# Statistical Learning (5454) - Assignment 1

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## Exercise 1

Let's load the data

```
data("diabetes", package = "lars")
# y <- diabetes$y
# X <- as.data.frame(diabetes$x)
head(diabetes)
```

```
##           x.age        x.sex        x.bmi        x.map         x.tc         x.ldl
## 1  0.038075906  0.050680119  0.061696207  0.021872355 -0.044223498 -0.034820763
## 2 -0.001882017 -0.044641637 -0.051474061 -0.026327835 -0.008448724 -0.019163340
## 3  0.085298906  0.050680119  0.044451213 -0.005670611 -0.045599451 -0.034194466
## 4 -0.089062939 -0.044641637 -0.011595015 -0.036656447  0.012190569  0.024990593
## 5  0.005383060 -0.044641637 -0.036384692  0.021872355  0.003934852  0.015596140
## 6 -0.092695478 -0.044641637 -0.040695940 -0.019442093 -0.068990650 -0.079287844
##           x.hdl        x.tch        x.ltg        x.glu   y        x2.age
## 1 -0.043400846 -0.002592262  0.019908421 -0.017646125 151  0.0380759064
## 2  0.074411564 -0.039493383 -0.068329744 -0.092204050  75 -0.0018820165
## 3 -0.032355932 -0.002592262  0.002863771 -0.025930339 141  0.0852989063
## 4 -0.036037570  0.034308859  0.022692023 -0.009361911 206 -0.0890629394
## 5  0.008142084 -0.002592262 -0.031991445 -0.046640874 135  0.0053830604
## 6  0.041276824 -0.076394504 -0.041180385 -0.096346157  97 -0.0926954778
##          x2.sex        x2.bmi        x2.map         x2.tc        x2.ldl
## 1  0.0506801187  0.0616962065  0.0218723550 -0.0442234984 -0.0348207628
## 2 -0.0446416365 -0.0514740612 -0.0263278347 -0.0084487241 -0.0191633397
## 3  0.0506801187  0.0444512133 -0.0056706106 -0.0455994513 -0.0341944659
## 4 -0.0446416365 -0.0115950145 -0.0366564468  0.0121905688  0.0249905934
## 5 -0.0446416365 -0.0363846922  0.0218723550  0.0039348516  0.0155961395
## 6 -0.0446416365 -0.0406959405 -0.0194420933 -0.0689906499 -0.0792878444
##          x2.hdl        x2.tch        x2.ltg        x2.glu       x2.age^2
## 1 -0.0434008457 -0.0025922620  0.0199084209 -0.0176461252 -0.0148551625
## 2  0.0744115641 -0.0394933829 -0.0683297436 -0.0922040496 -0.0412915429
## 3 -0.0323559322 -0.0025922620  0.0028637705 -0.0259303390  0.0916434391
## 4 -0.0360375700  0.0343088589  0.0226920226 -0.0093619113  0.1036403301
## 5  0.0081420836 -0.0025922620 -0.0319914449 -0.0466408736 -0.0408265979
## 6  0.0412768238 -0.0763945038 -0.0411803852 -0.0963461565  0.1157092549
##         x2.bmi^2       x2.map^2        x2.tc^2       x2.ldl^2       x2.hdl^2
## 1  0.0225045739 -0.0310446765 -0.0043311197 -0.0137399243 -0.0046314248
## 2  0.0056427733 -0.0273076609 -0.0309389016 -0.0248010319  0.0400365241
## 3 -0.0041764214 -0.0388099038 -0.0025859366 -0.0143055611 -0.0148614560
## 4 -0.0310170859 -0.0159874156 -0.0298483890 -0.0214340114 -0.0117828858
```

```
## 5 -0.0136807215 -0.0310446765 -0.0317282077 -0.0264236384 -0.0268506700
## 6 -0.0088370145 -0.0327918526  0.0352626533  0.0526602897 -0.0068304035
##          x2.tch^2       x2.ltg^2       x2.glu^2      x2.age:sex      x2.age:bmi
## 1 -0.0304484629 -0.0288162192 -0.0275255618  0.0328649758  0.0405716741
## 2 -0.0094854824  0.0371612444  0.0880219609 -0.0066099928 -0.0067648038
## 3 -0.0304484629 -0.0348099250 -0.0224326123  0.0840517453  0.0708891293
## 4 -0.0146503349 -0.0269850701 -0.0306820952  0.0766292449  0.0129034054
## 5 -0.0304484629 -0.0191324512 -0.0012284185 -0.0135465959 -0.0129173209
## 6  0.0482386067 -0.0087497144  0.0990402558  0.0800975464  0.0704832806
##          x2.age:map       x2.age:tc      x2.age:ldl      x2.age:hdl      x2.age:tch
## 1  0.0016606410 -0.0465532511 -0.0382447104 -0.0345115069 -0.0121122609
## 2 -0.0159342243 -0.0117287997 -0.0096555406  0.0006995477 -0.0083689963
## 3 -0.0279128687 -0.0917442739 -0.0716415163 -0.0602920920 -0.0147605279
## 4  0.0562904032 -0.0342989420 -0.0571356258  0.0786805432 -0.0760817036
## 5 -0.0144024121 -0.0116206046 -0.0086502423  0.0049801694 -0.0102788452
## 6  0.0234365273  0.1189685396  0.1438718189 -0.0851146968  0.1432199339
##          x2.age:ltg      x2.age:glu      x2.sex:bmi      x2.sex:map       x2.sex:tc
## 1  0.0030648916 -0.0302775066  0.0621030123  0.0122820371 -0.0485722318
## 2 -0.0102016795 -0.0113801440  0.0445181909  0.0137392710  0.0062226212
## 3 -0.0077635174 -0.0646990887  0.0435615292 -0.0181579597 -0.0500315236
## 4 -0.0555091413  0.0033785934  0.0067497817  0.0237941848 -0.0130586592
## 5 -0.0165418441 -0.0208710562  0.0302274415 -0.0331836602 -0.0053461470
## 6  0.0675437504  0.1843686827  0.0343105127  0.0070359951  0.0627810439
##          x2.sex:ldl      x2.sex:hdl      x2.sex:tch      x2.sex:ltg      x2.sex:glu
## 1 -0.0441240238 -0.0308042981 -0.0195479919  0.0142268228 -0.0293859648
## 2  0.0112617659 -0.0565675488  0.0224021267  0.0575880019  0.0784642525
## 3 -0.0434530875 -0.0179545693 -0.0195479919 -0.0041216840 -0.0384231554
## 4 -0.0304033769  0.0566194244 -0.0505546014 -0.0287218500 -0.0011399371
## 5 -0.0215384529  0.0113446351 -0.0140762373  0.0231308241  0.0346819482
## 6  0.0679972794 -0.0226114568  0.0588804908  0.0318440815  0.0824444620
##          x2.bmi:map       x2.bmi:tc      x2.bmi:ldl      x2.bmi:hdl      x2.bmi:tch
## 1  0.0090008988 -0.0717180778 -0.0603176794 -0.0413575386 -0.0240342004
## 2  0.0091148702 -0.0028355367  0.0087097314 -0.0671553344  0.0240456899
## 3 -0.0226918084 -0.0564432291 -0.0464818380 -0.0136167525 -0.0230540270
## 4 -0.0092925186 -0.0153834201 -0.0193921008  0.0279274131 -0.0292499537
## 5 -0.0334523099 -0.0154230197 -0.0255070025  0.0119441348 -0.0184594644
## 6 -0.0020460266  0.0488321410  0.0580412284 -0.0190229456  0.0476394964
##          x2.bmi:ltg      x2.bmi:glu       x2.map:tc      x2.map:ldl      x2.map:hdl
## 1  0.0048261936 -0.0410278367 -0.0327209536 -0.0257474212 -0.0112074291
## 2  0.0552994440  0.0806093115 -0.0070399803  0.0018462404 -0.0319794277
## 3 -0.0194513972 -0.0423606977 -0.0062598621 -0.0049233843  0.0120934525
## 4 -0.0280603703 -0.0160690142 -0.0214874364 -0.0291135216  0.0354925517
## 5  0.0034088636  0.0170453175 -0.0099837004 -0.0017149265  0.0119825521
## 6  0.0146962189  0.0634061398  0.0171122204  0.0244459437 -0.0081883427
##          x2.map:tch      x2.map:ltg      x2.map:glu       x2.tc:ldl       x2.tc:hdl
## 1 -0.0138251131 -0.0101938361 -0.0257784633 -0.0068689647  0.0398230899
## 2  0.0098745200  0.0203696547  0.0313619644 -0.0262353123 -0.0164622948
## 3 -0.0122818754 -0.0203183065 -0.0149534838 -0.0065969775  0.0300168640
## 4 -0.0397827564 -0.0385992765 -0.0109701272 -0.0242291837 -0.0122792654
## 5 -0.0138251131 -0.0356386917 -0.0386583542 -0.0276482686 -0.0018670731
## 6  0.0195036026 -0.0020081382  0.0201031994  0.0483666130 -0.0654803859
##           x2.tc:tch       x2.tc:ltg       x2.tc:glu      x2.ldl:hdl      x2.ldl:tch
## 1 -0.0193030537 -0.0428915072  0.0009629700  0.0423549304 -0.0220378305
## 2 -0.0155012002 -0.0123430995  0.0009326831 -0.0212564243 -0.0115642516
```

2

```
## 3 -0.0192411418 -0.0271777643  0.0098716066  0.0335869646 -0.0220633407
## 4 -0.0140331587 -0.0186440420 -0.0188580962 -0.0098784247 -0.0099839514
## 5 -0.0214699727 -0.0270791696 -0.0203958711  0.0123759491 -0.0240914053
## 6  0.0701909475  0.0350969957  0.1309600895 -0.0612519836  0.0717191451
##      x2.ldl:ltg    x2.ldl:glu    x2.hdl:tch    x2.hdl:ltg    x2.hdl:glu
## 1 -0.0311245646 -0.0009221095  0.0334936252  0.0008521487  0.0311502576
## 2  0.0129733755  0.0237834359 -0.0238146613 -0.0945055990 -0.1403775894
## 3 -0.0180161691  0.0049134553  0.0329558784  0.0182807986  0.0327952439
## 4 -0.0033727555 -0.0191092832  0.0081586184  0.0018977323  0.0215138966
## 5 -0.0268464903 -0.0296874121  0.0309841399  0.0144891320  0.0053856590
## 6  0.0560369456  0.1496630223 -0.0278444433 -0.0180308997 -0.0755127518
##      x2.tch:ltg    x2.tch:glu    x2.ltg:glu
## 1 -0.0281911757 -0.0176581553 -0.0277936831
## 2  0.0252977155  0.0530335390  0.1040132768
## 3 -0.0273318271 -0.0172359590 -0.0223037368
## 4 -0.0120454909 -0.0248722040 -0.0250419367
## 5 -0.0255745144 -0.0161804685  0.0087351987
## 6  0.0339989574  0.1261465729  0.0577886517
```

Setting a seed and splitting the data into test and training data set.

```r
set.seed(123)
# generate & separate train and test data
diabetes_rand <- diabetes[sample(nrow(diabetes)), ]

train <- diabetes_rand[1:400, ]
test <- diabetes_rand[401:nrow(diabetes), ]

correlation_matrix <- cor(diabetes, use = "complete.obs")

# View the correlation matrix
print(correlation_matrix)
```

```
##                    x.age         x.sex         x.bmi         x.map          x.tc
## x.age       1.000000000  0.1737371006  0.1850846661  0.3354267105  0.2600608202
## x.sex       0.173737101  1.0000000000  0.0881613990  0.2410131688  0.0352768192
## x.bmi       0.185084666  0.0881613990  1.0000000000  0.3954153212  0.2497774217
## x.map       0.335426711  0.2410131688  0.3954153212  1.0000000000  0.2424697089
## x.tc        0.260060820  0.0352768192  0.2497774217  0.2424697089  1.0000000000
## x.ldl       0.219243140  0.1426372570  0.2611699112  0.1855578262  0.8966629578
## x.hdl      -0.075180975 -0.3790896292 -0.3668109784 -0.1787612071  0.0515193643
## x.tch       0.203840900  0.3321150931  0.4138066018  0.2576533662  0.5422072805
## x.ltg       0.270776785  0.1499175570  0.4461586482  0.3934781393  0.5155007619
## x.glu       0.301731008  0.2081332162  0.3886799939  0.3904293804  0.3257167531
## y           0.187888751  0.0430619985  0.5864501345  0.4414838489  0.2120224810
## x2.age      1.000000000  0.1737371006  0.1850846661  0.3354267105  0.2600608202
## x2.sex      0.173737101  1.0000000000  0.0881613990  0.2410131688  0.0352768192
## x2.bmi      0.185084666  0.0881613990  1.0000000000  0.3954153212  0.2497774217
## x2.map      0.335426711  0.2410131688  0.3954153212  1.0000000000  0.2424697089
## x2.tc       0.260060820  0.0352768192  0.2497774217  0.2424697089  1.0000000000
## x2.ldl      0.219243140  0.1426372570  0.2611699112  0.1855578262  0.8966629578
## x2.hdl     -0.075180975 -0.3790896292 -0.3668109784 -0.1787612071  0.0515193643
## x2.tch      0.203840900  0.3321150931  0.4138066018  0.2576533662  0.5422072805
## x2.ltg      0.270776785  0.1499175570  0.4461586482  0.3934781393  0.5155007619
## x2.glu      0.301731008  0.2081332162  0.3886799939  0.3904293804  0.3257167531
```

```
## x2.age^2   -0.200495040 -0.0244232033 -0.1268748659 -0.1177109968 -0.1087044594
## x2.bmi^2   -0.143868720 -0.0555678457  0.4132850342  0.0440619095 -0.0893698322
## x2.map^2    0.012518945 -0.0812021734  0.1037548658  0.2397639191 -0.0004758044
## x2.tc^2    -0.053884745  0.0557870248 -0.0003494694 -0.0176322531  0.2530913728
## x2.ldl^2   -0.047331454  0.0469285912  0.0095656454 -0.0230735322  0.2504506228
## x2.hdl^2    0.087011384 -0.0803374453 -0.1489612676 -0.0468457765  0.0749226244
## x2.tch^2   -0.020125953  0.0591041522  0.0726953952  0.0329556492  0.2282672535
## x2.ltg^2   -0.003460702  0.0123132414  0.0313917446  0.0573975334  0.0910358367
## x2.glu^2   -0.020809533 -0.0143449155  0.0230966296  0.0044639997  0.0188212593
## x2.age:sex -0.028576256  0.0224381418 -0.0605077952 -0.0725035333 -0.1163813014
## x2.age:bmi -0.145877538 -0.0594595280 -0.2074500182 -0.0954221480 -0.2354394023
## x2.age:map -0.144654860 -0.0761504485 -0.1019887700  0.0161609111 -0.1269903777
## x2.age:tc  -0.121837971 -0.1114848384 -0.2295100022 -0.1158217493 -0.0781834504
## x2.age:ldl -0.109247343 -0.0739301682 -0.2312079435 -0.1562158608 -0.1117212327
## x2.age:hdl  0.005604460 -0.0427299841 -0.0227803332  0.0012628738  0.1137175197
## x2.age:tch -0.100933545 -0.0466376197 -0.1287481461 -0.0697967484 -0.1627778782
## x2.age:ltg -0.107215864 -0.0972593838 -0.1038157271  0.0130339243 -0.0997097575
## x2.age:glu -0.164832239 -0.0862420468 -0.1250066265 -0.0616478268 -0.1715608934
## x2.sex:bmi -0.060018981  0.0112940598 -0.0808793812  0.0089199718  0.0004948300
## x2.sex:map -0.073924590  0.0317369250  0.0091688727 -0.1017612046 -0.0362958126
## x2.sex:tc  -0.113872180  0.0044577752  0.0004881049 -0.0348306192  0.0826768700
## x2.sex:ldl -0.074443717  0.0182064027 -0.0429552876 -0.0235644272  0.0747024485
## x2.sex:hdl -0.042134530 -0.0525489110  0.0818138029 -0.0262908744  0.0084093606
## x2.sex:tch -0.047737839  0.0444091125 -0.0210230565  0.0129109592  0.0394783867
## x2.sex:ltg -0.098016155  0.0192289379  0.0128834947 -0.0224706021  0.0204416263
## x2.sex:glu -0.083049266  0.0270528925 -0.0138768376 -0.0277524895 -0.0080364898
## x2.bmi:map -0.089846895  0.0083205149  0.0598224636  0.1179932918 -0.1320488990
## x2.bmi:tc  -0.243932458  0.0005079012 -0.1335145154 -0.1453019176 -0.0005389223
## x2.bmi:ldl -0.242531427 -0.0447481976 -0.1423628916 -0.1904968972  0.0126295085
## x2.bmi:hdl -0.021901621  0.0797695870 -0.1268962378  0.0263653418 -0.0306445132
## x2.bmi:tch -0.130488623 -0.0208161851  0.0623632666 -0.0968954529  0.0309730021
## x2.bmi:ltg -0.108613056  0.0133747731  0.0794981638 -0.0028027188 -0.0466545458
## x2.bmi:glu -0.116585444 -0.0134395603  0.1029993963 -0.0150691992 -0.0203986852
## x2.map:tc  -0.122028662 -0.0359278391 -0.1440373425 -0.0005902251 -0.0269543299
## x2.map:ldl -0.162179239 -0.0242952105 -0.1885353397 -0.0500505942 -0.0536063916
## x2.map:hdl  0.001115853 -0.0235584525  0.0242306114  0.0129865271  0.0024722339
## x2.map:tch -0.069734729  0.0126021908 -0.0955180962 -0.0102520409 -0.0108461721
## x2.map:ltg  0.013861319 -0.0237125311 -0.0028489838  0.0997876121 -0.0162808854
## x2.map:glu -0.056012801 -0.0261851293 -0.0146807551  0.1135000957 -0.0907218997
## x2.tc:ldl  -0.074796332  0.0496675875  0.0080605702 -0.0345693350  0.2347735149
## x2.tc:hdl   0.107902518  0.0080921096 -0.0302441056  0.0026548905 -0.0587978164
## x2.tc:tch  -0.130604532  0.0309453843  0.0245196633 -0.0087101459  0.1901576018
## x2.tc:ltg  -0.099138767  0.0201676433 -0.0443384935 -0.0152213973  0.1892733138
## x2.tc:glu  -0.170073634 -0.0082731014 -0.0216825108 -0.0989831591 -0.0117303664
## x2.ldl:hdl  0.056102655  0.0399081113  0.0994258083  0.0668042354 -0.0734995647
## x2.ldl:tch -0.103238076  0.0247923945 -0.0188906800 -0.0508125514  0.1819573865
## x2.ldl:ltg -0.185603635 -0.0144219894 -0.1173018020 -0.1248244288  0.1002095697
## x2.ldl:glu -0.163159437 -0.0373621718 -0.0561809808 -0.1338484666  0.0070818380
## x2.hdl:tch -0.061511146  0.0127573609  0.0359508011  0.0063636116 -0.1757302212
## x2.hdl:ltg  0.041410778  0.0562128075 -0.0103895844 -0.0040105617 -0.0459353081
## x2.hdl:glu -0.066475047  0.0597710905 -0.0732927967 -0.0171885246 -0.1147613582
## x2.tch:ltg -0.094962592 -0.0011584540  0.0279503571  0.0232026673  0.1377744178
## x2.tch:glu -0.029666566 -0.0394728426  0.0781879245 -0.0333750715  0.1003161198
## x2.ltg:glu -0.037115755 -0.0172274540  0.0742693463  0.0078892077 -0.0093040913
```

```
##                    x.ldl         x.hdl         x.tch         x.ltg         x.glu
## x.age         0.219243140  -0.075180975   0.203840900   0.270776785   0.301731008
## x.sex         0.142637257  -0.379089629   0.332115093   0.149917557   0.208133216
## x.bmi         0.261169911  -0.366810978   0.413806602   0.446158648   0.388679994
## x.map         0.185557826  -0.178761207   0.257653366   0.393478139   0.390429380
## x.tc          0.896662958   0.051519364   0.542207281   0.515500762   0.325716753
## x.ldl         1.000000000  -0.196455124   0.659816889   0.318353399   0.290600375
## x.hdl        -0.196455124   1.000000000  -0.738492729  -0.398577005  -0.273697301
## x.tch         0.659816889  -0.738492729   1.000000000   0.617857392   0.417212114
## x.ltg         0.318353399  -0.398577005   0.617857392   1.000000000   0.464670456
## x.glu         0.290600375  -0.273697301   0.417212114   0.464670456   1.000000000
## y             0.174053587  -0.394789251   0.430452885   0.565883425   0.382483484
## x2.age        0.219243140  -0.075180975   0.203840900   0.270776785   0.301731008
## x2.sex        0.142637257  -0.379089629   0.332115093   0.149917557   0.208133216
## x2.bmi        0.261169911  -0.366810978   0.413806602   0.446158648   0.388679994
## x2.map        0.185557826  -0.178761207   0.257653366   0.393478139   0.390429380
## x2.tc         0.896662958   0.051519364   0.542207281   0.515500762   0.325716753
## x2.ldl        1.000000000  -0.196455124   0.659816889   0.318353399   0.290600375
## x2.hdl       -0.196455124   1.000000000  -0.738492729  -0.398577005  -0.273697301
## x2.tch        0.659816889  -0.738492729   1.000000000   0.617857392   0.417212114
## x2.ltg        0.318353399  -0.398577005   0.617857392   1.000000000   0.464670456
## x2.glu        0.290600375  -0.273697301   0.417212114   0.464670456   1.000000000
## x2.age^2     -0.095130043   0.004400571  -0.085284488  -0.092985240  -0.134796374
## x2.bmi^2     -0.094233228  -0.082636805   0.041456959   0.052548329   0.072015365
## x2.map^2     -0.039963524   0.010985984  -0.008253702   0.077467602   0.097247988
## x2.tc^2       0.235883534  -0.037585343   0.154693350   0.127533653  -0.007475069
## x2.ldl^2      0.270831477  -0.037026908   0.197441211   0.082610684   0.042711602
## x2.hdl^2     -0.096349321   0.463222539  -0.118219710  -0.046832661  -0.040572249
## x2.tch^2      0.205359774  -0.162375587   0.470542290   0.200557882   0.157390001
## x2.ltg^2     -0.111847035  -0.074985702   0.159007343   0.213579691   0.063896385
## x2.glu^2     -0.009210617  -0.057726637   0.087499446   0.071795163   0.139048525
## x2.age:sex   -0.075323623  -0.039256416  -0.046107714  -0.098693643  -0.082519731
## x2.age:bmi   -0.231484751  -0.020565919  -0.125080132  -0.103521592  -0.117538979
## x2.age:map   -0.167165992   0.001218572  -0.072474579   0.013891404  -0.061954066
## x2.age:tc    -0.109037987   0.100077834  -0.154157692  -0.096923240  -0.157249636
## x2.age:ldl   -0.075926680   0.054380469  -0.137924505  -0.176941941  -0.159775587
## x2.age:hdl    0.060307946   0.165680553  -0.076244013   0.042668555  -0.068811484
## x2.age:tch   -0.142139153  -0.070851076  -0.032255685  -0.105628104  -0.032644680
## x2.age:ltg   -0.177657125   0.038630310  -0.102910345  -0.004723573  -0.039477896
## x2.age:glu   -0.170130109  -0.066069359  -0.033729576  -0.041867104  -0.032970386
## x2.sex:bmi   -0.043111891   0.075609501  -0.020141137   0.012867746  -0.013676967
## x2.sex:map   -0.024310271  -0.024975103   0.012714495  -0.023069383  -0.028116011
## x2.sex:tc     0.073955830   0.007666019   0.037308231   0.020139162  -0.007813090
## x2.sex:ldl    0.075803358   0.038951758   0.033352344  -0.013844454  -0.036841448
## x2.sex:hdl    0.042301690  -0.150840824   0.015592587   0.057113036   0.061009696
## x2.sex:tch    0.034939660   0.015041109   0.096960354  -0.001318961  -0.044460048
## x2.sex:ltg   -0.013911933   0.052846500  -0.001265177   0.016937328  -0.018466430
## x2.sex:glu   -0.037516113   0.057207024  -0.043217412  -0.018713389  -0.021886506
## x2.bmi:map   -0.171197002   0.023310906  -0.087452648  -0.002515257  -0.014304795
## x2.bmi:tc     0.012489103  -0.029813642   0.030760219  -0.046071603  -0.021307387
## x2.bmi:ldl    0.016096228   0.101093664  -0.026473685  -0.117304390  -0.057710231
## x2.bmi:hdl    0.102755822  -0.272699915   0.042842685  -0.010292216  -0.072942348
## x2.bmi:tch   -0.026360466   0.041969410   0.118083274   0.031509822   0.087200002
## x2.bmi:ltg   -0.117468040  -0.010139858   0.031689305   0.044827105   0.082646446
```

```
## x2.bmi:glu -0.054634830 -0.067938199  0.082907648  0.078133182  0.034128846
## x2.map:tc   -0.053095813  0.002594327 -0.010831887 -0.015678722 -0.096424122
## x2.map:ldl  -0.038426319  0.067225442 -0.070476230 -0.123541830 -0.136076070
## x2.map:hdl   0.063451555 -0.078815757  0.006969518 -0.003651295 -0.015721284
## x2.map:tch  -0.069897034  0.007323357  0.052770793  0.025785690 -0.036692836
## x2.map:ltg  -0.127064751 -0.003978775  0.026740759  0.083316101  0.008923977
## x2.map:glu  -0.126809533 -0.015522067 -0.034477466  0.008085698  0.006426217
## x2.tc:ldl    0.268974600 -0.047696761  0.162748055  0.063958474  0.004642894
## x2.tc:hdl   -0.074968719  0.135366950 -0.206681966 -0.044910241 -0.112720302
## x2.tc:tch    0.201004776 -0.162405955  0.293532571  0.122958448  0.088568387
## x2.tc:ltg    0.095369872 -0.042605659  0.148450243  0.123544836 -0.009839556
## x2.tc:glu    0.007320381 -0.113072191  0.113066262 -0.010404166  0.029561677
## x2.ldl:hdl  -0.061277703 -0.170668352 -0.066159100  0.099969823 -0.031524921
## x2.ldl:tch   0.237072317 -0.048000703  0.239051447  0.004318640  0.050496371
## x2.ldl:ltg   0.139006939  0.101644562  0.006052074 -0.159490449 -0.104051322
## x2.ldl:glu   0.069966831 -0.031204363  0.068891157 -0.101296324 -0.013995275
## x2.hdl:tch  -0.057375804 -0.181607351 -0.225932093 -0.089197282 -0.087393440
## x2.hdl:ltg   0.104295483 -0.086546548 -0.107302292 -0.109716012 -0.089179764
## x2.hdl:glu  -0.032737301 -0.074631518 -0.104647413 -0.088768443 -0.092023029
## x2.tch:ltg   0.005345568 -0.092367104  0.288976571  0.200270538  0.105512303
## x2.tch:glu   0.063181342 -0.091480034  0.229235468  0.106655898  0.121933597
## x2.ltg:glu  -0.093637122 -0.078214167  0.107501340  0.081994921  0.100842191
##                        y        x2.age        x2.sex        x2.bmi        x2.map
## x.age     0.187888751  1.000000000  0.1737371006  0.1850846661  0.3354267105
## x.sex     0.043061998  0.173737101  1.0000000000  0.0881613990  0.2410131688
## x.bmi     0.586450134  0.185084666  0.0881613990  1.0000000000  0.3954153212
## x.map     0.441483849  0.335426711  0.2410131688  0.3954153212  1.0000000000
## x.tc      0.212022481  0.260060820  0.0352768192  0.2497774217  0.2424697089
## x.ldl     0.174053587  0.219243140  0.1426372570  0.2611699112  0.1855578262
## x.hdl    -0.394789251 -0.075180975 -0.3790896292 -0.3668109784 -0.1787612071
## x.tch     0.430452885  0.203840900  0.3321150931  0.4138066018  0.2576533662
## x.ltg     0.565883425  0.270776785  0.1499175570  0.4461586482  0.3934781393
## x.glu     0.382483484  0.301731008  0.2081332162  0.3886799939  0.3904293804
## y         1.000000000  0.187888751  0.0430619985  0.5864501345  0.4414838489
## x2.age    0.187888751  1.000000000  0.1737371006  0.1850846661  0.3354267105
## x2.sex    0.043061998  0.173737101  1.0000000000  0.0881613990  0.2410131688
## x2.bmi    0.586450134  0.185084666  0.0881613990  1.0000000000  0.3954153212
## x2.map    0.441483849  0.335426711  0.2410131688  0.3954153212  1.0000000000
## x2.tc     0.212022481  0.260060820  0.0352768192  0.2497774217  0.2424697089
## x2.ldl    0.174053587  0.219243140  0.1426372570  0.2611699112  0.1855578262
## x2.hdl   -0.394789251 -0.075180975 -0.3790896292 -0.3668109784 -0.1787612071
## x2.tch    0.430452885  0.203840900  0.3321150931  0.4138066018  0.2576533662
## x2.ltg    0.565883425  0.270776785  0.1499175570  0.4461586482  0.3934781393
## x2.glu    0.382483484  0.301731008  0.2081332162  0.3886799939  0.3904293804
## x2.age^2 -0.013103238 -0.200495040 -0.0244232033 -0.1268748659 -0.1177109968
## x2.bmi^2  0.252642182 -0.143868720 -0.0555678457  0.4132850342  0.0440619095
## x2.map^2  0.159667551  0.012518945 -0.0812021734  0.1037548658  0.2397639191
## x2.tc^2   0.026601503 -0.053884745  0.0557870248 -0.0003494694 -0.0176322531
## x2.ldl^2  0.003852301 -0.047331454  0.0469285912  0.0095656454 -0.0230735322
## x2.hdl^2 -0.116274697  0.087011384 -0.0803374453 -0.1489612676 -0.0468457765
## x2.tch^2  0.111539664 -0.020125953  0.0591041522  0.0726953952  0.0329556492
## x2.ltg^2  0.079597979 -0.003460702  0.0123132414  0.0313917446  0.0573975334
## x2.glu^2  0.135533694 -0.020809533 -0.0143449155  0.0230966296  0.0044639997
## x2.age:sex 0.056969255 -0.028576256  0.0224381418 -0.0605077952 -0.0725035333
```

```
## x2.age:bmi -0.046930562 -0.145877538 -0.0594595280 -0.2074500182 -0.0954221480
## x2.age:map  0.071570572 -0.144654860 -0.0761504485 -0.1019887700  0.0161609111
## x2.age:tc  -0.109985791 -0.121837971 -0.1114848384 -0.2295100022 -0.1158217493
## x2.age:ldl -0.152253161 -0.109247343 -0.0739301682 -0.2312079435 -0.1562158608
## x2.age:hdl -0.047376428  0.005604460 -0.0427299841 -0.0227803332  0.0012628738
## x2.age:tch -0.016739565 -0.100933545 -0.0466376197 -0.1287481461 -0.0697967484
## x2.age:ltg  0.047019208 -0.107215864 -0.0972593838 -0.1038157271  0.0130339243
## x2.age:glu  0.046106123 -0.164832239 -0.0862420468 -0.1250066265 -0.0616478268
## x2.sex:bmi  0.045520159 -0.060018981  0.0112940598 -0.0808793812  0.0089199718
## x2.sex:map  0.057585660 -0.073924590  0.0317369250  0.0091688727 -0.1017612046
## x2.sex:tc   0.015936279 -0.113872180  0.0044577752  0.0004881049 -0.0348306192
## x2.sex:ldl -0.038207180 -0.074443717  0.0182064027 -0.0429552876 -0.0235644272
## x2.sex:hdl  0.087389801 -0.042134530 -0.0525489110  0.0818138029 -0.0262908744
## x2.sex:tch -0.018432792 -0.047737839  0.0444091125 -0.0210230565  0.0129109592
## x2.sex:ltg  0.032127120 -0.098016155  0.0192289379  0.0128834947 -0.0224706021
## x2.sex:glu  0.037082727 -0.083049266  0.0270528925 -0.0138768376 -0.0277524895
## x2.bmi:map  0.147113178 -0.089846895  0.0083205149  0.0598224636  0.1179932918
## x2.bmi:tc  -0.067025590 -0.243932458  0.0005079012 -0.1335145154 -0.1453019176
## x2.bmi:ldl -0.111384066 -0.242531427 -0.0447481976 -0.1423628916 -0.1904968972
## x2.bmi:hdl -0.052755021 -0.021901621  0.0797695870 -0.1268962378  0.0263653418
## x2.bmi:tch  0.060290748 -0.130488623 -0.0208161851  0.0623632666 -0.0968954529
## x2.bmi:ltg  0.098689644 -0.108613056  0.0133747731  0.0794981638 -0.0028027188
## x2.bmi:glu  0.155782699 -0.116585444 -0.0134395603  0.1029993963 -0.0150691992
## x2.map:tc  -0.010957091 -0.122028662 -0.0359278391 -0.1440373425 -0.0005902251
## x2.map:ldl -0.083696906 -0.162179239 -0.0242952105 -0.1885353397 -0.0500505942
## x2.map:hdl  0.015446414  0.001115853 -0.0235584525  0.0242306114  0.0129865271
## x2.map:tch -0.003577406 -0.069734729  0.0126021908 -0.0955180962 -0.0102520409
## x2.map:ltg  0.099435161  0.013861319 -0.0237125311 -0.0028489838  0.0997876121
## x2.map:glu  0.079563794 -0.056012801 -0.0261851293 -0.0146807551  0.1135000957
## x2.tc:ldl   0.006713017 -0.074796332  0.0496675875  0.0080605702 -0.0345693350
## x2.tc:hdl  -0.025811265  0.107902518  0.0080921096 -0.0302441056  0.0026548905
## x2.tc:tch   0.039022382 -0.130604532  0.0309453843  0.0245196633 -0.0087101459
## x2.tc:ltg   0.021384107 -0.099138767  0.0201676433 -0.0443384935 -0.0152213973
## x2.tc:glu   0.036562323 -0.170073634 -0.0082731014 -0.0216825108 -0.0989831591
## x2.ldl:hdl  0.089468402  0.056102655  0.0399081113  0.0994258083  0.0668042354
## x2.ldl:tch -0.017699820 -0.103238076  0.0247923945 -0.0188906800 -0.0508125514
## x2.ldl:ltg -0.097206180 -0.185603635 -0.0144219894 -0.1173018020 -0.1248244288
## x2.ldl:glu -0.016955757 -0.163159437 -0.0373621718 -0.0561809808 -0.1338484666
## x2.hdl:tch -0.003693633 -0.061511146  0.0127573609  0.0359508011  0.0063636116
## x2.hdl:ltg -0.014534072  0.041410778  0.0562128075 -0.0103895844 -0.0040105617
## x2.hdl:glu -0.087742007 -0.066475047  0.0597710905 -0.0732927967 -0.0171885246
## x2.tch:ltg  0.073885451 -0.094962592 -0.0011584540  0.0279503571  0.0232026673
## x2.tch:glu  0.137648195 -0.029666566 -0.0394728426  0.0781879245 -0.0333750715
## x2.ltg:glu  0.123426555 -0.037115755 -0.0172274540  0.0742693463  0.0078892077
##                   x2.tc       x2.ldl       x2.hdl      x2.tch       x2.ltg
## x.age       0.2600608202  0.219243140 -0.075180975  0.203840900  0.270776785
## x.sex       0.0352768192  0.142637257 -0.379089629  0.332115093  0.149917557
## x.bmi       0.2497774217  0.261169911 -0.366810978  0.413806602  0.446158648
## x.map       0.2424697089  0.185557826 -0.178761207  0.257653366  0.393478139
## x.tc        1.0000000000  0.896662958  0.051519364  0.542207281  0.515500762
## x.ldl       0.8966629578  1.000000000 -0.196455124  0.659816889  0.318353399
## x.hdl       0.0515193643 -0.196455124  1.000000000 -0.738492729 -0.398577005
## x.tch       0.5422072805  0.659816889 -0.738492729  1.000000000  0.617857392
## x.ltg       0.5155007619  0.318353399 -0.398577005  0.617857392  1.000000000
```

```
## x.glu        0.3257167531  0.290600375 -0.273697301  0.417212114  0.464670456
## y            0.2120224810  0.174053587 -0.394789251  0.430452885  0.565883425
## x2.age       0.2600608202  0.219243140 -0.075180975  0.203840900  0.270776785
## x2.sex       0.0352768192  0.142637257 -0.379089629  0.332115093  0.149917557
## x2.bmi       0.2497774217  0.261169911 -0.366810978  0.413806602  0.446158648
## x2.map       0.2424697089  0.185557826 -0.178761207  0.257653366  0.393478139
## x2.tc        1.0000000000  0.896662958  0.051519364  0.542207281  0.515500762
## x2.ldl       0.8966629578  1.000000000 -0.196455124  0.659816889  0.318353399
## x2.hdl       0.0515193643 -0.196455124  1.000000000 -0.738492729 -0.398577005
## x2.tch       0.5422072805  0.659816889 -0.738492729  1.000000000  0.617857392
## x2.ltg       0.5155007619  0.318353399 -0.398577005  0.617857392  1.000000000
## x2.glu       0.3257167531  0.290600375 -0.273697301  0.417212114  0.464670456
## x2.age^2    -0.1087044594 -0.095130043  0.004400571 -0.085284488 -0.092985240
## x2.bmi^2    -0.0893698322 -0.094233228 -0.082636805  0.041456959  0.052548329
## x2.map^2    -0.0004758044 -0.039963524  0.010985984 -0.008253702  0.077467602
## x2.tc^2      0.2530913728  0.235883534 -0.037585343  0.154693350  0.127533653
## x2.ldl^2     0.2504506228  0.270831477 -0.037026908  0.197441211  0.082610684
## x2.hdl^2     0.0749226244 -0.096349321  0.463222539 -0.118219710 -0.046832661
## x2.tch^2     0.2282672535  0.205359774 -0.162375587  0.470542290  0.200557882
## x2.ltg^2     0.0910358367 -0.111847035 -0.074985702  0.159007343  0.213579691
## x2.glu^2     0.0188212593 -0.009210617 -0.057726637  0.087499446  0.071795163
## x2.age:sex  -0.1163813014 -0.075323623 -0.039256416 -0.046107714 -0.098693643
## x2.age:bmi  -0.2354394023 -0.231484751 -0.020565919 -0.125080132 -0.103521592
## x2.age:map  -0.1269903777 -0.167165992  0.001218572 -0.072474579  0.013891404
## x2.age:tc   -0.0781834504 -0.109037987  0.100077834 -0.154157692 -0.096923240
## x2.age:ldl  -0.1117212327 -0.075926680  0.054380469 -0.137924505 -0.176941941
## x2.age:hdl   0.1137175197  0.060307946  0.165680553 -0.076244013  0.042668555
## x2.age:tch  -0.1627778782 -0.142139153 -0.070851076 -0.032255685 -0.105628104
## x2.age:ltg  -0.0997097575 -0.177657125  0.038630310 -0.102910345 -0.004723573
## x2.age:glu  -0.1715608934 -0.170130109 -0.066069359 -0.033729576 -0.041867104
## x2.sex:bmi   0.0004948300 -0.043111891  0.075609501 -0.020141137  0.012867746
## x2.sex:map  -0.0362958126 -0.024310271 -0.024975103  0.012714495 -0.023069383
## x2.sex:tc    0.0826768700  0.073955830  0.007666019  0.037308231  0.020139162
## x2.sex:ldl   0.0747024485  0.075803358  0.038951758  0.033352344 -0.013844454
## x2.sex:hdl   0.0084093606  0.042301690 -0.150840824  0.015592587  0.057113036
## x2.sex:tch   0.0394783867  0.034939660  0.015041109  0.096960354 -0.001318961
## x2.sex:ltg   0.0204416263 -0.013911933  0.052846500 -0.001265177  0.016937328
## x2.sex:glu  -0.0080364898 -0.037516113  0.057207024 -0.043217412 -0.018713389
## x2.bmi:map  -0.1320488990 -0.171197002  0.023310906 -0.087452648 -0.002515257
## x2.bmi:tc   -0.0005389223  0.012489103 -0.029813642  0.030760219 -0.046071603
## x2.bmi:ldl   0.0126295085  0.016096228  0.101093664 -0.026473685 -0.117304390
## x2.bmi:hdl  -0.0306445132  0.102755822 -0.272699915  0.042842685 -0.010292216
## x2.bmi:tch   0.0309730021 -0.026360466  0.041969410  0.118083274  0.031509822
## x2.bmi:ltg  -0.0466545458 -0.117468040 -0.010139858  0.031689305  0.044827105
## x2.bmi:glu  -0.0203986852 -0.054634830 -0.067938199  0.082907648  0.078133182
## x2.map:tc   -0.0269543299 -0.053095813  0.002594327 -0.010831887 -0.015678722
## x2.map:ldl  -0.0536063916 -0.038426319  0.067225442 -0.070476230 -0.123541830
## x2.map:hdl   0.0024722339  0.063451555 -0.078815757  0.006969518 -0.003651295
## x2.map:tch  -0.0108461721 -0.069897034  0.007323357  0.052770793  0.025785690
## x2.map:ltg  -0.0162808854 -0.127064751 -0.003978775  0.026740759  0.083316101
## x2.map:glu  -0.0907218997 -0.126809533 -0.015522067 -0.034477466  0.008085698
## x2.tc:ldl    0.2347735149  0.268974600 -0.047696761  0.162748055  0.063958474
## x2.tc:hdl   -0.0587978164 -0.074968719  0.135366950 -0.206681966 -0.044910241
## x2.tc:tch    0.1901576018  0.201004776 -0.162405955  0.293532571  0.122958448
```

```
## x2.tc:ltg   0.1892733138  0.095369872 -0.042605659  0.148450243  0.123544836
## x2.tc:glu  -0.0117303664  0.007320381 -0.113072191  0.113066262 -0.010404166
## x2.ldl:hdl -0.0734995647 -0.061277703 -0.170668352 -0.066159100  0.099969823
## x2.ldl:tch  0.1819573865  0.237072317 -0.048000703  0.239051447  0.004318640
## x2.ldl:ltg  0.1002095697  0.139006939  0.101644562  0.006052074 -0.159490449
## x2.ldl:glu  0.0070818380  0.069966831 -0.031204363  0.068891157 -0.101296324
## x2.hdl:tch -0.1757302212 -0.057375804 -0.181607351 -0.225932093 -0.089197282
## x2.hdl:ltg -0.0459353081  0.104295483 -0.086546548 -0.107302292 -0.109716012
## x2.hdl:glu -0.1147613582 -0.032737301 -0.074631518 -0.104647413 -0.088768443
## x2.tch:ltg  0.1377744178  0.005345568 -0.092367104  0.288976571  0.200270538
## x2.tch:glu  0.1003161198  0.063181342 -0.091480034  0.229235468  0.106655898
## x2.ltg:glu -0.0093040913 -0.093637122 -0.078214167  0.107501340  0.081994921
##                    x2.glu      x2.age^2    x2.bmi^2      x2.map^2      x2.tc^2
## x.age          0.301731008 -0.2004950399 -0.143868720  0.0125189445 -0.0538847452
## x.sex          0.208133216 -0.0244232033 -0.055567846 -0.0812021734  0.0557870248
## x.bmi          0.388679994 -0.1268748659  0.413285034  0.1037548658 -0.0003494694
## x.map          0.390429380 -0.1177109968  0.044061909  0.2397639191 -0.0176322531
## x.tc           0.325716753 -0.1087044594 -0.089369832 -0.0004758044  0.2530913728
## x.ldl          0.290600375 -0.0951300429 -0.094233228 -0.0399635243  0.2358835341
## x.hdl         -0.273697301  0.0044005709 -0.082636805  0.0109859841 -0.0375853430
## x.tch          0.417212114 -0.0852844882  0.041456959 -0.0082537021  0.1546933500
## x.ltg          0.464670456 -0.0929852402  0.052548329  0.0774676019  0.1275336528
## x.glu          1.000000000 -0.1347963738  0.072015365  0.0972479883 -0.0074750695
## y              0.382483484 -0.0131032376  0.252642182  0.1596675511  0.0266015031
## x2.age         0.301731008 -0.2004950399 -0.143868720  0.0125189445 -0.0538847452
## x2.sex         0.208133216 -0.0244232033 -0.055567846 -0.0812021734  0.0557870248
## x2.bmi         0.388679994 -0.1268748659  0.413285034  0.1037548658 -0.0003494694
## x2.map         0.390429380 -0.1177109968  0.044061909  0.2397639191 -0.0176322531
## x2.tc          0.325716753 -0.1087044594 -0.089369832 -0.0004758044  0.2530913728
## x2.ldl         0.290600375 -0.0951300429 -0.094233228 -0.0399635243  0.2358835341
## x2.hdl        -0.273697301  0.0044005709 -0.082636805  0.0109859841 -0.0375853430
## x2.tch         0.417212114 -0.0852844882  0.041456959 -0.0082537021  0.1546933500
## x2.ltg         0.464670456 -0.0929852402  0.052548329  0.0774676019  0.1275336528
## x2.glu         1.000000000 -0.1347963738  0.072015365  0.0972479883 -0.0074750695
## x2.age^2      -0.134796374  1.0000000000  0.021023048 -0.0083282424  0.0704392777
## x2.bmi^2       0.072015365  0.0210230478  1.000000000  0.1635484345 -0.0025407469
## x2.map^2       0.097247988 -0.0083282424  0.163548435  1.0000000000  0.0041059850
## x2.tc^2       -0.007475069  0.0704392777 -0.002540747  0.0041059850  1.0000000000
## x2.ldl^2       0.042711602  0.0276466461 -0.008737002 -0.0180100666  0.8535953426
## x2.hdl^2      -0.040572249 -0.0904111834  0.006790788  0.0368501665 -0.0357533088
## x2.tch^2       0.157390001 -0.0078333336  0.040340819  0.0066334972  0.3281713232
## x2.ltg^2       0.063896385  0.0436036029  0.055028696  0.0210030763  0.1342785196
## x2.glu^2       0.139048525 -0.0141885285  0.078218461  0.1244278323  0.0028265362
## x2.age:sex    -0.082519731  0.1803816413 -0.012334537 -0.0051256094 -0.0250502039
## x2.age:bmi    -0.117538979  0.3314921084  0.098551750  0.0554649600  0.0276923739
## x2.age:map    -0.061954066  0.3857593696  0.077099199  0.2031620106 -0.0108389864
## x2.age:tc     -0.157249636  0.3881070107 -0.042382255  0.0224665817  0.1853790976
## x2.age:ldl    -0.159775587  0.3702389385 -0.025734848  0.0030774577  0.1720328783
## x2.age:hdl    -0.068811484 -0.1510349389 -0.062957011 -0.0299800093  0.0503984107
## x2.age:tch    -0.032644680  0.3767057296  0.037523892  0.0211452431  0.0597257639
## x2.age:ltg    -0.039477896  0.3667061617  0.010281453  0.0668577285  0.0772491292
## x2.age:glu    -0.032970386  0.4592023456  0.031699817  0.0375136076 -0.0532983386
## x2.sex:bmi    -0.013676967  0.0007959632  0.179892865  0.1347539434  0.0819828233
## x2.sex:map    -0.028116011  0.0249303541  0.115643923  0.1150060051  0.0286655067
```

```
## x2.sex:tc  -0.007813090  0.0343844439  0.042682123  0.0384843903  0.1019891959
## x2.sex:ldl -0.036841448  0.0171285987  0.011965316  0.0152389939  0.1134477295
## x2.sex:hdl  0.061009696  0.0351592671  0.022557392 -0.0093194244 -0.0170385495
## x2.sex:tch -0.044460048  0.0138289704  0.027023527  0.0380049151  0.0636288448
## x2.sex:ltg -0.018466430  0.0057715693  0.074888770  0.0885294975  0.0170766561
## x2.sex:glu -0.021886506  0.0065457017  0.062374724  0.0925517437  0.0132421612
## x2.bmi:map -0.014304795  0.0642033212  0.390944151  0.4561983080  0.0155153236
## x2.bmi:tc  -0.021307387  0.1616275091  0.102324508  0.0111060578  0.3546744536
## x2.bmi:ldl -0.057710231  0.1454514725  0.140734489 -0.0081256046  0.3662606773
## x2.bmi:hdl -0.072942348  0.0778592730 -0.430260581 -0.0673917281  0.0231991928
## x2.bmi:tch  0.087200002  0.0478235669  0.433014372  0.0438966740  0.2111442144
## x2.bmi:ltg  0.082646446  0.0437340206  0.425690065  0.1031437227  0.1027850007
## x2.bmi:glu  0.034128846  0.0289516613  0.389757106  0.1765962943  0.0772100731
## x2.map:tc  -0.096424122  0.1426816874 -0.018130980  0.2277789695  0.1426515974
## x2.map:ldl -0.136076070  0.1176566018 -0.020030770  0.1633262926  0.1610284078
## x2.map:hdl -0.015721284  0.0195403306 -0.097183923 -0.0907758248 -0.0195352767
## x2.map:tch -0.036692836  0.0745655634  0.073083304  0.1800450010  0.0969946180
## x2.map:ltg  0.008923977  0.0809619984  0.118735055  0.3546058400  0.0253302369
## x2.map:glu  0.006426217  0.0596211452  0.104217051  0.4045371976 -0.0458756856
## x2.tc:ldl   0.004642894  0.0573032428 -0.002096238 -0.0108369782  0.9483123252
## x2.tc:hdl  -0.112720302 -0.0312926130 -0.032419242 -0.0025297055  0.0409374628
## x2.tc:tch   0.088568387  0.0663213884  0.026934001  0.0152164086  0.6791163481
## x2.tc:ltg  -0.009839556  0.1158522312  0.017188071  0.0343329775  0.6133994068
## x2.tc:glu   0.029561677  0.0666858613  0.093972053  0.0643308093  0.3810052856
## x2.ldl:hdl -0.031524921  0.0185149436 -0.006461728 -0.0103888255  0.0265906191
## x2.ldl:tch  0.050496371  0.0266698050  0.008277963 -0.0056703307  0.6135987693
## x2.ldl:ltg -0.104051322  0.1094219854  0.022046095  0.0165545139  0.5909764548
## x2.ldl:glu -0.013995275  0.0708546014  0.071020019  0.0225386003  0.3824634170
## x2.hdl:tch -0.087393440  0.0706763039 -0.027389195 -0.0122576276  0.0211390726
## x2.hdl:ltg -0.089179764  0.0332480637 -0.088711309 -0.0153812979  0.1218844684
## x2.hdl:glu -0.092023029 -0.0058943567 -0.088425683 -0.0214201900  0.0321347240
## x2.tch:ltg  0.105512303  0.0572009516  0.085416009  0.0316522205  0.2321091173
## x2.tch:glu  0.121933597  0.0637169040  0.116947747  0.0450996916  0.1998629311
## x2.ltg:glu  0.100842191  0.0179183418  0.142117077  0.1163723581  0.0640716559
##               x2.ldl^2     x2.hdl^2     x2.tch^2      x2.ltg^2     x2.glu^2
## x.age      -0.047331454  0.087011384 -0.020125953 -0.003460702 -0.020809533
## x.sex       0.046928591 -0.080337445  0.059104152  0.012313241 -0.014344915
## x.bmi       0.009565645 -0.148961268  0.072695395  0.031391745  0.023096630
## x.map      -0.023073532 -0.046845776  0.032955649  0.057397533  0.004464000
## x.tc        0.250450623  0.074922624  0.228267253  0.091035837  0.018821259
## x.ldl       0.270831477 -0.096349321  0.205359774 -0.111847035 -0.009210617
## x.hdl      -0.037026908  0.463222539 -0.162375587 -0.074985702 -0.057726637
## x.tch       0.197441211 -0.118219710  0.470542290  0.159007343  0.087499446
## x.ltg       0.082610684 -0.046832661  0.200557882  0.213579691  0.071795163
## x.glu       0.042711602 -0.040572249  0.157390001  0.063896385  0.139048525
## y           0.003852301 -0.116274697  0.111539664  0.079597979  0.135533694
## x2.age     -0.047331454  0.087011384 -0.020125953 -0.003460702 -0.020809533
## x2.sex      0.046928591 -0.080337445  0.059104152  0.012313241 -0.014344915
## x2.bmi      0.009565645 -0.148961268  0.072695395  0.031391745  0.023096630
## x2.map     -0.023073532 -0.046845776  0.032955649  0.057397533  0.004464000
## x2.tc       0.250450623  0.074922624  0.228267253  0.091035837  0.018821259
## x2.ldl      0.270831477 -0.096349321  0.205359774 -0.111847035 -0.009210617
## x2.hdl     -0.037026908  0.463222539 -0.162375587 -0.074985702 -0.057726637
## x2.tch      0.197441211 -0.118219710  0.470542290  0.159007343  0.087499446
```

```
## x2.ltg      0.082610684 -0.046832661  0.200557882  0.213579691  0.071795163
## x2.glu      0.042711602 -0.040572249  0.157390001  0.063896385  0.139048525
## x2.age^2    0.027646646 -0.090411183 -0.007833334  0.043603603 -0.014188528
## x2.bmi^2   -0.008737002  0.006790788  0.040340819  0.055028696  0.078218461
## x2.map^2   -0.018010067  0.036850167  0.006633497  0.021003076  0.124427832
## x2.tc^2     0.853595343 -0.035753309  0.328171323  0.134278520  0.002826536
## x2.ldl^2    1.000000000 -0.006885811  0.489798988  0.005912885  0.019336086
## x2.hdl^2   -0.006885811  1.000000000  0.298093159  0.010549013 -0.019986080
## x2.tch^2    0.489798988  0.298093159  1.000000000  0.259474197  0.136842574
## x2.ltg^2    0.005912885  0.010549013  0.259474197  1.000000000  0.168344838
## x2.glu^2    0.019336086 -0.019986080  0.136842574  0.168344838  1.000000000
## x2.age:sex -0.006675477 -0.063767827 -0.033303697 -0.042345168 -0.005098707
## x2.age:bmi  0.009463144 -0.039497954 -0.002947603  0.077799549  0.108266038
## x2.age:map -0.045658330 -0.001165985 -0.025311300  0.093274749  0.091188941
## x2.age:tc   0.118555021 -0.089008639 -0.004005711  0.107735648  0.058571822
## x2.age:ldl  0.135890146 -0.126063183 -0.023184801 -0.013353704  0.038894083
## x2.age:hdl  0.019705724  0.118658514 -0.049023287 -0.082279286 -0.094836777
## x2.age:tch  0.044951150 -0.101647436  0.088829106  0.150968614  0.113875617
## x2.age:ltg -0.001174438 -0.067645979  0.029141394  0.303538465  0.127218581
## x2.age:glu -0.039035508 -0.079785224  0.032560009  0.116466075  0.353237482
## x2.sex:bmi  0.082271863  0.127669944  0.115112464  0.023326067  0.132097282
## x2.sex:map  0.049080385 -0.007275089  0.072571366  0.001303035  0.113866735
## x2.sex:tc   0.238857599 -0.118488378  0.209879376  0.050809174  0.110877987
## x2.sex:ldl  0.269017480  0.018820089  0.239055792 -0.008666365  0.049976052
## x2.sex:hdl -0.024680358 -0.466964323 -0.170191833  0.071980348  0.003348827
## x2.sex:tch  0.161735880  0.209025124  0.328183321  0.005944056  0.058370774
## x2.sex:ltg  0.044641634  0.058078180  0.142078072  0.015773493  0.136958970
## x2.sex:glu  0.054579214 -0.004107023  0.056440717  0.041804318  0.279736209
## x2.bmi:map -0.026582697 -0.012052196 -0.024066711  0.075103812  0.167909912
## x2.bmi:tc   0.358447927 -0.146697289  0.275100848  0.152456893  0.147044600
## x2.bmi:ldl  0.390443479  0.035033350  0.322753723  0.048907097  0.079722324
## x2.bmi:hdl -0.057227437 -0.558087206 -0.290609150 -0.108860847 -0.068644856
## x2.bmi:tch  0.260422058  0.245554225  0.516245057  0.209202271  0.154983897
## x2.bmi:ltg  0.103720490  0.035739876  0.203043277  0.370332514  0.227931171
## x2.bmi:glu  0.074646594  0.004293073  0.155706932  0.190920152  0.541093593
## x2.map:tc   0.121252446 -0.105328593  0.122369937  0.182105802  0.117008102
## x2.map:ldl  0.159910918 -0.062868262  0.110084129  0.010594941  0.073729260
## x2.map:hdl -0.029144519 -0.142940344 -0.141378821 -0.135899834 -0.116452923
## x2.map:tch  0.096504532  0.042248834  0.273457734  0.244121987  0.157833770
## x2.map:ltg -0.017626834  0.003922525  0.134517550  0.484189339  0.250311154
## x2.map:glu -0.058837935 -0.064696663  0.013623714  0.165322651  0.559956240
## x2.tc:ldl   0.959148710 -0.082008287  0.396961623 -0.001407881  0.007929740
## x2.tc:hdl  -0.279787653  0.287225319 -0.488304660 -0.194928216 -0.150142639
## x2.tc:tch   0.803887505 -0.163638479  0.693495162  0.230991346  0.109867882
## x2.tc:ltg   0.358212588 -0.129616702  0.332663945  0.573783098  0.123223529
## x2.tc:glu   0.375617255 -0.084502678  0.310649153  0.212607358  0.471432496
## x2.ldl:hdl -0.311485904 -0.285052963 -0.551270002  0.036686397 -0.074559031
## x2.ldl:tch  0.835068344  0.053515412  0.710503545 -0.021791524  0.064066954
## x2.ldl:ltg  0.436915320 -0.037144947  0.338585386  0.066906983  0.071663377
## x2.ldl:glu  0.420673944 -0.025233562  0.304169380 -0.014279384  0.387958321
## x2.hdl:tch -0.146292689 -0.775044342 -0.763993168 -0.170748488 -0.091874811
## x2.hdl:ltg  0.002541878 -0.312178687 -0.437700902 -0.444785208 -0.144407886
## x2.hdl:glu -0.039276507 -0.177053084 -0.285500458 -0.164856466 -0.471869179
## x2.tch:ltg  0.182215779  0.120551978  0.664308331  0.653626945  0.185628976
```

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```
## x2.tch:glu  0.242310816  0.059790694  0.503905502  0.271799832  0.589317295
## x2.ltg:glu  0.035067276 -0.018822029  0.234426816  0.516973492  0.654883045
##                x2.age:sex   x2.age:bmi    x2.age:map    x2.age:tc   x2.age:ldl
## x.age       -0.0285762557 -0.145877538 -0.1446548604 -0.121837971 -0.109247343
## x.sex        0.0224381418 -0.059459528 -0.0761504485 -0.111484838 -0.073930168
## x.bmi       -0.0605077952 -0.207450018 -0.1019887700 -0.229510002 -0.231207943
## x.map       -0.0725035333 -0.095422148  0.0161609111 -0.115821749 -0.156215861
## x.tc        -0.1163813014 -0.235439402 -0.1269903777 -0.078183450 -0.111721233
## x.ldl       -0.0753236233 -0.231484751 -0.1671659915 -0.109037987 -0.075926680
## x.hdl       -0.0392564164 -0.020565919  0.0012185719  0.100077834  0.054380469
## x.tch       -0.0461077145 -0.125080132 -0.0724745794 -0.154157692 -0.137924505
## x.ltg       -0.0986936428 -0.103521592  0.0138914044 -0.096923240 -0.176941941
## x.glu       -0.0825197311 -0.117538979 -0.0619540661 -0.157249636 -0.159775587
## y            0.0569692548 -0.046930562  0.0715705722 -0.109985791 -0.152253161
## x2.age      -0.0285762557 -0.145877538 -0.1446548604 -0.121837971 -0.109247343
## x2.sex       0.0224381418 -0.059459528 -0.0761504485 -0.111484838 -0.073930168
## x2.bmi      -0.0605077952 -0.207450018 -0.1019887700 -0.229510002 -0.231207943
## x2.map      -0.0725035333 -0.095422148  0.0161609111 -0.115821749 -0.156215861
## x2.tc       -0.1163813014 -0.235439402 -0.1269903777 -0.078183450 -0.111721233
## x2.ldl      -0.0753236233 -0.231484751 -0.1671659915 -0.109037987 -0.075926680
## x2.hdl      -0.0392564164 -0.020565919  0.0012185719  0.100077834  0.054380469
## x2.tch      -0.0461077145 -0.125080132 -0.0724745794 -0.154157692 -0.137924505
## x2.ltg      -0.0986936428 -0.103521592  0.0138914044 -0.096923240 -0.176941941
## x2.glu      -0.0825197311 -0.117538979 -0.0619540661 -0.157249636 -0.159775587
## x2.age^2     0.1803816413  0.331492108  0.3857593696  0.388107011  0.370238938
## x2.bmi^2    -0.0123345374  0.098551750  0.0770991988 -0.042382255 -0.025734848
## x2.map^2    -0.0051256094  0.055464960  0.2031620106  0.022466582  0.003077458
## x2.tc^2     -0.0250502039  0.027692374 -0.0108389864  0.185379098  0.172032878
## x2.ldl^2    -0.0066754770  0.009463144 -0.0456583297  0.118555021  0.135890146
## x2.hdl^2    -0.0637678268 -0.039497954 -0.0011659846 -0.089008639 -0.126063183
## x2.tch^2    -0.0333036975 -0.002947603 -0.0253112997 -0.004005711 -0.023184801
## x2.ltg^2    -0.0423451682  0.077799549  0.0932747491  0.107735648 -0.013353704
## x2.glu^2    -0.0050987065  0.108266038  0.0911889407  0.058571822  0.038894083
## x2.age:sex   1.0000000000  0.057880043  0.2286806704  0.029567822  0.126099713
## x2.age:bmi   0.0578800427  1.000000000  0.4398465188  0.371291953  0.379619575
## x2.age:map   0.2286806704  0.439846519  1.0000000000  0.328065240  0.258780766
## x2.age:tc    0.0295678225  0.371291953  0.3280652403  1.000000000  0.912948937
## x2.age:ldl   0.1260997132  0.379619575  0.2587807665  0.912948937  1.000000000
## x2.age:hdl  -0.3706127072 -0.297539567 -0.1544906946  0.039729885 -0.176132537
## x2.age:tch   0.3264005954  0.441120663  0.2998239986  0.583202644  0.674184644
## x2.age:ltg   0.1116205454  0.444984669  0.4177533065  0.565433771  0.379532265
## x2.age:glu   0.1763726726  0.389453477  0.4091993610  0.331572108  0.323120577
## x2.sex:bmi   0.1665268411  0.141160582  0.0665449040 -0.043598201 -0.002979047
## x2.sex:map   0.3002146946  0.048406178  0.0962081072 -0.019935239  0.021000764
## x2.sex:tc    0.2424291938 -0.027799373  0.0331013532  0.124065627  0.116090322
## x2.sex:ldl   0.1892888244 -0.010079169  0.0271506595  0.085678710  0.132439634
## x2.sex:hdl  -0.0157933224 -0.029797985  0.0230213807  0.084625754  0.038665864
## x2.sex:tch   0.1504266703  0.022345532 -0.0225126802  0.012215188  0.039064783
## x2.sex:ltg   0.2388814362 -0.010358254 -0.0008720391  0.001300567 -0.044793284
## x2.sex:glu   0.2658847020  0.043612882  0.0173736203 -0.027963737 -0.006396236
## x2.bmi:map   0.0216332534  0.344703683  0.1201703667  0.020450416  0.040985126
## x2.bmi:tc   -0.0682824581  0.156454266  0.0457552493  0.162880491  0.144949059
## x2.bmi:ldl  -0.0309033764  0.140023987  0.0477825351  0.129627701  0.149586630
## x2.bmi:hdl  -0.0365350937 -0.095037061 -0.0760540009  0.105266062  0.089823692
```

```
## x2.bmi:tch  0.0114559581  0.187510476  0.0952281393  0.041153454  0.039009080
## x2.bmi:ltg -0.0640449938  0.212843876  0.0944623016  0.038800613 -0.002726089
## x2.bmi:glu  0.0137235915  0.270416980  0.1280740951  0.065699980  0.035235143
## x2.map:tc   0.0008671765  0.082369157  0.2266333732  0.257413000  0.201607982
## x2.map:ldl  0.0431096037  0.099437951  0.1780206112  0.203611508  0.234017795
## x2.map:hdl -0.0760125659 -0.153379483 -0.0501071974  0.066505317  0.005121289
## x2.map:tch  0.0487725866  0.181475007  0.1562553616  0.090750922  0.085964915
## x2.map:ltg -0.0204813225  0.171724330  0.2498988160  0.119815663  0.008301476
## x2.map:glu  0.0175545591  0.172858271  0.2202661050  0.081050008  0.051712202
## x2.tc:ldl  -0.0212482182  0.019353293 -0.0363926310  0.158027390  0.172824068
## x2.tc:hdl  -0.0299367442 -0.003640449  0.0067137305 -0.021313004 -0.039529778
## x2.tc:tch   0.0034177639  0.039413337 -0.0214238500  0.120085196  0.116343588
## x2.tc:ltg  -0.0499449502  0.058371652  0.0476440903  0.244245064  0.168102198
## y2.tc:glu  -0.0326910107  0.114623478  0.0882652548  0.146249438  0.140565555
## x2.ldl:hdl -0.0141644866  0.041643985  0.0351621312  0.024802204 -0.003620113
## x2.ldl:tch -0.0035554184  0.004529589 -0.0647556402  0.064393339  0.096537597
## x2.ldl:ltg -0.0712222862  0.037999374 -0.0142337280  0.203244453  0.208216056
## x2.ldl:glu -0.0115274643  0.068312832  0.0454699143  0.128582877  0.182275643
## x2.hdl:tch  0.0566847868  0.046771646  0.0155932188  0.082439193  0.109531393
## x2.hdl:ltg  0.0482331459 -0.044175887 -0.0290484655  0.074727456  0.102088093
## x2.hdl:glu -0.0834368834 -0.033628191 -0.0116117762 -0.012228968 -0.018730805
## x2.tch:ltg -0.0503431770  0.065419741  0.0606746416  0.082374618  0.007838506
## x2.tch:glu  0.0676966986  0.097013048  0.0726452903  0.108552594  0.101106002
## x2.ltg:glu  0.0050311720  0.148132598  0.1044948009  0.093775674  0.015254343
##              x2.age:hdl    x2.age:tch   x2.age:ltg    x2.age:glu    x2.sex:bmi
## x.age        0.005604460 -0.100933545 -0.107215864 -0.1648322394 -0.0600189813
## x.sex       -0.042729984 -0.046637620 -0.097259384 -0.0862420468  0.0112940598
## x.bmi       -0.022780333 -0.128748146 -0.103815727 -0.1250066265 -0.0808793812
## x.map        0.001262874 -0.069796748  0.013033924 -0.0616478268  0.0089199718
## x.tc         0.113717520 -0.162777878 -0.099709757 -0.1715608934  0.0004948300
## x.ldl        0.060307946 -0.142139153 -0.177657125 -0.1701301093 -0.0431118913
## x.hdl        0.165680553 -0.070851076  0.038630310 -0.0660693589  0.0756095012
## x.tch       -0.076244013 -0.032255685 -0.102910345 -0.0337295764 -0.0201411371
## x.ltg        0.042668555 -0.105628104 -0.004723573 -0.0418671036  0.0128677464
## x.glu       -0.068811484 -0.032644680 -0.039477896 -0.0329703862 -0.0136769671
## y           -0.047376428 -0.016739565  0.047019208  0.0461061235  0.0455201592
## x2.age       0.005604460 -0.100933545 -0.107215864 -0.1648322394 -0.0600189813
## x2.sex      -0.042729984 -0.046637620 -0.097259384 -0.0862420468  0.0112940598
## x2.bmi      -0.022780333 -0.128748146 -0.103815727 -0.1250066265 -0.0808793812
## x2.map       0.001262874 -0.069796748  0.013033924 -0.0616478268  0.0089199718
## x2.tc        0.113717520 -0.162777878 -0.099709757 -0.1715608934  0.0004948300
## x2.ldl       0.060307946 -0.142139153 -0.177657125 -0.1701301093 -0.0431118913
## x2.hdl       0.165680553 -0.070851076  0.038630310 -0.0660693589  0.0756095012
## x2.tch      -0.076244013 -0.032255685 -0.102910345 -0.0337295764 -0.0201411371
## x2.ltg       0.042668555 -0.105628104 -0.004723573 -0.0418671036  0.0128677464
## x2.glu      -0.068811484 -0.032644680 -0.039477896 -0.0329703862 -0.0136769671
## x2.age^2    -0.151034939  0.376705730  0.366706162  0.4592023456  0.0007959632
## x2.bmi^2    -0.062957011  0.037523892  0.010281453  0.0316998170  0.1798928646
## x2.map^2    -0.029980009  0.021145243  0.066857728  0.0375136076  0.1347539434
## x2.tc^2      0.050398411  0.059725764  0.077249129 -0.0532983386  0.0819828233
## x2.ldl^2     0.019705724  0.044951150 -0.001174438 -0.0390355079  0.0822718633
## x2.hdl^2     0.118658514 -0.101647436 -0.067645979 -0.0797852239  0.1276699437
## x2.tch^2    -0.049023287  0.088829106  0.029141394  0.0325600088  0.1151124640
## x2.ltg^2    -0.082279286  0.150968614  0.303538465  0.1164660747  0.0233260673
```

```
## x2.glu^2   -0.094836777  0.113875617  0.127218581  0.3532374824  0.1320972815
## x2.age:sex -0.370612707  0.326400595  0.111620545  0.1763726726  0.1665268411
## x2.age:bmi -0.297539567  0.441120663  0.444984669  0.3894534766  0.1411605816
## x2.age:map -0.154490695  0.299823999  0.417753306  0.4091993610  0.0665449040
## x2.age:tc   0.039729885  0.583202644  0.565433771  0.3315721079 -0.0435982008
## x2.age:ldl -0.176132537  0.674184644  0.379532265  0.3231205772 -0.0029790474
## x2.age:hdl  1.000000000 -0.720335114 -0.380373589 -0.3029832889 -0.1014983689
## x2.age:tch -0.720335114  1.000000000  0.653810912  0.4748952320  0.0672033520
## x2.age:ltg -0.380373589  0.653810912  1.000000000  0.4315098206 -0.0064544570
## x2.age:glu -0.302983289  0.474895232  0.431509821  1.0000000000  0.0585056877
## x2.sex:bmi -0.101498369  0.067203352 -0.006454457  0.0585056877  1.0000000000
## x2.sex:map -0.102574015  0.045114452 -0.016411598  0.0143075339  0.3928115022
## x2.sex:tc  -0.018080872  0.093288949  0.030691920  0.0163573822  0.2478242443
## x2.sex:ldl -0.041109452  0.083681350 -0.050556547 -0.0039156694  0.2467156664
## x2.sex:hdl  0.045280977  0.012743332  0.084856329 -0.0114217961 -0.3568589376
## x2.sex:tch -0.047776948  0.059665462 -0.038095349  0.0486423071  0.4060061404
## x2.sex:ltg -0.015505648  0.024216063  0.077458005  0.0437653740  0.4430440073
## x2.sex:glu -0.123094028  0.106639105  0.030402840  0.1126305994  0.3808317917
## x2.bmi:map -0.166946226  0.139143771  0.119726062  0.1320495700  0.3485594339
## x2.bmi:tc   0.028498827  0.103586813  0.089668905  0.1031900320  0.0784986563
## x2.bmi:ldl  0.027502894  0.080776596  0.025721386  0.0467713249  0.1445634852
## x2.bmi:hdl  0.105589376 -0.010452714 -0.016612769  0.0323445066 -0.3405032337
## x2.bmi:tch -0.061440815  0.103176164  0.076372255  0.0622455088  0.3500715983
## x2.bmi:ltg -0.094478271  0.101612671  0.178998882  0.1210991876  0.2301991141
## x2.bmi:glu -0.058064453  0.103835609  0.137153507  0.2416304883  0.2618970401
## x2.map:tc   0.047171886  0.114273268  0.156450381  0.1249590901  0.0173193753
## x2.map:ldl -0.022956991  0.109234916  0.045539915  0.0917217438  0.0541000594
## x2.map:hdl  0.346818624 -0.196260873 -0.108473346 -0.0499601559 -0.2461386000
## x2.map:tch -0.241353185  0.260257976  0.204966118  0.1474634079  0.2403675700
## x2.map:ltg -0.152780241  0.206717116  0.371681611  0.1597147925  0.1964099635
## x2.map:glu -0.077672935  0.132270940  0.149048916  0.3541380169  0.2571139992
## x2.tc:ldl   0.030370602  0.053122693  0.026218765 -0.0466051813  0.0796451020
## x2.tc:hdl   0.124347381 -0.116617943 -0.048720290 -0.1099842216 -0.0313143797
## x2.tc:tch  -0.051741982  0.121602949  0.087104651  0.0561955077  0.0791321658
## x2.tc:ltg   0.007123885  0.150750260  0.270803965  0.0714235590  0.0488185480
## x2.tc:glu  -0.068183909  0.174857744  0.142373681  0.2816620280  0.0757234572
## x2.ldl:hdl -0.014403166  0.000982944  0.062940905 -0.0200051963 -0.0689979837
## x2.ldl:tch  0.008679396  0.037361453 -0.026012057  0.0005293125  0.0781597796
## x2.ldl:ltg  0.036748095  0.085200157  0.120576729  0.0245290036  0.0847263742
## x2.ldl:glu -0.062883979  0.147433094  0.040272064  0.2055509809  0.0679014807
## x2.hdl:tch -0.021309985  0.005883798  0.037768988  0.0137578640 -0.1406807558
## x2.hdl:ltg  0.148496987 -0.084653289 -0.073714791 -0.0666438037 -0.1535156035
## x2.hdl:glu  0.180186739 -0.167922075 -0.112046260 -0.1367378044 -0.1485339527
## x2.tch:ltg -0.114061331  0.180969153  0.219141770  0.1220711797  0.1341069066
## x2.tch:glu -0.183257845  0.254405467  0.185216910  0.2414693121  0.1368734417
## x2.ltg:glu -0.149933411  0.209318090  0.307147788  0.3203509909  0.1308876394
##               x2.sex:map     x2.sex:tc    x2.sex:ldl    x2.sex:hdl    x2.sex:tch
## x.age       -0.073924590 -0.1138721799 -0.074443717 -0.042134530 -0.047737839
## x.sex        0.031736925  0.0044577752  0.018206403 -0.052548911  0.044409112
## x.bmi        0.009168873  0.0004881049 -0.042955288  0.081813803 -0.021023057
## x.map       -0.101761205 -0.0348306192 -0.023564427 -0.026290874  0.012910959
## x.tc        -0.036295813  0.0826768700  0.074702448  0.008409361  0.039478387
## x.ldl       -0.024310271  0.0739558300  0.075803358  0.042301690  0.034939660
## x.hdl       -0.024975103  0.0076660192  0.038951758 -0.150840824  0.015041109
```

```
## x.tch        0.012714495  0.0373082312  0.033352344  0.015592587  0.096960354
## x.ltg       -0.023069383  0.0201391617 -0.013844454  0.057113036 -0.001318961
## x.glu       -0.028116011 -0.0078130901 -0.036841448  0.061009696 -0.044460048
## y            0.057585660  0.0159362785 -0.038207180  0.087389801 -0.018432792
## x2.age      -0.073924590 -0.1138721799 -0.074443717 -0.042134530 -0.047737839
## x2.sex       0.031736925  0.0044577752  0.018206403 -0.052548911  0.044409112
## x2.bmi       0.009168873  0.0004881049 -0.042955288  0.081813803 -0.021023057
## x2.map      -0.101761205 -0.0348306192 -0.023564427 -0.026290874  0.012910959
## x2.tc       -0.036295813  0.0826768700  0.074702448  0.008409361  0.039478387
## x2.ldl      -0.024310271  0.0739558300  0.075803358  0.042301690  0.034939660
## x2.hdl      -0.024975103  0.0076660192  0.038951758 -0.150840824  0.015041109
## x2.tch       0.012714495  0.0373082312  0.033352344  0.015592587  0.096960354
## x2.ltg      -0.023069383  0.0201391617 -0.013844454  0.057113036 -0.001318961
## x2.glu      -0.028116011 -0.0078130901 -0.036841448  0.061009696 -0.044460048
## x2.age^2     0.024930354  0.0343844439  0.017128599  0.035159267  0.013828970
## x2.bmi^2     0.115643923  0.0426821229  0.011965316  0.022557392  0.027023527
## x2.map^2     0.115006005  0.0384843903  0.015238994 -0.009319424  0.038004915
## x2.tc^2      0.028665507  0.1019891959  0.113447729 -0.017038549  0.063628845
## x2.ldl^2     0.049080385  0.2388575988  0.269017480 -0.024680358  0.161735880
## x2.hdl^2    -0.007275089 -0.1184883782  0.018820089 -0.466964323  0.209025124
## x2.tch^2     0.072571366  0.2098793760  0.239055792 -0.170191833  0.328183321
## x2.ltg^2     0.001303035  0.0508091737 -0.008666365  0.071980348  0.005944056
## x2.glu^2     0.113866735  0.1108779870  0.049976052  0.003348827  0.058370774
## x2.age:sex   0.300214695  0.2424291938  0.189288824 -0.015793322  0.150426670
## x2.age:bmi   0.048406178 -0.0277993728 -0.010079169 -0.029797985  0.022345532
## x2.age:map   0.096208107  0.0331013532  0.027150660  0.023021381 -0.022512680
## x2.age:tc   -0.019935239  0.1240656273  0.085678710  0.084625754  0.012215188
## x2.age:ldl   0.021000764  0.1160903225  0.132439634  0.038665864  0.039064783
## x2.age:hdl -0.102574015 -0.0180808725 -0.041109452  0.045280977 -0.047776948
## x2.age:tch   0.045114452  0.0932889493  0.083681350  0.012743332  0.059665462
## x2.age:ltg -0.016411598  0.0306919203 -0.050556547  0.084856329 -0.038095349
## x2.age:glu   0.014307534  0.0163573822 -0.003915669 -0.011421796  0.048642307
## x2.sex:bmi   0.392811502  0.2478242443  0.246715666 -0.356858938  0.406006140
## x2.sex:map   1.000000000  0.2369765360  0.154561094 -0.102444346  0.195741930
## x2.sex:tc    0.236976536  1.0000000000  0.901773518  0.071591505  0.561165227
## x2.sex:ldl   0.154561094  0.9017735184  1.000000000 -0.150912700  0.653040136
## x2.sex:hdl -0.102444346  0.0715915054 -0.150912700  1.000000000 -0.702443085
## x2.sex:tch  0.195741930  0.5611652269  0.653040136 -0.702443085  1.000000000
## x2.sex:ltg  0.371529108  0.5156860330  0.299891440 -0.369680861  0.604347626
## x2.sex:glu  0.357703593  0.3234446722  0.263795958 -0.209839339  0.369597486
## x2.bmi:map  0.150552521  0.0226211221  0.011050989 -0.118361857  0.122029420
## x2.bmi:tc  -0.023750284  0.2065162352  0.168174666  0.078821368  0.065269217
## x2.bmi:ldl  0.005576056  0.1959041025  0.191548316  0.017509415  0.082814051
## x2.bmi:hdl -0.195074904 -0.0127720979 -0.033584649  0.193740295 -0.111391511
## x2.bmi:tch  0.167322003  0.1330695498  0.107774335 -0.073212474  0.141048779
## x2.bmi:ltg  0.119366472  0.0816862758  0.047025261 -0.008662432  0.055184430
## x2.bmi:glu  0.210335135  0.0850808694  0.036062883 -0.015574517  0.055086642
## x2.map:tc   0.025080446  0.2796248172  0.255246023  0.043505641  0.158927484
## x2.map:ldl  0.124970998  0.2840565686  0.302838404 -0.010620575  0.195981300
## x2.map:hdl -0.351466868 -0.0455836501 -0.053346022  0.172200652 -0.162517496
## x2.map:tch  0.334432576  0.2234955683  0.211253653 -0.134030068  0.286326004
## x2.map:ltg  0.177992482  0.1114238375  0.051091279 -0.065338333  0.131059200
## x2.map:glu  0.223697529  0.0905546992  0.021553108 -0.009070172  0.071133021
## x2.tc:ldl   0.045578913  0.1856482012  0.196862204  0.004239784  0.102204545
```

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## x2.tc:hdl  -0.071415958 -0.4226722255 -0.360718302 -0.171959475 -0.151598520
## x2.tc:tch   0.082903741  0.3311326144  0.303496860  0.077232865  0.159667732
## x2.tc:ltg  -0.005550729  0.1556716158  0.120451800  0.077523962  0.038045994
## x2.tc:glu   0.032191855  0.2265048640  0.199711457  0.038656655  0.110637082
## x2.ldl:hdl -0.034595582 -0.3354737724 -0.401215005  0.112872856 -0.261324359
## x2.ldl:tch  0.063644444  0.3122104231  0.364221659 -0.045673193  0.231299815
## x2.ldl:ltg  0.029396425  0.1902484880  0.184806912  0.001086631  0.084028520
## x2.ldl:glu  0.008293900  0.2280212415  0.258679344  0.011876607  0.110493417
## x2.hdl:tch -0.036215426 -0.0834292381 -0.180324985  0.383754397 -0.354356038
## x2.hdl:ltg -0.121757489 -0.1178118312 -0.067946036  0.114609979 -0.153691092
## x2.hdl:glu -0.100575001 -0.0854293523 -0.065023705  0.113860159 -0.115156951
## x2.tch:ltg  0.094493584  0.1709501945  0.087218159 -0.034268969  0.159550997
## x2.tch:glu  0.096050354  0.1797564650  0.131522257 -0.035679087  0.153092720
## x2.ltg:glu  0.124609847  0.1009842206  0.008974947 -0.017494091  0.078429718
##               x2.sex:ltg   x2.sex:glu   x2.bmi:map    x2.bmi:tc   x2.bmi:ldl
## x.age       -0.0980161546 -0.083049266 -0.089846895 -0.2439324576 -0.242531427
## x.sex        0.0192289379  0.027052892  0.008320515  0.0005079012 -0.044748198
## x.bmi        0.0128834947 -0.013876838  0.059822464 -0.1335145154 -0.142362892
## x.map       -0.0224706021 -0.027752489  0.117993292 -0.1453019176 -0.190496897
## x.tc         0.0204416263 -0.008036490 -0.132048899 -0.0005389223  0.012629509
## x.ldl       -0.0139119328 -0.037516113 -0.171197002  0.0124891034  0.016096228
## x.hdl        0.0528464996  0.057207024  0.023310906 -0.0298136425  0.101093664
## x.tch       -0.0012651774 -0.043217412 -0.087452648  0.0307602194 -0.026473685
## x.ltg        0.0169373280 -0.018713389 -0.002515257 -0.0460716026 -0.117304390
## x.glu       -0.0184664300 -0.021886506 -0.014304795 -0.0213073874 -0.057710231
## y            0.0321271204  0.037082727  0.147113178 -0.0670255903 -0.111384066
## x2.age      -0.0980161546 -0.083049266 -0.089846895 -0.2439324576 -0.242531427
## x2.sex       0.0192289379  0.027052892  0.008320515  0.0005079012 -0.044748198
## x2.bmi       0.0128834947 -0.013876838  0.059822464 -0.1335145154 -0.142362892
## x2.map      -0.0224706021 -0.027752489  0.117993292 -0.1453019176 -0.190496897
## x2.tc        0.0204416263 -0.008036490 -0.132048899 -0.0005389223  0.012629509
## x2.ldl      -0.0139119328 -0.037516113 -0.171197002  0.0124891034  0.016096228
## x2.hdl       0.0528464996  0.057207024  0.023310906 -0.0298136425  0.101093664
## x2.tch      -0.0012651774 -0.043217412 -0.087452648  0.0307602194 -0.026473685
## x2.ltg       0.0169373280 -0.018713389 -0.002515257 -0.0460716026 -0.117304390
## x2.glu      -0.0184664300 -0.021886506 -0.014304795 -0.0213073874 -0.057710231
## x2.age^2     0.0057715693  0.006545702  0.064203321  0.1616275091  0.145451473
## x2.bmi^2     0.0748887698  0.062374724  0.390944151  0.1023245076  0.140734489
## x2.map^2     0.0885294975  0.092551744  0.456198308  0.0111060578 -0.008125605
## x2.tc^2      0.0170766561  0.013242161  0.015515324  0.3546744536  0.366260677
## x2.ldl^2     0.0446416337  0.054579214 -0.026582697  0.3584479271  0.390443479
## x2.hdl^2     0.0580781804 -0.004107023 -0.012052196 -0.1466972891  0.035033350
## x2.tch^2     0.1420780720  0.056440717 -0.024066711  0.2751008482  0.322753723
## x2.ltg^2     0.0157734932  0.041804318  0.075103812  0.1524568932  0.048907097
## x2.glu^2     0.1369589696  0.279736209  0.167909912  0.1470445996  0.079722324
## x2.age:sex   0.2388814362  0.265884702  0.021633253 -0.0682824581 -0.030903376
## x2.age:bmi  -0.0103582538  0.043612882  0.344703683  0.1564542657  0.140023987
## x2.age:map  -0.0008720391  0.017373620  0.120170367  0.0457552493  0.047782535
## x2.age:tc    0.0013005668 -0.027963737  0.020450416  0.1628804908  0.129627701
## x2.age:ldl  -0.0447932842 -0.006396236  0.040985126  0.1449490585  0.149586630
## x2.age:hdl  -0.0155056482 -0.123094028 -0.166946226  0.0284988266  0.027502894
## x2.age:tch   0.0242160628  0.106639105  0.139143771  0.1035868127  0.080776596
## x2.age:ltg   0.0774580054  0.030402840  0.119726062  0.0896689048  0.025721386
## x2.age:glu   0.0437653740  0.112630599  0.132049570  0.1031900320  0.046771325
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## x2.sex:bmi  0.4430440073  0.380831792  0.348559434  0.0784986563  0.144563485
## x2.sex:map  0.3715291085  0.357703593  0.150552521 -0.0237502836  0.005576056
## x2.sex:tc   0.5156860330  0.323444672  0.022621122  0.2065162352  0.195904103
## x2.sex:ldl  0.2998914399  0.263795958  0.011050989  0.1681746658  0.191548316
## x2.sex:hdl -0.3696808614 -0.209839339 -0.118361857  0.0788213681  0.017509415
## x2.sex:tch  0.6043476259  0.369597486  0.122029420  0.0652692168  0.082814051
## x2.sex:ltg  1.0000000000  0.445987703  0.150229566  0.0591617880  0.073098977
## x2.sex:glu  0.4459877035  1.000000000  0.208049264  0.0508227994  0.039950875
## x2.bmi:map  0.1502295662  0.208049264  1.000000000  0.1152694673  0.053648013
## x2.bmi:tc   0.0591617880  0.050822799  0.115269467  1.0000000000  0.897063174
## x2.bmi:ldl  0.0730989773  0.039950875  0.053648013  0.8970631743  1.000000000
## x2.bmi:hdl -0.1309095577 -0.093068461 -0.177359735  0.1087640663 -0.122327224
## x2.bmi:tch  0.1433984659  0.102190818  0.192960512  0.5248735896  0.620146440
## x2.bmi:ltg  0.0558945006  0.092051748  0.372884724  0.4659733833  0.255077950
## x2.bmi:glu  0.1205300080  0.205421448  0.366200535  0.3668911472  0.300724227
## x2.map:tc   0.0856053120  0.060426129  0.161257943  0.3821957259  0.308835531
## x2.map:ldl  0.0795626229  0.041667456  0.174096548  0.3265673621  0.327440865
## x2.map:hdl -0.1764414370 -0.119609134 -0.343156955  0.0807407134  0.033663321
## x2.map:tch  0.2168419171  0.153629261  0.351069826  0.1578511244  0.136507062
## x2.map:ltg  0.1979160384  0.171983933  0.410842452  0.1692346331  0.060515315
## x2.map:glu  0.1765750011  0.319802218  0.408700550  0.1151930857  0.059208506
## x2.tc:ldl   0.0400445827  0.033052345 -0.002546513  0.3862437330  0.400207292
## x2.tc:hdl  -0.1400379793 -0.108231097  0.014490090 -0.3778861927 -0.365965295
## x2.tc:tch   0.1052339677  0.080290709 -0.001401225  0.4958169006  0.494221124
## x2.tc:ltg   0.0276852405  0.017080322  0.044752234  0.4783283129  0.448953215
## x2.tc:glu   0.0800770641  0.144042187  0.083193333  0.4620561149  0.415951873
## x2.ldl:hdl -0.0939620612 -0.061811778  0.061904283 -0.2880935554 -0.433585359
## x2.ldl:tch  0.0626596776  0.047493280 -0.047023133  0.4244559927  0.503072314
## x2.ldl:ltg  0.0880155447  0.010176569  0.030634847  0.5262823668  0.572517041
## x2.ldl:glu  0.0331550102  0.163092412  0.043744581  0.4111062763  0.463207082
## x2.hdl:tch -0.1420996663 -0.036036377  0.032644796 -0.0464674873 -0.183626005
## x2.hdl:ltg -0.2492814909 -0.121246780 -0.078924634 -0.0412454545 -0.034130530
## x2.hdl:glu -0.1644068279 -0.347796972 -0.083769189 -0.0492895672 -0.085241728
## x2.tch:ltg  0.2310213530  0.099195125  0.072853974  0.3080408466  0.262441649
## x2.tch:glu  0.1613498698  0.313905808  0.094869136  0.2917370199  0.278868920
## x2.ltg:glu  0.1848008593  0.246285756  0.162951788  0.2546204812  0.127755553
##             x2.bmi:hdl  x2.bmi:tch  x2.bmi:ltg  x2.bmi:glu    x2.map:tc
## x.age       -0.021901621 -0.13048862 -0.108613056 -0.116585444 -0.1220286617
## x.sex        0.079769587 -0.02081619  0.013374773 -0.013439560 -0.0359278391
## x.bmi       -0.126896238  0.06236327  0.079498164  0.102999396 -0.1440373425
## x.map        0.026365342 -0.09689545 -0.002802719 -0.015069199 -0.0005902251
## x.tc        -0.030644513  0.03097300 -0.046654546 -0.020398685 -0.0269543299
## x.ldl        0.102755822 -0.02636047 -0.117468040 -0.054634830 -0.0530958133
## x.hdl       -0.272699915  0.04196941 -0.010139858 -0.067938199  0.0025943266
## x.tch        0.042842685  0.11808327  0.031689305  0.082907648 -0.0108318867
## x.ltg       -0.010292216  0.03150982  0.044827105  0.078133182 -0.0156787221
## x.glu       -0.072942348  0.08720000  0.082646446  0.034128846 -0.0964241223
## y           -0.052755021  0.06029075  0.098689644  0.155782699 -0.0109570905
## x2.age      -0.021901621 -0.13048862 -0.108613056 -0.116585444 -0.1220286617
## x2.sex       0.079769587 -0.02081619  0.013374773 -0.013439560 -0.0359278391
## x2.bmi      -0.126896238  0.06236327  0.079498164  0.102999396 -0.1440373425
## x2.map       0.026365342 -0.09689545 -0.002802719 -0.015069199 -0.0005902251
## x2.tc       -0.030644513  0.03097300 -0.046654546 -0.020398685 -0.0269543299
## x2.ldl       0.102755822 -0.02636047 -0.117468040 -0.054634830 -0.0530958133
```

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## x2.hdl     -0.272699915  0.04196941 -0.010139858 -0.067938199  0.0025943266
## x2.tch      0.042842685  0.11808327  0.031689305  0.082907648 -0.0108318867
## x2.ltg     -0.010292216  0.03150982  0.044827105  0.078133182 -0.0156787221
## x2.glu     -0.072942348  0.08720000  0.082646446  0.034128846 -0.0964241223
## x2.age^2    0.077859273  0.04782357  0.043734021  0.028951661  0.1426816874
## x2.bmi^2   -0.430260581  0.43301437  0.425690065  0.389757106 -0.0181309800
## x2.map^2   -0.067391728  0.04389667  0.103143723  0.176596294  0.2277789695
## x2.tc^2     0.023199193  0.21114421  0.102785001  0.077210073  0.1426515974
## x2.ldl^2   -0.057227437  0.26042206  0.103720490  0.074646594  0.1212524458
## x2.hdl^2   -0.558087206  0.24555423  0.035739876  0.004293073 -0.1053285929
## x2.tch^2   -0.290609150  0.51624506  0.203043277  0.155706932  0.1223699368
## x2.ltg^2   -0.108860847  0.20920227  0.370332514  0.190920152  0.1821058018
## x2.glu^2   -0.068644856  0.15498390  0.227931171  0.541093593  0.1170081022
## x2.age:sex -0.036535094  0.01145596 -0.064044994  0.013723591  0.0008671765
## x2.age:bmi -0.095037061  0.18751048  0.212843876  0.270416980  0.0823691566
## x2.age:map -0.076054001  0.09522814  0.094462302  0.128074095  0.2266333732
## x2.age:tc   0.105266062  0.04115345  0.038800613  0.065699980  0.2574129998
## x2.age:ldl  0.089823692  0.03900908 -0.002726089  0.035235143  0.2016079818
## x2.age:hdl  0.105589376 -0.06144082 -0.094478271 -0.058064453  0.0471718863
## x2.age:tch -0.010452714  0.10317616  0.101612671  0.103835609  0.1142732676
## x2.age:ltg -0.016612769  0.07637226  0.178998882  0.137153507  0.1564503811
## x2.age:glu  0.032344507  0.06224551  0.121099188  0.241630488  0.1249590901
## x2.sex:bmi -0.340503234  0.35007160  0.230199114  0.261897040  0.0173193753
## x2.sex:map -0.195074904  0.16732200  0.119366472  0.210335135  0.0250804459
## x2.sex:tc  -0.012772098  0.13306955  0.081686276  0.085080869  0.2796248172
## x2.sex:ldl -0.033584649  0.10777433  0.047025261  0.036062883  0.2552460230
## x2.sex:hdl  0.193740295 -0.07321247 -0.008662432 -0.015574517  0.0435056412
## x2.sex:tch -0.111391511  0.14104878  0.055184430  0.055086642  0.1589274843
## x2.sex:ltg -0.130909558  0.14339847  0.055894501  0.120530008  0.0856053120
## x2.sex:glu -0.093068461  0.10219082  0.092051748  0.205421448  0.0604261288
## x2.bmi:map -0.177359735  0.19296051  0.372884724  0.366200535  0.1612579433
## x2.bmi:tc   0.108764066  0.52487359  0.465973383  0.366891147  0.3821957259
## x2.bmi:ldl -0.122327224  0.62014644  0.255077950  0.300724227  0.3088355309
## x2.bmi:hdl  1.000000000 -0.70052179 -0.395270417 -0.264288260  0.1355021274
## x2.bmi:tch -0.700521787  1.00000000  0.619581173  0.451668083  0.1202066798
## x2.bmi:ltg -0.395270417  0.61958117  1.000000000  0.529104054  0.1543782785
## x2.bmi:glu -0.264288260  0.45166808  0.529104054  1.000000000  0.1205485817
## x2.map:tc   0.135502127  0.12020668  0.154378279  0.120548582  1.0000000000
## x2.map:ldl  0.059844115  0.12678589  0.080639112  0.090827324  0.8856115904
## x2.map:hdl  0.320644763 -0.18287529 -0.159955516 -0.118300671  0.0923758284
## x2.map:tch -0.173679310  0.26695381  0.229705107  0.175960746  0.5299031146
## x2.map:ltg -0.103622496  0.18363634  0.367340226  0.226737111  0.5054220910
## x2.map:glu -0.049574898  0.11201998  0.195767998  0.488035567  0.3023070197
## x2.tc:ldl   0.006987752  0.23848888  0.115406214  0.075128001  0.1368796874
## x2.tc:hdl   0.028107704 -0.28052145 -0.175881028 -0.138436185 -0.2383939312
## x2.tc:tch  -0.031458543  0.37808184  0.202549378  0.159370774  0.2260403692
## x2.tc:ltg   0.055693496  0.27288119  0.230199526  0.174467948  0.3109810055
## x2.tc:glu   0.007436141  0.29748414  0.255985030  0.349841232  0.2605286450
## x2.ldl:hdl  0.270467647 -0.33070142 -0.050529798 -0.072729335 -0.1554291687
## x2.ldl:tch -0.117035260  0.36484887  0.108047906  0.101695861  0.1601529443
## x2.ldl:ltg -0.019671952  0.32822143  0.200711245  0.131927621  0.2632380250
## x2.ldl:glu -0.044468990  0.29076555  0.129526179  0.264538671  0.2039392405
## x2.hdl:tch  0.520994051 -0.45315279 -0.144344493 -0.091591306 -0.0214034701
## x2.hdl:ltg  0.410229403 -0.35709050 -0.369943114 -0.167666843 -0.0353800371
```

```
## x2.hdl:glu  0.336793588 -0.30922808 -0.213342703 -0.378165894 -0.0262013917
## x2.tch:ltg -0.253013398  0.47468239  0.399034042  0.233003517  0.1932761264
## x2.tch:glu -0.236340213  0.44921669  0.302104175  0.438684023  0.1644433924
## x2.ltg:glu -0.142300893  0.29673777  0.438444832  0.550850880  0.1858407188
##             x2.map:ldl   x2.map:hdl   x2.map:tch   x2.map:ltg   x2.map:glu
## x.age      -0.16217924  0.001115853 -0.069734729  0.013861319 -0.056012801
## x.sex      -0.02429521 -0.023558453  0.012602191 -0.023712531 -0.026185129
## x.bmi      -0.18853534  0.024230611 -0.095518096 -0.002848984 -0.014680755
## x.map      -0.05005059  0.012986527 -0.010252041  0.099787612  0.113500096
## x.tc       -0.05360639  0.002472234 -0.010846172 -0.016280885 -0.090721900
## x.ldl      -0.03842632  0.063451555 -0.069897034 -0.127064751 -0.126809533
## x.hdl       0.06722544 -0.078815757  0.007323357 -0.003978775 -0.015522067
## x.tch      -0.07047623  0.006969518  0.052770793  0.026740759 -0.034477466
## x.ltg      -0.12354183 -0.003651295  0.025785690  0.083316101  0.008085698
## x.glu      -0.13607607 -0.015721284 -0.036692836  0.008923977  0.006426217
## y          -0.08369691  0.015446414 -0.003577406  0.099435161  0.079563794
## x2.age     -0.16217924  0.001115853 -0.069734729  0.013861319 -0.056012801
## x2.sex     -0.02429521 -0.023558453  0.012602191 -0.023712531 -0.026185129
## x2.bmi     -0.18853534  0.024230611 -0.095518096 -0.002848984 -0.014680755
## x2.map     -0.05005059  0.012986527 -0.010252041  0.099787612  0.113500096
## x2.tc      -0.05360639  0.002472234 -0.010846172 -0.016280885 -0.090721900
## x2.ldl     -0.03842632  0.063451555 -0.069897034 -0.127064751 -0.126809533
## x2.hdl      0.06722544 -0.078815757  0.007323357 -0.003978775 -0.015522067
## x2.tch     -0.07047623  0.006969518  0.052770793  0.026740759 -0.034477466
## x2.ltg     -0.12354183 -0.003651295  0.025785690  0.083316101  0.008085698
## x2.glu     -0.13607607 -0.015721284 -0.036692836  0.008923977  0.006426217
## x2.age^2    0.11765660  0.019540331  0.074565563  0.080961998  0.059621145
## x2.bmi^2   -0.02003077 -0.097183923  0.073083304  0.118735055  0.104217051
## x2.map^2    0.16332629 -0.090775825  0.180045001  0.354605840  0.404537198
## x2.tc^2     0.16102841 -0.019535277  0.096994618  0.025330237 -0.045875686
## x2.ldl^2    0.15991092 -0.029144519  0.096504532 -0.017626834 -0.058837935
## x2.hdl^2   -0.06286826 -0.142940344  0.042248834  0.003922525 -0.064696663
## x2.tch^2    0.11008413 -0.141378821  0.273457734  0.134517550  0.013623714
## x2.ltg^2    0.01059494 -0.135899834  0.244121987  0.484189339  0.165322651
## x2.glu^2    0.07372926 -0.116452923  0.157833770  0.250311154  0.559956240
## x2.age:sex  0.04310960 -0.076012566  0.048772587 -0.020481322  0.017554559
## x2.age:bmi  0.09943795 -0.153379483  0.181475007  0.171724330  0.172858271
## x2.age:map  0.17802061 -0.050107197  0.156255362  0.249898816  0.220266105
## x2.age:tc   0.20361151  0.066505317  0.090750922  0.119815663  0.081050008
## x2.age:ldl  0.23401779  0.005121289  0.085964915  0.008301476  0.051712202
## x2.age:hdl -0.02295699  0.346818624 -0.241353185 -0.152780241 -0.077672935
## x2.age:tch  0.10923492 -0.196260873  0.260257976  0.206717116  0.132270940
## x2.age:ltg  0.04553991 -0.108473346  0.204966118  0.371681611  0.149048916
## x2.age:glu  0.09172174 -0.049960156  0.147463408  0.159714792  0.354138017
## x2.sex:bmi  0.05410006 -0.246138600  0.240367570  0.196409963  0.257113999
## x2.sex:map  0.12497100 -0.351466868  0.334432576  0.177992482  0.223697529
## x2.sex:tc   0.28405657 -0.045583650  0.223495568  0.111423837  0.090554699
## x2.sex:ldl  0.30283840 -0.053346022  0.211253653  0.051091279  0.021553108
## x2.sex:hdl -0.01062057  0.172200652 -0.134030068 -0.065338333 -0.009070172
## x2.sex:tch  0.19598130 -0.162517496  0.286326004  0.131059200  0.071133021
## x2.sex:ltg  0.07956262 -0.176441437  0.216841917  0.197916038  0.176575001
## x2.sex:glu  0.04166746 -0.119609134  0.153629261  0.171983933  0.319802218
## x2.bmi:map  0.17409655 -0.343156955  0.351069826  0.410842452  0.408700550
## x2.bmi:tc   0.32656736  0.080740713  0.157851124  0.169234633  0.115193086
```

```
## x2.bmi:ldl   0.32744087   0.033663321   0.136507062   0.060515315   0.059208506
## x2.bmi:hdl   0.05984411   0.320644763  -0.173679310  -0.103622496  -0.049574898
## x2.bmi:tch   0.12678589  -0.182875293   0.266953815   0.183636338   0.112019978
## x2.bmi:ltg   0.08063911  -0.159955516   0.229705107   0.367340226   0.195767998
## x2.bmi:glu   0.09082732  -0.118300671   0.175960746   0.226737111   0.488035567
## x2.map:tc    0.88561159   0.092375828   0.529903115   0.505422091   0.302307020
## x2.map:ldl   1.00000000  -0.177967774   0.642467106   0.292256748   0.245198888
## x2.map:hdl  -0.17796777   1.000000000  -0.713197773  -0.360443869  -0.215589915
## x2.map:tch   0.64246711  -0.713197773   1.000000000   0.611432317   0.372319617
## x2.map:ltg   0.29225675  -0.360443869   0.611432317   1.000000000   0.473993798
## x2.map:glu   0.24519889  -0.215589915   0.372319617   0.473993798   1.000000000
## x2.tc:ldl    0.18419777  -0.022435157   0.094609514  -0.021980064  -0.054773906
## x2.tc:hdl   -0.22235503   0.077387048  -0.232972722  -0.166890715  -0.111988993
## x2.tc:tch    0.22943496  -0.085199838   0.244796206   0.123189442   0.048443096
## x2.tc:ltg    0.23385513  -0.035651424   0.225939739   0.298745849   0.099600785
## x2.tc:glu    0.22378618  -0.032992822   0.204268942   0.198384091   0.290306708
## x2.ldl:hdl  -0.20306168   0.046515392  -0.126542171  -0.038565278  -0.014556238
## x2.ldl:tch   0.22159622  -0.038137598   0.139042811  -0.004575771  -0.027943105
## x2.ldl:ltg   0.33423229  -0.056880631   0.185054282   0.082866547   0.030726225
## x2.ldl:glu   0.25225087  -0.039288416   0.150989629   0.043830221   0.175417561
## x2.hdl:tch  -0.03062513   0.171584914  -0.196129047  -0.105393245   0.019958255
## x2.hdl:ltg  -0.04284127   0.345473605  -0.329848887  -0.241804374  -0.097171475
## x2.hdl:glu  -0.04495790   0.236897569  -0.214109946  -0.161407237  -0.257589270
## x2.tch:ltg   0.13352082  -0.263200332   0.409726061   0.333202359   0.133684901
## x2.tch:glu   0.13715790  -0.174409133   0.293130357   0.225979257   0.292270867
## x2.ltg:glu   0.06686915  -0.153223884   0.262698858   0.442756406   0.511638116
##                x2.tc:ldl     x2.tc:hdl     x2.tc:tch     x2.tc:ltg     x2.tc:glu
## x.age       -0.074796332   0.107902518  -0.130604532  -0.099138767  -0.170073634
## x.sex        0.049667588   0.008092110   0.030945384   0.020167643  -0.008273101
## x.bmi        0.008060570  -0.030244106   0.024519663  -0.044338494  -0.021682511
## x.map       -0.034569335   0.002654890  -0.008710146  -0.015221397  -0.098983159
## x.tc         0.234773515  -0.058797816   0.190157602   0.189273314  -0.011730366
## x.ldl        0.268974600  -0.074968719   0.201004776   0.095369872   0.007320381
## x.hdl       -0.047696761   0.135366950  -0.162405955  -0.042605659  -0.113072191
## x.tch        0.162748055  -0.206681966   0.293532571   0.148450243   0.113066262
## x.ltg        0.063958474  -0.044910241   0.122958448   0.123544836  -0.010404166
## x.glu        0.004642894  -0.112720302   0.088568387  -0.009839556   0.029561677
## y            0.006713017  -0.025811265   0.039022382   0.021384107   0.036562323
## x2.age      -0.074796332   0.107902518  -0.130604532  -0.099138767  -0.170073634
## x2.sex       0.049667588   0.008092110   0.030945384   0.020167643  -0.008273101
## x2.bmi       0.008060570  -0.030244106   0.024519663  -0.044338494  -0.021682511
## x2.map      -0.034569335   0.002654890  -0.008710146  -0.015221397  -0.098983159
## x2.tc        0.234773515  -0.058797816   0.190157602   0.189273314  -0.011730366
## x2.ldl       0.268974600  -0.074968719   0.201004776   0.095369872   0.007320381
## x2.hdl      -0.047696761   0.135366950  -0.162405955  -0.042605659  -0.113072191
## x2.tch       0.162748055  -0.206681966   0.293532571   0.148450243   0.113066262
## x2.ltg       0.063958474  -0.044910241   0.122958448   0.123544836  -0.010404166
## x2.glu       0.004642894  -0.112720302   0.088568387  -0.009839556   0.029561677
## x2.age^2     0.057303243  -0.031292613   0.066321388   0.115852231   0.066685861
## x2.bmi^2    -0.002096238  -0.032419242   0.026934001   0.017188071   0.093972053
## x2.map^2    -0.010836978  -0.002529705   0.015216409   0.034332977   0.064330809
## x2.tc^2      0.948312325   0.040937463   0.679116348   0.613399407   0.381005286
## x2.ldl^2     0.959148710  -0.279787653   0.803887505   0.358212588   0.375617255
## x2.hdl^2    -0.082008287   0.287225319  -0.163638479  -0.129616702  -0.084502678
```

```
## x2.tch^2    0.396961623 -0.488304660  0.693495162  0.332663945  0.310649153
## x2.ltg^2   -0.001407881 -0.194928216  0.230991346  0.573783098  0.212607358
## x2.glu^2    0.007929740 -0.150142639  0.109867882  0.123223529  0.471432496
## x2.age:sex -0.021248218 -0.029936744  0.003417764 -0.049944950 -0.032691011
## x2.age:bmi  0.019353293 -0.003640449  0.039413337  0.058371652  0.114623478
## x2.age:map -0.036392631  0.006713731 -0.021423850  0.047644090  0.088265255
## x2.age:tc   0.158027390 -0.021313004  0.120085196  0.244245064  0.146249438
## x2.age:ldl  0.172824068 -0.039529778  0.116343588  0.168102198  0.140565555
## x2.age:hdl  0.030370602  0.124347381 -0.051741982  0.007123885 -0.068183909
## x2.age:tch  0.053122693 -0.116617943  0.121602949  0.150750260  0.174857744
## x2.age:ltg  0.026218765 -0.048720290  0.087104651  0.270803965  0.142373681
## x2.age:glu -0.046605181 -0.109984222  0.056195508  0.071423559  0.281662028
## x2.sex:bmi  0.079645102 -0.031314380  0.079132166  0.048818548  0.075723457
## x2.sex:map  0.045578913 -0.071415958  0.082903741 -0.005550729  0.032191855
## x2.sex:tc   0.185648201 -0.422672226  0.331132614  0.155671616  0.226504864
## x2.sex:ldl  0.196862204 -0.360718302  0.303496860  0.120451800  0.199711457
## x2.sex:hdl  0.004239784 -0.171959475  0.077232865  0.077523962  0.038656655
## x2.sex:tch  0.102204545 -0.151598520  0.159667732  0.038045994  0.110637082
## x2.sex:ltg  0.040044583 -0.140037979  0.105233968  0.027685241  0.080077064
## x2.sex:glu  0.033052345 -0.108231097  0.080290709  0.017080322  0.144042187
## x2.bmi:map -0.002546513  0.014490090 -0.001401225  0.044752234  0.083193333
## x2.bmi:tc   0.386243733 -0.377886193  0.495816901  0.478328313  0.462056115
## x2.bmi:ldl  0.400207292 -0.365965295  0.494221124  0.448953215  0.415951873
## x2.bmi:hdl  0.006987752  0.028107704 -0.031458543  0.055693496  0.007436141
## x2.bmi:tch  0.238488884 -0.280521451  0.378081839  0.272881192  0.297484135
## x2.bmi:ltg  0.115406214 -0.175881028  0.202549378  0.230199526  0.255985030
## x2.bmi:glu  0.075128001 -0.138436185  0.159370774  0.174467948  0.349841232
## x2.map:tc   0.136879687 -0.238393931  0.226040369  0.310981005  0.260528645
## x2.map:ldl  0.184197774 -0.222355028  0.229434962  0.233855132  0.223786176
## x2.map:hdl -0.022435157  0.077387048 -0.085199838 -0.035651424 -0.032992822
## x2.map:tch  0.094609514 -0.232972722  0.244796206  0.225939739  0.204268942
## x2.map:ltg -0.021980064 -0.166890715  0.123189442  0.298745849  0.198384091
## x2.map:glu -0.054773906 -0.111988993  0.048443096  0.099600785  0.290306708
## x2.tc:ldl   1.000000000 -0.143438452  0.770475067  0.463917476  0.392458685
## x2.tc:hdl  -0.143438452  1.000000000 -0.634302802 -0.268405972 -0.272153576
## x2.tc:tch   0.770475067 -0.634302802  1.000000000  0.585881804  0.486282844
## x2.tc:ltg   0.463917476 -0.268405972  0.585881804  1.000000000  0.418112495
## x2.tc:glu   0.392458685 -0.272153576  0.486282844  0.418112495  1.000000000
## x2.ldl:hdl -0.137813531  0.753133647 -0.494054606 -0.169105368 -0.186734120
## x2.ldl:tch  0.756839790 -0.566519440  0.903244941  0.390172314  0.400845144
## x2.ldl:ltg  0.565295890 -0.310736958  0.597750826  0.761798429  0.394310787
## x2.ldl:glu  0.434658181 -0.268853799  0.476654053  0.316172289  0.880908714
## x2.hdl:tch -0.015078335  0.224748487 -0.200548014 -0.045638434 -0.072109531
## x2.hdl:ltg  0.065681779  0.352794642 -0.191505855  0.004718312 -0.087113250
## x2.hdl:glu  0.006747653  0.226989957 -0.149014023 -0.069990825 -0.081492128
## x2.tch:ltg  0.191621315 -0.450797276  0.534873215  0.557534429  0.332472331
## x2.tch:glu  0.218587735 -0.332708018  0.431243413  0.304949539  0.595923805
## x2.ltg:glu  0.027869664 -0.228441153  0.225890726  0.338988878  0.544766436
##              x2.ldl:hdl   x2.ldl:tch   x2.ldl:ltg   x2.ldl:glu   x2.hdl:tch
## x.age        0.056102655 -0.1032380759 -0.185603635 -0.163159437 -0.061511146
## x.sex        0.039908111  0.0247923945 -0.014421989 -0.037362172  0.012757361
## x.bmi        0.099425808 -0.0188906800 -0.117301802 -0.056180981  0.035950801
## x.map        0.066804235 -0.0508125514 -0.124824429 -0.133848467  0.006363612
## x.tc        -0.073499565  0.1819573865  0.100209570  0.007081838 -0.175730221
```

```
## x.ldl       -0.061277703  0.2370723175  0.139006939  0.069966831 -0.057375804
## x.hdl       -0.170668352 -0.0480007028  0.101644562 -0.031204363 -0.181607351
## x.tch       -0.066159100  0.2390514470  0.006052074  0.068891157 -0.225932093
## x.ltg        0.099969823  0.0043186398 -0.159490449 -0.101296324 -0.089197282
## x.glu       -0.031524921  0.0504963714 -0.104051322 -0.013995275 -0.087393440
## y            0.089468402 -0.0176998200 -0.097206180 -0.016955757 -0.003693633
## x2.age       0.056102655 -0.1032380759 -0.185603635 -0.163159437 -0.061511146
## x2.sex       0.039908111  0.0247923945 -0.014421989 -0.037362172  0.012757361
## x2.bmi       0.099425808 -0.0188906800 -0.117301802 -0.056180981  0.035950801
## x2.map       0.066804235 -0.0508125514 -0.124824429 -0.133848467  0.006363612
## x2.tc       -0.073499565  0.1819573865  0.100209570  0.007081838 -0.175730221
## x2.ldl      -0.061277703  0.2370723175  0.139006939  0.069966831 -0.057375804
## x2.hdl      -0.170668352 -0.0480007028  0.101644562 -0.031204363 -0.181607351
## x2.tch      -0.066159100  0.2390514470  0.006052074  0.068891157 -0.225932093
## x2.ltg       0.099969823  0.0043186398 -0.159490449 -0.101296324 -0.089197282
## x2.glu      -0.031524921  0.0504963714 -0.104051322 -0.013995275 -0.087393440
## x2.age^2     0.018514944  0.0266698050  0.109421985  0.070854601  0.070676304
## x2.bmi^2    -0.006461728  0.0082779625  0.022046095  0.071020019 -0.027389195
## x2.map^2    -0.010388826 -0.0056703307  0.016554514  0.022538600 -0.012257628
## x2.tc^2      0.026590619  0.6135987693  0.590976455  0.382463417  0.021139073
## x2.ldl^2    -0.311485904  0.8350683435  0.436915320  0.420673944 -0.146292689
## x2.hdl^2    -0.285052963  0.0535154124 -0.037144947 -0.025233562 -0.775044342
## x2.tch^2    -0.551270002  0.7105035453  0.338585386  0.304169380 -0.763993168
## x2.ltg^2     0.036686397 -0.0217915235  0.066906983 -0.014279384 -0.170748488
## x2.glu^2    -0.074559031  0.0640669536  0.071663377  0.387958321 -0.091874811
## x2.age:sex -0.014164487 -0.0035554184 -0.071222286 -0.011527464  0.056684787
## x2.age:bmi  0.041643985  0.0045295894  0.037999374  0.068312832  0.046771646
## x2.age:map  0.035162131 -0.0647556402 -0.014233728  0.045469914  0.015593219
## x2.age:tc   0.024802204  0.0643933387  0.203244453  0.128582877  0.082439193
## x2.age:ldl -0.003620113  0.0965375973  0.208216056  0.182275643  0.109531393
## x2.age:hdl -0.014403166  0.0086793959  0.036748095 -0.062883979 -0.021309985
## x2.age:tch  0.000982944  0.0373614526  0.085200157  0.147433094  0.005883798
## x2.age:ltg  0.062940905 -0.0260120569  0.120576729  0.040272064  0.037768988
## x2.age:glu -0.020005196  0.0005293125  0.024529004  0.205550981  0.013757864
## x2.sex:bmi -0.068997984  0.0781597796  0.084726374  0.067901481 -0.140680756
## x2.sex:map -0.034595582  0.0636444445  0.029396425  0.008293900 -0.036215426
## x2.sex:tc  -0.335473772  0.3122104231  0.190248488  0.228021241 -0.083429238
## x2.sex:ldl -0.401215005  0.3642216590  0.184806912  0.258679344 -0.180324985
## x2.sex:hdl  0.112872856 -0.0456731927  0.001086631  0.011876607  0.383754397
## x2.sex:tch -0.261324359  0.2312998148  0.084028520  0.110493417 -0.354356038
## x2.sex:ltg -0.093962061  0.0626596776  0.088015545  0.033155010 -0.142099666
## x2.sex:glu -0.061811778  0.0474932797  0.010176569  0.163092412 -0.036036377
## x2.bmi:map  0.061904283 -0.0470231328  0.030634847  0.043744581  0.032644796
## x2.bmi:tc  -0.288093555  0.4244559927  0.526282367  0.411106276 -0.046467487
## x2.bmi:ldl -0.433585359  0.5030723142  0.572517041  0.463207082 -0.183626005
## x2.bmi:hdl  0.270467647 -0.1170352598 -0.019671952 -0.044468990  0.520994051
## x2.bmi:tch -0.330701415  0.3648488746  0.328221429  0.290765555 -0.453152791
## x2.bmi:ltg -0.050529798  0.1080479060  0.200711245  0.129526179 -0.144344493
## x2.bmi:glu -0.072729335  0.1016958615  0.131927621  0.264538671 -0.091591306
## x2.map:tc  -0.155429169  0.1601529443  0.263238025  0.203939240 -0.021403470
## x2.map:ldl -0.203061681  0.2215962228  0.334232286  0.252250866 -0.030625130
## x2.map:hdl  0.046515392 -0.0381375978 -0.056880631 -0.039288416  0.171584914
## x2.map:tch -0.126542171  0.1390428110  0.185054282  0.150989629 -0.196129047
## x2.map:ltg -0.038565278 -0.0045757715  0.082866547  0.043830221 -0.105393245
```

```
## x2.map:glu -0.014556238 -0.0279431051  0.030726225  0.175417561  0.019958255
## x2.tc:ldl  -0.137813531  0.7568397904  0.565295890  0.434658181 -0.015078335
## x2.tc:hdl   0.753133647 -0.5665194404 -0.310736958 -0.268853799  0.224748487
## x2.tc:tch  -0.494054606  0.9032449409  0.597750826  0.476654053 -0.200548014
## x2.tc:ltg  -0.169105368  0.3901723141  0.761798429  0.316172289 -0.045638434
## x2.tc:glu  -0.186734120  0.4008451443  0.394310787  0.880908714 -0.072109531
## x2.ldl:hdl  1.000000000 -0.6713111148 -0.358453853 -0.289470526  0.587001609
## x2.ldl:tch -0.671311115  1.0000000000  0.566931763  0.489063938 -0.362346493
## x2.ldl:ltg -0.358453853  0.5669317626  1.000000000  0.461276742 -0.112501765
## x2.ldl:glu -0.289470526  0.4890639375  0.461276742  1.000000000 -0.105504956
## x2.hdl:tch  0.587001609 -0.3623464928 -0.112501765 -0.105504956  1.000000000
## x2.hdl:ltg  0.198236904 -0.0741754834 -0.023727167 -0.037161178  0.525731595
## x2.hdl:glu  0.214082609 -0.1197977447 -0.070145017 -0.245175517  0.310620496
## x2.tch:ltg -0.222952005  0.2863676577  0.410268051  0.204348187 -0.476564157
## x2.tch:glu -0.239347153  0.3354308013  0.257948607  0.635333436 -0.318518583
## x2.ltg:glu -0.056753019  0.0631102791  0.122021907  0.274173137 -0.134840368
##               x2.hdl:ltg   x2.hdl:glu   x2.tch:ltg  x2.tch:glu   x2.ltg:glu
## x.age       0.041410778 -0.066475047 -0.094962592 -0.02966657 -0.037115755
## x.sex       0.056212807  0.059771091 -0.001158454 -0.03947284 -0.017227454
## x.bmi      -0.010389584 -0.073292797  0.027950357  0.07818792  0.074269346
## x.map      -0.004010562 -0.017188525  0.023202667 -0.03337507  0.007889208
## x.tc       -0.045935308 -0.114761358  0.137774418  0.10031612 -0.009304091
## x.ldl       0.104295483 -0.032737301  0.005345568  0.06318134 -0.093637122
## x.hdl      -0.086546548 -0.074631518 -0.092367104 -0.09148003 -0.078214167
## x.tch      -0.107302292 -0.104647413  0.288976571  0.22923547  0.107501340
## x.ltg      -0.109716012 -0.088768443  0.200270538  0.10665590  0.081994921
## x.glu      -0.089179764 -0.092023029  0.105512303  0.12193360  0.100842191
## y          -0.014534072 -0.087742007  0.073885451  0.13764820  0.123426555
## x2.age      0.041410778 -0.066475047 -0.094962592 -0.02966657 -0.037115755
## x2.sex      0.056212807  0.059771091 -0.001158454 -0.03947284 -0.017227454
## x2.bmi     -0.010389584 -0.073292797  0.027950357  0.07818792  0.074269346
## x2.map     -0.004010562 -0.017188525  0.023202667 -0.03337507  0.007889208
## x2.tc      -0.045935308 -0.114761358  0.137774418  0.10031612 -0.009304091
## x2.ldl      0.104295483 -0.032737301  0.005345568  0.06318134 -0.093637122
## x2.hdl     -0.086546548 -0.074631518 -0.092367104 -0.09148003 -0.078214167
## x2.tch     -0.107302292 -0.104647413  0.288976571  0.22923547  0.107501340
## x2.ltg     -0.109716012 -0.088768443  0.200270538  0.10665590  0.081994921
## x2.glu     -0.089179764 -0.092023029  0.105512303  0.12193360  0.100842191
## x2.age^2    0.033248064 -0.005894357  0.057200952  0.06371690  0.017918342
## x2.bmi^2   -0.088711309 -0.088425683  0.085416009  0.11694775  0.142117077
## x2.map^2   -0.015381298 -0.021420190  0.031652220  0.04509969  0.116372358
## x2.tc^2     0.121884468  0.032134724  0.232109117  0.19986293  0.064071656
## x2.ldl^2    0.002541878 -0.039276507  0.182215779  0.24231082  0.035067276
## x2.hdl^2   -0.312178687 -0.177053084  0.120551978  0.05979069 -0.018822029
## x2.tch^2   -0.437700902 -0.285500458  0.664308331  0.50390550  0.234426816
## x2.ltg^2   -0.444785208 -0.164856466  0.653626945  0.27179983  0.516973492
## x2.glu^2   -0.144407886 -0.471869179  0.185628976  0.58931729  0.654883045
## x2.age:sex  0.048233146 -0.083436883 -0.050343177  0.06769670  0.005031172
## x2.age:bmi -0.044175887 -0.033628191  0.065419741  0.09701305  0.148132598
## x2.age:map -0.029048465 -0.011611776  0.060674642  0.07264529  0.104494801
## x2.age:tc   0.074727456 -0.012228968  0.082374618  0.10855259  0.093775674
## x2.age:ldl  0.102088093 -0.018730805  0.007838506  0.10110600  0.015254343
## x2.age:hdl  0.148496987  0.180186739 -0.114061331 -0.18325785 -0.149933411
## x2.age:tch -0.084653289 -0.167922075  0.180969153  0.25440547  0.209318090
```

```
## x2.age:ltg -0.073714791 -0.112046260  0.219141770  0.18521691  0.307147788
## x2.age:glu -0.066643804 -0.136737804  0.122071180  0.24146931  0.320350991
## x2.sex:bmi -0.153515604 -0.148533953  0.134106907  0.13687344  0.130887639
## x2.sex:map -0.121757489 -0.100575001  0.094493584  0.09605035  0.124609847
## x2.sex:tc  -0.117811831 -0.085429352  0.170950195  0.17975646  0.100984221
## x2.sex:ldl -0.067946036 -0.065023705  0.087218159  0.13152226  0.008974947
## x2.sex:hdl  0.114609979  0.113860159 -0.034268969 -0.03567909 -0.017494091
## x2.sex:tch -0.153691092 -0.115156951  0.159550997  0.15309272  0.078429718
## x2.sex:ltg -0.249281491 -0.164406828  0.231021353  0.16134987  0.184800859
## x2.sex:glu -0.121246780 -0.347796972  0.099195125  0.31390581  0.246285756
## x2.bmi:map -0.078924634 -0.083769189  0.072853974  0.09486914  0.162951788
## x2.bmi:tc  -0.041245454 -0.049289567  0.308040847  0.29173702  0.254620481
## x2.bmi:ldl -0.034130530 -0.085241728  0.262441649  0.27886892  0.127755553
## x2.bmi:hdl  0.410229403  0.336793588 -0.253013398 -0.23634021 -0.142300893
## x2.bmi:tch -0.357090505 -0.309228084  0.474682388  0.44921669  0.296737770
## x2.bmi:ltg -0.369943114 -0.213342703  0.399034042  0.30210417  0.438444832
## x2.bmi:glu -0.167666843 -0.378165894  0.233003517  0.43868402  0.550850880
## x2.map:tc  -0.035380037 -0.026201392  0.193276126  0.16444339  0.185840719
## x2.map:ldl -0.042841268 -0.044957897  0.133520820  0.13715790  0.066869153
## x2.map:hdl  0.345473605  0.236897569 -0.263200332 -0.17440913 -0.153223884
## x2.map:tch -0.329848887 -0.214109946  0.409726061  0.29313036  0.262698858
## x2.map:ltg -0.241804374 -0.161407237  0.333202359  0.22597926  0.442756406
## x2.map:glu -0.097171475 -0.257589270  0.133684901  0.29227087  0.511638116
## x2.tc:ldl   0.065681779  0.006747653  0.191621315  0.21858773  0.027869664
## x2.tc:hdl   0.352794642  0.226989957 -0.450797276 -0.33270802 -0.228441153
## x2.tc:tch  -0.191505855 -0.149014023  0.534873215  0.43124341  0.225890726
## x2.tc:ltg   0.004718312 -0.069990825  0.557534429  0.30494954  0.338988878
## x2.tc:glu  -0.087113250 -0.081492128  0.332472331  0.59592380  0.544766436
## x2.ldl:hdl  0.198236904  0.214082609 -0.222952005 -0.23934715 -0.056753019
## x2.ldl:tch -0.074175483 -0.119797745  0.286367658  0.33543080  0.063110279
## x2.ldl:ltg -0.023727167 -0.070145017  0.410268051  0.25794861  0.122021907
## x2.ldl:glu -0.037161178 -0.245175517  0.204348187  0.63533344  0.274173137
## x2.hdl:tch  0.525731595  0.310620496 -0.476564157 -0.31851858 -0.134840368
## x2.hdl:ltg  1.000000000  0.369309957 -0.748085062 -0.33867897 -0.302167677
## x2.hdl:glu  0.369309957  1.000000000 -0.330716708 -0.77782380 -0.475539850
## x2.tch:ltg -0.748085062 -0.330716708  1.000000000  0.51410283  0.458498485
## x2.tch:glu -0.338678968 -0.777823804  0.514102829  1.00000000  0.637264658
## x2.ltg:glu -0.302167677 -0.475539850  0.458498485  0.63726466  1.000000000
```

```r
#corrplot::corrplot() # class pairs()
```

```r
# Fit linear regression model using all explanatory variables
lm <- lm(y ~ ., data = train)
summary(lm)
```

```
##
## Call:
## lm(formula = y ~ ., data = train)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -156.786 -32.537  -3.705  31.178 147.425
##
## Coefficients: (10 not defined because of singularities)
##               Estimate Std. Error t value Pr(>|t|)
```

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```
## (Intercept)     153.369        2.721  56.363  < 2e-16 ***
## xage             81.886       71.749   1.141 0.254572
## xsex           -255.777       70.832  -3.611 0.000352 ***
## xbmi            528.146       91.850   5.750 2.01e-08 ***
## xmap            296.011       78.602   3.766 0.000196 ***
## xtc           -7867.184    61448.499  -0.128 0.898203
## xldl           6828.671    54006.646   0.126 0.899458
## xhdl           2713.183    22962.883   0.118 0.906016
## xtch              2.586      293.038   0.009 0.992965
## xltg           3265.869    20200.587   0.162 0.871662
## xglu             41.897       75.496   0.555 0.579296
## x2age               NA           NA      NA       NA
## x2sex               NA           NA      NA       NA
## x2bmi               NA           NA      NA       NA
## x2map               NA           NA      NA       NA
## x2tc                NA           NA      NA       NA
## x2ldl               NA           NA      NA       NA
## x2hdl               NA           NA      NA       NA
## x2tch               NA           NA      NA       NA
## x2ltg               NA           NA      NA       NA
## x2glu               NA           NA      NA       NA
## x2age^2          86.964       73.567   1.182 0.238002
## x2bmi^2          51.874       96.556   0.537 0.591460
## x2map^2         -21.138       77.036  -0.274 0.783951
## x2tc^2         8728.312     7307.897   1.194 0.233179
## x2ldl^2        4242.932     5481.928   0.774 0.439485
## x2hdl^2        2007.250     1668.648   1.203 0.229857
## x2tch^2        1054.392      660.232   1.597 0.111208
## x2ltg^2        1943.703     1762.998   1.102 0.271036
## x2glu^2          84.044      103.716   0.810 0.418330
## x2age:sex        88.860       79.636   1.116 0.265293
## x2age:bmi       -14.171       83.274  -0.170 0.864977
## x2age:map        68.555       81.359   0.843 0.400045
## x2age:tc        165.542      762.600   0.217 0.828282
## x2age:ldl      -348.265      623.173  -0.559 0.576632
## x2age:hdl        79.551      323.223   0.246 0.805741
## x2age:tch       266.402      238.856   1.115 0.265510
## x2age:ltg       -37.693      261.010  -0.144 0.885261
## x2age:glu        49.919       85.922   0.581 0.561646
## x2sex:bmi       129.069       86.972   1.484 0.138742
## x2sex:map        44.093       81.417   0.542 0.588477
## x2sex:tc       -118.910      630.584  -0.189 0.850543
## x2sex:ldl       105.708      507.361   0.208 0.835083
## x2sex:hdl        39.088      291.760   0.134 0.893505
## x2sex:tch      -231.382      225.774  -1.025 0.306179
## x2sex:ltg       166.764      249.533   0.668 0.504400
## x2sex:glu        38.114       79.736   0.478 0.632957
## x2bmi:map       112.403       95.888   1.172 0.241936
## x2bmi:tc       -297.189      714.129  -0.416 0.677562
## x2bmi:ldl       241.309      607.030   0.398 0.691235
## x2bmi:hdl       110.115      352.393   0.312 0.754872
## x2bmi:tch      -146.881      249.354  -0.589 0.556228
## x2bmi:ltg       216.059      279.525   0.773 0.440096
## x2bmi:glu        50.396       95.977   0.525 0.599877
```

```
## x2map:tc       472.216    798.092    0.592 0.554463
## x2map:ldl     -321.780    672.545   -0.478 0.632641
## x2map:hdl     -129.578    354.607   -0.365 0.715033
## x2map:tch       33.840    219.725    0.154 0.877695
## x2map:ltg     -202.866    309.995   -0.654 0.513292
## x2map:glu     -102.594     98.208   -1.045 0.296932
## x2tc:ldl    -11741.507  12135.241   -0.968 0.333965
## x2tc:hdl     -4723.789   3949.564   -1.196 0.232532
## x2tc:tch     -2634.025   1905.098   -1.383 0.167703
## x2tc:ltg     -4274.923  13369.930   -0.320 0.749364
## x2tc:glu      -245.319    633.912   -0.387 0.699007
## x2ldl:hdl     2946.867   3259.390    0.904 0.366583
## x2ldl:tch     1377.567   1575.091    0.875 0.382421
## x2ldl:ltg     2838.100  11127.686    0.255 0.798842
## x2ldl:glu      140.784    534.589    0.263 0.792442
## x2hdl:tch     1497.555   1089.290    1.375 0.170113
## x2hdl:ltg     1656.195   4686.111    0.353 0.723991
## x2hdl:glu      273.629    324.426    0.843 0.399592
## x2tch:ltg      630.922    684.956    0.921 0.357654
## x2tch:glu      265.616    251.806    1.055 0.292259
## x2ltg:glu      109.318    285.646    0.383 0.702181
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 53.82 on 335 degrees of freedom
## Multiple R-squared:  0.5925, Adjusted R-squared:  0.5146
## F-statistic:  7.61 on 64 and 335 DF,  p-value: < 2.2e-16
```

```r
# Make predictions on the training set
pred_train <- predict(lm, train)
```

```
## Warning in predict.lm(lm, train): prediction from rank-deficient fit; attr(*,
## "non-estim") has doubtful cases
```

```r
# Make predictions on the test set
pred_test <- predict(lm, test)
```

```
## Warning in predict.lm(lm, test): prediction from rank-deficient fit; attr(*,
## "non-estim") has doubtful cases
```

```r
# Calculate MSE for the training set
mse_train <- mean((train$y - pred_train)^2)

# Calculate MSE for the test set
mse_test <- mean((test$y - pred_test)^2)
```

- Explanation: Random selection
- Explanation standardized
- Interpret correlation

**Exercise 2**

**Exercise 3**

**Exercise 4**

**Exercise 5**