sum of Sq RSS AIC
## - parents_cohabit 1 1.55 4376.2 1296.6
## - attended_nursery 1 3.63 4378.3 1296.9
## - going_out_amount 1 4.42 4379.1 1297.0
## - student_guardian 2 18.88 4393.5 1297.2
## - dad_edu 1 7.38 4382.0 1297.5
## - paid_extra_classes 1 7.51 4382.2 1297.5
## - freetime 1 8.91 4383.6 1297.7
## - dad_job 4 49.72 4424.4 1297.7

```



```

## - internet 1 10.11 4384.8 1297.9
## - extracurricular_activities 1 10.55 4385.2 1298.0
## - urban_rural 1 10.78 4385.4 1298.0
## - mom_edu 1 11.16 4385.8 1298.0
## - family_relationship 1 12.96 4387.6 1298.3
## <none> 4374.7 1298.4
## - fam_size 1 14.30 4389.0 1298.5
## - age 1 15.24 4389.9 1298.7
## - absences 1 18.68 4393.3 1299.2
## + weekend_alcohol_cons 1 1.69 4373.0 1300.1
## + traveltime 1 0.76 4373.9 1300.3
## + fam_edu_support 1 0.13 4374.5 1300.4
## - has_romantic_partner 1 28.95 4403.6 1300.7
## - weekday_alcohol_cons 1 36.97 4411.6 1301.8
## + school_reason 3 16.95 4357.7 1301.9
## + mom_job 4 27.44 4347.2 1302.3
## - health 1 44.59 4419.3 1303.0
## - sex 1 49.74 4424.4 1303.7
## - studytime 1 68.35 4443.0 1306.5
## - extra_school_support 1 100.96 4475.6 1311.2
## - wants_higher_education 1 160.26 4534.9 1319.7
## - school 1 175.03 4549.7 1321.8
## - failures 1 337.10 4711.8 1344.6
##
## Step: AIC=1296.62
## final_grade ~ school + sex + age + urban_rural + fam_size + mom_edu +
## dad_edu + dad_job + student_guardian + studytime + failures +
## extra_school_support + paid_extra_classes + extracurricular_activities +
## attended_nursery + wants_higher_education + internet + has_romantic_partner +
## family_relationship + freetime + going_out_amount + weekday_alcohol_cons +
## health + absences
##
## Df Sum of Sq RSS AIC
## - attended_nursery 1 3.65 4379.9 1295.2
## - going_out_amount 1 4.36 4380.6 1295.3
## - student_guardian 2 19.26 4395.5 1295.5
## - dad_edu 1 7.22 4383.4 1295.7
## - paid_extra_classes 1 7.47 4383.7 1295.7
## - dad_job 4 48.90 4425.1 1295.8
## - freetime 1 8.87 4385.1 1295.9
## - urban_rural 1 10.16 4386.4 1296.1
## - mom_edu 1 10.69 4386.9 1296.2
## - internet 1 10.90 4387.1 1296.2
## - extracurricular_activities 1 11.42 4387.6 1296.3
## - fam_size 1 12.83 4389.0 1296.5
## - family_relationship 1 13.06 4389.3 1296.5
## <none> 4376.2 1296.6
## - age 1 15.91 4392.1 1297.0
## - absences 1 19.97 4396.2 1297.6
## + parents_cohabit 1 1.55 4374.7 1298.4
## + weekend_alcohol_cons 1 1.53 4374.7 1298.4
## + traveltime 1 0.81 4375.4 1298.5
## + fam_edu_support 1 0.16 4376.1 1298.6
## - has_romantic_partner 1 29.76 4406.0 1299.0

```

```

## - weekday_alcohol_cons      1      36.40 4412.6 1300.0
## + school_reason              3      16.56 4359.6 1300.2
## + mom_job                    4      27.63 4348.6 1300.5
## - health                     1      44.50 4420.7 1301.2
## - sex                        1      48.91 4425.1 1301.8
## - studytime                  1      68.18 4444.4 1304.7
## - extra_school_support       1     101.47 4477.7 1309.5
## - wants_higher_education     1     161.03 4537.2 1318.1
## - school                     1     175.84 4552.1 1320.2
## - failures                    1     337.85 4714.1 1342.9
##
## Step: AIC=1295.16
## final_grade ~ school + sex + age + urban_rural + fam_size + mom_edu +
##     dad_edu + dad_job + student_guardian + studytime + failures +
##     extra_school_support + paid_extra_classes + extracurricular_activities +
##     wants_higher_education + internet + has_romantic_partner +
##     family_relationship + freetime + going_out_amount + weekday_alcohol_cons +
##     health + absences
##
##              Df Sum of Sq    RSS    AIC
## - going_out_amount      1      4.60 4384.5 1293.8
## - student_guardian        2     20.31 4400.2 1294.2
## - dad_edu                 1      7.14 4387.0 1294.2
## - paid_extra_classes      1      7.71 4387.6 1294.3
## - dad_job                 4     49.58 4429.4 1294.5
## - freetime                1      8.86 4388.7 1294.5
## - mom_edu                 1      9.57 4389.4 1294.6
## - urban_rural             1     10.21 4390.1 1294.7
## - extracurricular_activities 1     11.03 4390.9 1294.8
## - internet                1     11.36 4391.2 1294.8
## - fam_size                1     11.54 4391.4 1294.9
## - family_relationship      1     12.69 4392.6 1295.0
## <none>                    4379.9 1295.2
## - age                     1     15.47 4395.3 1295.5
## - absences                1     19.80 4399.7 1296.1
## + attended_nursery        1      3.65 4376.2 1296.6
## + parents_cohabit         1      1.58 4378.3 1296.9
## + weekend_alcohol_cons     1      1.31 4378.6 1297.0
## + traveltime              1      0.68 4379.2 1297.1
## + fam_edu_support         1      0.15 4379.7 1297.1
## - has_romantic_partner     1     29.59 4409.5 1297.5
## - weekday_alcohol_cons     1     35.14 4415.0 1298.3
## + school_reason           3     16.58 4363.3 1298.7
## + mom_job                  4     27.27 4352.6 1299.1
## - health                   1     44.73 4424.6 1299.8
## - sex                      1     47.87 4427.7 1300.2
## - studytime                1     67.89 4447.8 1303.2
## - extra_school_support     1    102.61 4482.5 1308.2
## - wants_higher_education   1    161.63 4541.5 1316.7
## - school                   1    177.12 4557.0 1318.9
## - failures                  1    336.05 4715.9 1341.1
##
## Step: AIC=1293.84
## final_grade ~ school + sex + age + urban_rural + fam_size + mom_edu +

```

```

##      dad_edu + dad_job + student_guardian + studytime + failures +
##      extra_school_support + paid_extra_classes + extracurricular_activities +
##      wants_higher_education + internet + has_romantic_partner +
##      family_relationship + freetime + weekday_alcohol_cons + health +
##      absences
##
##              Df Sum of Sq    RSS    AIC
## - dad_edu          1      6.76 4391.2 1292.8
## - paid_extra_classes 1      7.72 4392.2 1293.0
## - student_guardian    2     21.67 4406.1 1293.0
## - dad_job           4     49.79 4434.3 1293.2
## - urban_rural        1      9.55 4394.0 1293.3
## - mom_edu            1      9.76 4394.2 1293.3
## - extracurricular_activities 1     10.27 4394.7 1293.4
## - internet           1     10.59 4395.1 1293.4
## - family_relationship 1     11.63 4396.1 1293.6
## - fam_size           1     11.83 4396.3 1293.6
## <none>                                4384.5 1293.8
## - age                1     13.99 4398.5 1293.9
## - freetime           1     14.90 4399.4 1294.0
## - absences           1     20.88 4405.4 1294.9
## + going_out_amount   1      4.60 4379.9 1295.2
## + attended_nursery    1      3.90 4380.6 1295.3
## + weekend_alcohol_cons 1      3.19 4381.3 1295.4
## + parents_cohabit     1      1.51 4383.0 1295.6
## + traveltime          1      0.46 4384.0 1295.8
## + fam_edu_support     1      0.10 4384.4 1295.8
## - has_romantic_partner 1     28.43 4412.9 1296.0
## + school_reason       3     16.39 4368.1 1297.4
## + mom_job             4     26.37 4358.1 1297.9
## - weekday_alcohol_cons 1     43.01 4427.5 1298.2
## - health              1     43.07 4427.5 1298.2
## - sex                 1     46.28 4430.7 1298.7
## - studytime           1     69.33 4453.8 1302.0
## - extra_school_support 1    101.44 4485.9 1306.7
## - wants_higher_education 1    161.61 4546.1 1315.3
## - school              1    181.25 4565.7 1318.1
## - failures            1    333.96 4718.4 1339.5
##
## Step:  AIC=1292.84
## final_grade ~ school + sex + age + urban_rural + fam_size + mom_edu +
##      dad_job + student_guardian + studytime + failures + extra_school_support +
##      paid_extra_classes + extracurricular_activities + wants_higher_education +
##      internet + has_romantic_partner + family_relationship + freetime +
##      weekday_alcohol_cons + health + absences
##
##              Df Sum of Sq    RSS    AIC
## - paid_extra_classes 1      6.79 4398.0 1291.8
## - urban_rural        1      9.60 4400.8 1292.3
## - extracurricular_activities 1     10.30 4401.5 1292.4
## - internet           1     10.82 4402.1 1292.4
## - fam_size           1     11.47 4402.7 1292.5
## - family_relationship 1     11.59 4402.8 1292.5
## - student_guardian    2     25.38 4416.6 1292.6

```

```

## <none>                                4391.2 1292.8
## - freetime                            1      13.83 4405.1 1292.9
## - age                                 1      13.90 4405.1 1292.9
## - dad_job                             4      54.97 4446.2 1292.9
## - absences                            1      19.15 4410.4 1293.7
## + dad_edu                             1       6.76 4384.5 1293.8
## + going_out_amount                    1       4.23 4387.0 1294.2
## + attended_nursery                    1       3.81 4387.4 1294.3
## + weekend_alcohol_cons                  1       2.28 4389.0 1294.5
## + parents_cohabit                     1       1.36 4389.9 1294.6
## + traveltime                           1       0.33 4390.9 1294.8
## + fam_edu_support                      1       0.21 4391.0 1294.8
## - mom_edu                             1     30.06 4421.3 1295.3
## - has_romantic_partner                 1     30.32 4421.6 1295.3
## + school_reason                        3     16.63 4374.6 1296.4
## - health                              1     41.93 4433.2 1297.0
## + mom_job                             4     24.46 4366.8 1297.2
## - weekday_alcohol_cons                 1     43.41 4434.6 1297.2
## - sex                                 1     47.03 4438.3 1297.8
## - studytime                           1     67.85 4459.1 1300.8
## - extra_school_support                 1    101.36 4492.6 1305.7
## - wants_higher_education               1    166.30 4557.5 1315.0
## - school                              1    183.71 4574.9 1317.4
## - failures                            1    340.22 4731.5 1339.3
##
## Step:  AIC=1291.85
## final_grade ~ school + sex + age + urban_rural + fam_size + mom_edu +
##      dad_job + student_guardian + studytime + failures + extra_school_support +
##      extracurricular_activities + wants_higher_education + internet +
##      has_romantic_partner + family_relationship + freetime + weekday_alcohol_cons +
##      health + absences
##
##              Df Sum of Sq    RSS    AIC
## - extracurricular_activities  1      9.50 4407.5 1291.2
## - urban_rural                 1     10.24 4408.3 1291.4
## - internet                    1     10.53 4408.6 1291.4
## - family_relationship          1     11.02 4409.0 1291.5
## - freetime                    1     12.19 4410.2 1291.6
## - fam_size                    1     12.51 4410.5 1291.7
## - student_guardian             2     26.17 4424.2 1291.7
## <none>                        4398.0 1291.8
## - age                         1     14.45 4412.5 1292.0
## - dad_job                     4     56.61 4454.6 1292.2
## - absences                    1     18.09 4416.1 1292.5
## + paid_extra_classes          1       6.79 4391.2 1292.8
## + dad_edu                     1       5.83 4392.2 1293.0
## + going_out_amount            1       4.26 4393.8 1293.2
## + attended_nursery            1       4.05 4394.0 1293.2
## + weekend_alcohol_cons         1       2.33 4395.7 1293.5
## + parents_cohabit             1       1.34 4396.7 1293.7
## + traveltime                   1       0.47 4397.6 1293.8
## - mom_edu                     1     27.00 4425.0 1293.8
## + fam_edu_support             1       0.05 4398.0 1293.8
## - has_romantic_partner        1     29.97 4428.0 1294.2

```

```

## + school_reason      3      18.06 4380.0 1295.2
## + mom_job            4      25.67 4372.4 1296.0
## - health             1      43.92 4441.9 1296.3
## - weekday_alcohol_cons 1      45.18 4443.2 1296.5
## - sex                1      49.12 4447.1 1297.1
## - studytime          1      67.75 4465.8 1299.8
## - extra_school_support 1     104.21 4502.2 1305.0
## - wants_higher_education 1    165.15 4563.2 1313.8
## - school             1    185.06 4583.1 1316.6
## - failures           1    350.17 4748.2 1339.6
##
## Step: AIC=1291.25
## final_grade ~ school + sex + age + urban_rural + fam_size + mom_edu +
## dad_job + student_guardian + studytime + failures + extra_school_support +
## wants_higher_education + internet + has_romantic_partner +
## family_relationship + freetime + weekday_alcohol_cons + health +
## absences
##
##              Df Sum of Sq    RSS    AIC
## - urban_rural      1      9.14 4416.7 1290.6
## - freetime          1      9.71 4417.2 1290.7
## - internet          1     11.28 4418.8 1290.9
## - student_guardian    2     25.04 4432.6 1290.9
## - family_relationship 1     11.63 4419.2 1291.0
## - fam_size          1     12.19 4419.7 1291.0
## - age               1     13.32 4420.8 1291.2
## <none>                                4407.5 1291.2
## - dad_job           4     56.35 4463.9 1291.5
## + extracurricular_activities 1      9.50 4398.0 1291.8
## - absences          1     18.49 4426.0 1292.0
## + paid_extra_classes 1      5.99 4401.5 1292.4
## + dad_edu           1      5.91 4401.6 1292.4
## + attended_nursery   1      3.64 4403.9 1292.7
## + going_out_amount   1      3.55 4404.0 1292.7
## + weekend_alcohol_cons 1      2.19 4405.3 1292.9
## + parents_cohabit    1      2.08 4405.4 1292.9
## + traveltime         1      0.48 4407.1 1293.2
## + fam_edu_support    1      0.02 4407.5 1293.2
## - has_romantic_partner 1     27.59 4435.1 1293.3
## - mom_edu            1     29.44 4437.0 1293.6
## + school_reason      3     21.20 4386.3 1294.1
## + mom_job            4     26.19 4381.3 1295.4
## - health             1     44.30 4451.8 1295.7
## - weekday_alcohol_cons 1     45.25 4452.8 1295.9
## - sex                1     45.30 4452.8 1295.9
## - studytime          1     72.41 4479.9 1299.8
## - extra_school_support 1    106.45 4514.0 1304.7
## - wants_higher_education 1    167.43 4575.0 1313.4
## - school             1    192.29 4599.8 1317.0
## - failures           1    346.56 4754.1 1338.4
##
## Step: AIC=1290.59
## final_grade ~ school + sex + age + fam_size + mom_edu + dad_job +
## student_guardian + studytime + failures + extra_school_support +

```

```

##      wants_higher_education + internet + has_romantic_partner +
##      family_relationship + freetime + weekday_alcohol_cons + health +
##      absences
##
##              Df Sum of Sq    RSS    AIC
## - freetime      1      9.93 4426.6 1290.0
## - family_relationship  1     10.54 4427.2 1290.1
## - student_guardian    2     25.07 4441.7 1290.3
## - internet          1     13.19 4429.9 1290.5
## - fam_size          1     13.43 4430.1 1290.6
## <none>                        4416.7 1290.6
## - age              1     13.96 4430.6 1290.6
## - dad_job          4     55.23 4471.9 1290.7
## - absences         1     17.98 4434.6 1291.2
## + urban_rural      1      9.14 4407.5 1291.2
## + extracurricular_activities 1      8.40 4408.3 1291.4
## + paid_extra_classes 1      6.61 4410.1 1291.6
## + dad_edu           1      5.91 4410.8 1291.7
## + attended_nursery  1      3.69 4413.0 1292.0
## + going_out_amount  1      3.03 4413.6 1292.2
## + weekend_alcohol_cons 1      2.17 4414.5 1292.3
## + parents_cohabit   1      1.36 4415.3 1292.4
## + traveltime        1      0.01 4416.7 1292.6
## + fam_edu_support   1      0.00 4416.7 1292.6
## - has_romantic_partner 1     27.79 4444.5 1292.7
## - mom_edu           1     32.46 4449.1 1293.3
## + school_reason     3     20.00 4396.7 1293.7
## + mom_job           4     27.47 4389.2 1294.5
## - health            1     44.28 4460.9 1295.1
## - sex               1     45.49 4462.2 1295.2
## - weekday_alcohol_cons 1     47.17 4463.8 1295.5
## - studytime         1     72.12 4488.8 1299.1
## - extra_school_support 1    107.52 4524.2 1304.2
## - wants_higher_education 1    168.49 4585.2 1312.9
## - school            1    241.06 4657.7 1323.1
## - failures          1    346.10 4762.8 1337.5
##
## Step:  AIC=1290.05
## final_grade ~ school + sex + age + fam_size + mom_edu + dad_job +
##      student_guardian + studytime + failures + extra_school_support +
##      wants_higher_education + internet + has_romantic_partner +
##      family_relationship + weekday_alcohol_cons + health + absences
##
##              Df Sum of Sq    RSS    AIC
## - family_relationship  1      8.16 4434.8 1289.2
## - dad_job             4     52.57 4479.2 1289.7
## - internet            1     11.47 4438.1 1289.7
## - student_guardian     2     26.48 4453.1 1289.9
## <none>                        4426.6 1290.0
## - fam_size            1     14.21 4440.8 1290.1
## - age                 1     15.81 4442.4 1290.4
## - absences            1     16.86 4443.5 1290.5
## + freetime            1      9.93 4416.7 1290.6
## + urban_rural         1      9.36 4417.2 1290.7

```

```

## + going_out_amount      1      7.18 4419.4 1291.0
## + extracurricular_activities 1      6.06 4420.5 1291.2
## + paid_extra_classes     1      5.22 4421.4 1291.3
## + dad_edu                1      5.14 4421.5 1291.3
## + attended_nursery       1      3.84 4422.8 1291.5
## + weekend_alcohol_cons    1      2.79 4423.8 1291.6
## + parents_cohabit        1      1.21 4425.4 1291.9
## + fam_edu_support        1      0.00 4426.6 1292.0
## + traveltime             1      0.00 4426.6 1292.0
## - has_romantic_partner   1     28.78 4455.4 1292.3
## - mom_edu                1     33.16 4459.8 1292.9
## + school_reason          3     18.34 4408.3 1293.4
## + mom_job                4     25.86 4400.7 1294.2
## - health                 1     46.55 4473.1 1294.8
## - sex                   1     50.03 4476.6 1295.3
## - weekday_alcohol_cons   1     51.28 4477.9 1295.5
## - studytime              1     72.24 4498.8 1298.6
## - extra_school_support    1    107.23 4533.8 1303.6
## - wants_higher_education  1    175.02 4601.6 1313.2
## - school                 1    244.99 4671.6 1323.0
## - failures               1    359.02 4785.6 1338.7
##
## Step:  AIC=1289.25
## final_grade ~ school + sex + age + fam_size + mom_edu + dad_job +
##      student_guardian + studytime + failures + extra_school_support +
##      wants_higher_education + internet + has_romantic_partner +
##      weekday_alcohol_cons + health + absences
##
##              Df Sum of Sq    RSS    AIC
## - dad_job      4      49.66 4484.4 1288.5
## - student_guardian 2      26.31 4461.1 1289.1
## - internet      1      13.01 4447.8 1289.2
## <none>                      4434.8 1289.2
## - fam_size      1      14.04 4448.8 1289.3
## - age           1      16.80 4451.6 1289.7
## - absences      1      18.43 4453.2 1289.9
## + urban_rural   1       8.35 4426.4 1290.0
## + family_relationship 1       8.16 4426.6 1290.0
## + freetime      1       7.55 4427.2 1290.1
## + extracurricular_activities 1       6.76 4428.0 1290.3
## + going_out_amount 1       5.46 4429.3 1290.5
## + dad_edu       1       5.22 4429.5 1290.5
## + paid_extra_classes 1       4.90 4429.9 1290.5
## + weekend_alcohol_cons 1       3.91 4430.9 1290.7
## + attended_nursery 1       3.47 4431.3 1290.7
## + parents_cohabit 1       1.35 4433.4 1291.0
## + fam_edu_support 1       0.00 4434.8 1291.2
## + traveltime    1       0.00 4434.8 1291.2
## - has_romantic_partner 1     29.32 4464.1 1291.5
## - mom_edu       1     32.88 4467.6 1292.0
## + school_reason  3     18.26 4416.5 1292.6
## - health        1     43.06 4477.8 1293.5
## + mom_job       4     23.94 4410.8 1293.7
## - sex           1     46.93 4481.7 1294.1

```

```

## - weekday_alcohol_cons      1      55.75 4490.5 1295.3
## - studytime                  1      71.60 4506.4 1297.6
## - extra_school_support      1     107.16 4541.9 1302.7
## - wants_higher_education    1     175.85 4610.6 1312.5
## - school                    1     245.45 4680.2 1322.2
## - failures                   1     364.95 4799.7 1338.6
##
## Step: AIC=1288.47
## final_grade ~ school + sex + age + fam_size + mom_edu + student_guardian +
##      studytime + failures + extra_school_support + wants_higher_education +
##      internet + has_romantic_partner + weekday_alcohol_cons +
##      health + absences
##
##              Df Sum of Sq    RSS    AIC
## - internet      1      8.61 4493.0 1287.7
## - fam_size       1     11.44 4495.9 1288.1
## - student_guardian 2     27.12 4511.5 1288.4
## <none>                                4484.4 1288.5
## + dad_edu        1     10.48 4473.9 1289.0
## - absences        1     17.44 4501.9 1289.0
## - age             1     18.53 4502.9 1289.2
## + dad_job         4     49.66 4434.8 1289.2
## + urban_rural     1      7.40 4477.0 1289.4
## + weekend_alcohol_cons 1      7.36 4477.1 1289.4
## + extracurricular_activities 1      6.82 4477.6 1289.5
## + paid_extra_classes 1      6.47 4478.0 1289.5
## + freetime        1      5.70 4478.7 1289.7
## + going_out_amount 1      5.32 4479.1 1289.7
## + family_relationship 1      5.25 4479.2 1289.7
## + attended_nursery 1      4.27 4480.1 1289.8
## - has_romantic_partner 1     25.41 4509.8 1290.1
## + parents_cohabit 1      0.69 4483.7 1290.4
## + traveltime      1      0.12 4484.3 1290.5
## + fam_edu_support 1      0.03 4484.4 1290.5
## + school_reason   3     18.35 4466.1 1291.8
## - health          1     40.61 4525.0 1292.3
## - sex             1     46.24 4530.7 1293.1
## + mom_job         4     18.46 4466.0 1293.8
## - mom_edu         1     55.25 4539.7 1294.4
## - weekday_alcohol_cons 1     64.29 4548.7 1295.7
## - studytime       1     64.75 4549.2 1295.8
## - extra_school_support 1     95.20 4579.6 1300.1
## - wants_higher_education 1    171.89 4656.3 1310.9
## - school          1    258.16 4742.6 1322.8
## - failures        1    379.10 4863.5 1339.1
##
## Step: AIC=1287.72
## final_grade ~ school + sex + age + fam_size + mom_edu + student_guardian +
##      studytime + failures + extra_school_support + wants_higher_education +
##      has_romantic_partner + weekday_alcohol_cons + health + absences
##
##              Df Sum of Sq    RSS    AIC
## - fam_size       1     11.71 4504.7 1287.4
## <none>                                4493.0 1287.7

```



```

## - student_guardian      2      28.93 4522.0 1287.9
## - absences             1      16.84 4509.9 1288.2
## + dad_edu              1      10.47 4482.6 1288.2
## + urban_rural          1       8.63 4484.4 1288.5
## + internet             1       8.61 4484.4 1288.5
## - age                  1      19.81 4512.8 1288.6
## + extracurricular_activities 1       7.48 4485.6 1288.6
## + weekend_alcohol_cons  1       6.56 4486.5 1288.8
## + family_relationship  1       6.39 4486.6 1288.8
## + paid_extra_classes    1       6.25 4486.8 1288.8
## + attended_nursery      1       4.64 4488.4 1289.0
## + freetime             1       4.53 4488.5 1289.1
## + going_out_amount      1       4.09 4488.9 1289.1
## + dad_job              4      45.26 4447.8 1289.2
## - has_romantic_partner  1      24.08 4517.1 1289.2
## + parents_cohabit       1       1.19 4491.8 1289.5
## + fam_edu_support       1       0.10 4492.9 1289.7
## + traveltime           1       0.00 4493.0 1289.7
## + school_reason        3      19.18 4473.9 1290.9
## - health               1      42.09 4535.1 1291.8
## - sex                  1      45.32 4538.4 1292.2
## + mom_job              4      21.82 4471.2 1292.6
## - weekday_alcohol_cons  1      62.77 4555.8 1294.7
## - studytime            1      64.25 4557.3 1294.9
## - mom_edu              1      67.59 4560.6 1295.4
## - extra_school_support  1      96.78 4589.8 1299.5
## - wants_higher_education 1     173.21 4666.2 1310.3
## - school               1     284.88 4777.9 1325.6
## - failures             1     387.58 4880.6 1339.4
##
## Step:  AIC=1287.41
## final_grade ~ school + sex + age + mom_edu + student_guardian +
##      studytime + failures + extra_school_support + wants_higher_education +
##      has_romantic_partner + weekday_alcohol_cons + health + absences
##
##              Df Sum of Sq    RSS    AIC
## <none>                        4504.7 1287.4
## - student_guardian      2      28.07 4532.8 1287.4
## + fam_size              1      11.71 4493.0 1287.7
## - absences             1      16.60 4521.3 1287.8
## + urban_rural          1       9.86 4494.9 1288.0
## + dad_edu              1       9.54 4495.2 1288.0
## + internet             1       8.88 4495.9 1288.1
## - age                  1      20.20 4524.9 1288.3
## + paid_extra_classes    1       7.12 4497.6 1288.4
## + extracurricular_activities 1       7.06 4497.7 1288.4
## + family_relationship  1       6.32 4498.4 1288.5
## + weekend_alcohol_cons  1       5.92 4498.8 1288.5
## + freetime             1       5.01 4499.7 1288.7
## + going_out_amount      1       4.42 4500.3 1288.8
## + attended_nursery      1       3.13 4501.6 1289.0
## - has_romantic_partner  1      25.09 4529.8 1289.0
## + dad_job              4      42.64 4462.1 1289.2
## + fam_edu_support       1       0.06 4504.7 1289.4

```

```
## + parents_cohabit      1      0.03 4504.7 1289.4
## + traveltime           1      0.00 4504.7 1289.4
## + school_reason        3     21.43 4483.3 1290.3
## - sex                   1     41.67 4546.4 1291.4
## - health                1     42.42 4547.2 1291.5
## + mom_job               4     23.75 4481.0 1292.0
## - weekday_alcohol_cons  1     60.73 4565.5 1294.1
## - studytime             1     65.05 4569.8 1294.7
## - mom_edu               1     65.71 4570.5 1294.8
## - extra_school_support  1     99.72 4604.5 1299.6
## - wants_higher_education 1    173.42 4678.2 1309.9
## - school                1    281.95 4786.7 1324.8
## - failures              1    400.80 4905.5 1340.7
```

```
summary(step)
```

```
##
## Call:
## lm(formula = final_grade ~ school + sex + age + mom_edu + student_guardian +
##      studytime + failures + extra_school_support + wants_higher_education +
##      has_romantic_partner + weekday_alcohol_cons + health + absences,
##      data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -12.1548  -1.3687   0.0072   1.5292   7.2845
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      8.90516     1.75710   5.068 5.28e-07 ***
## schoolMousinho da Silveira -1.51318     0.24021  -6.299 5.59e-10 ***
## sexM              -0.57091     0.23574  -2.422 0.015726 *
## age                0.16711     0.09910   1.686 0.092231 .
## mom_edu            0.30127     0.09906   3.041 0.002454 **
## student_guardianmother -0.45308     0.25282  -1.792 0.073592 .
## student_guardianother  0.03407     0.51153   0.067 0.946911
## studytime          0.40872     0.13508   3.026 0.002580 **
## failures           -1.48437     0.19764  -7.511 2.01e-13 ***
## extra_school_supportTRUE -1.33575     0.35655  -3.746 0.000196 ***
## wants_higher_educationTRUE 1.86377     0.37726   4.940 9.99e-07 ***
## has_romantic_partnerTRUE -0.42199     0.22456  -1.879 0.060679 .
## weekday_alcohol_cons  -0.35842     0.12260  -2.924 0.003584 **
## health             -0.17961     0.07351  -2.443 0.014826 *
## absences            -0.03687     0.02412  -1.529 0.126848
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.666 on 634 degrees of freedom
## Multiple R-squared:  0.3339, Adjusted R-squared:  0.3192
## F-statistic: 22.7 on 14 and 634 DF, p-value: < 2.2e-16
```

The hybrid step-wise linear regression model builder results in 14 different variables. There are 4 variables with higher statistical significance than the others, the school the student attended, the number of previous

failures the student has, whether or not the student had extra educational support, and whether or not the student wants a higher education. Among these, the one that has the highest estimate on the influence is whether or not the student wants higher education, although all 4 variables have fairly similar estimates. That is also the only predictor that has a positive relationship with the final score. All the other predictors, including, surprisingly whether a student has extra educational support, have negative relationships.

Sadly, the adjusted R-squared is 0.3192. This is low enough that we cannot make good predictions, even if we can identify influential factors.