R Notebook

Contoh 1. Seorang peneliti telah mengumpulkan data tentang tiga variabel psikologis, empat variabel akademik (nilai tes standar) dan jenis kelamin untuk 600 mahasiswa baru. Dia tertarik pada bagaimana himpunan variabel psikologis berhubungan dengan variabel akademik dan gender. Secara khusus, peneliti tertarik pada berapa banyak dimensi (variabel kanonik) yang diperlukan untuk memahami hubungan antara dua set variabel.

Contoh 2. Seorang peneliti tertarik untuk mengeksplorasi hubungan antar faktor dari dua tes kepribadian multidimensi, MMPI dan NEO. Dia tertarik pada dimensi apa yang umum di antara tes dan berapa banyak varians yang dibagi di antara keduanya. Dia secara khusus tertarik untuk menemukan apakah dimensi neurotisme dari NEO dapat menjelaskan sejumlah besar varian bersama antara kedua tes tersebut.

require(ggplot2)

## Loading required package: ggplot2

require(GGally)

## Loading required package: GGally

## Warning: package 'GGally' was built under R version 4.2.2

## Registered S3 method overwritten by 'GGally':  
## method from   
## +.gg ggplot2

require(CCA)

## Loading required package: CCA

## Warning: package 'CCA' was built under R version 4.2.2

## Loading required package: fda

## Warning: package 'fda' was built under R version 4.2.2

## Loading required package: splines

## Loading required package: fds

## Warning: package 'fds' was built under R version 4.2.2

## Loading required package: rainbow

## Warning: package 'rainbow' was built under R version 4.2.2

## Loading required package: MASS

## Loading required package: pcaPP

## Loading required package: RCurl

## Loading required package: deSolve

##   
## Attaching package: 'fda'

## The following object is masked from 'package:graphics':  
##   
## matplot

## Loading required package: fields

## Warning: package 'fields' was built under R version 4.2.2

## Loading required package: spam

## Warning: package 'spam' was built under R version 4.2.2

## Spam version 2.9-1 (2022-08-07) is loaded.  
## Type 'help( Spam)' or 'demo( spam)' for a short introduction   
## and overview of this package.  
## Help for individual functions is also obtained by adding the  
## suffix '.spam' to the function name, e.g. 'help( chol.spam)'.

##   
## Attaching package: 'spam'

## The following objects are masked from 'package:base':  
##   
## backsolve, forwardsolve

## Loading required package: viridis

## Warning: package 'viridis' was built under R version 4.2.2

## Loading required package: viridisLite

##   
## Try help(fields) to get started.

require(CCP)

## Loading required package: CCP

mm <- read.csv("https://stats.idre.ucla.edu/stat/data/mmreg.csv")  
colnames(mm) <- c("Control", "Concept", "Motivation", "Read","Write", "Math", "Science", "Sex")  
summary(mm)

## Control Concept Motivation Read   
## Min. :-2.23000 Min. :-2.620000 Min. :0.0000 Min. :28.3   
## 1st Qu.:-0.37250 1st Qu.:-0.300000 1st Qu.:0.3300 1st Qu.:44.2   
## Median : 0.21000 Median : 0.030000 Median :0.6700 Median :52.1   
## Mean : 0.09653 Mean : 0.004917 Mean :0.6608 Mean :51.9   
## 3rd Qu.: 0.51000 3rd Qu.: 0.440000 3rd Qu.:1.0000 3rd Qu.:60.1   
## Max. : 1.36000 Max. : 1.190000 Max. :1.0000 Max. :76.0   
## Write Math Science Sex   
## Min. :25.50 Min. :31.80 Min. :26.00 Min. :0.000   
## 1st Qu.:44.30 1st Qu.:44.50 1st Qu.:44.40 1st Qu.:0.000   
## Median :54.10 Median :51.30 Median :52.60 Median :1.000   
## Mean :52.38 Mean :51.85 Mean :51.76 Mean :0.545   
## 3rd Qu.:59.90 3rd Qu.:58.38 3rd Qu.:58.65 3rd Qu.:1.000   
## Max. :67.10 Max. :75.50 Max. :74.20 Max. :1.000

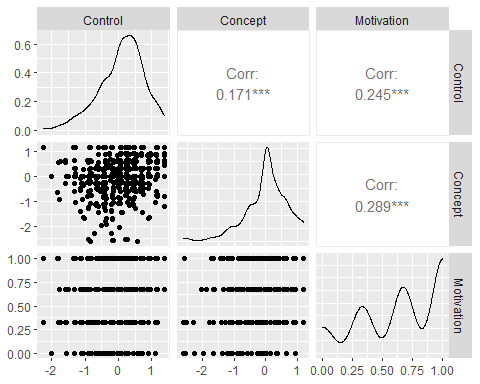
mm

## Control Concept Motivation Read Write Math Science Sex  
## 1 -0.84 -0.24 1.00 54.8 64.5 44.5 52.6 1  
## 2 -0.38 -0.47 0.67 62.7 43.7 44.7 52.6 1  
## 3 0.89 0.59 0.67 60.6 56.7 70.5 58.0 0  
## 4 0.71 0.28 0.67 62.7 56.7 54.7 58.0 0  
## 5 -0.64 0.03 1.00 41.6 46.3 38.4 36.3 1  
## 6 1.11 0.90 0.33 62.7 64.5 61.4 58.0 1  
## 7 0.06 0.03 0.67 41.6 39.1 56.3 45.0 0  
## 8 -0.91 -0.59 0.67 44.2 39.1 46.3 36.3 0  
## 9 0.45 0.03 1.00 62.7 51.5 54.4 49.8 1  
## 10 0.00 0.03 0.67 62.7 64.5 38.3 55.8 1  
## 11 0.24 -0.43 0.33 70.7 43.7 58.8 66.1 0  
## 12 -1.09 -0.26 0.33 44.2 41.1 45.1 47.1 0  
## 13 0.46 0.03 0.67 57.4 59.3 53.9 49.8 1  
## 14 0.68 0.06 0.67 49.5 51.5 41.2 41.7 1  
## 15 -0.14 -1.05 1.00 70.7 65.1 66.4 63.4 1  
## 16 0.10 -0.16 0.33 49.5 59.3 51.0 47.1 0  
## 17 0.45 0.65 1.00 57.4 56.7 46.9 52.6 1  
## 18 -1.56 0.03 0.33 62.7 54.1 53.0 55.3 1  
## 19 -1.02 -1.67 0.67 45.3 43.0 52.3 60.7 1  
## 20 0.94 0.03 1.00 68.0 56.7 59.6 58.0 1  
## 21 -0.40 0.03 1.00 44.2 54.1 59.3 58.0 1  
## 22 -0.19 -1.73 1.00 44.7 47.6 50.3 39.0 1  
## 23 0.26 0.03 0.33 48.4 48.9 52.2 43.9 0  
## 24 0.21 0.94 0.00 38.9 48.9 41.8 58.5 0  
## 25 0.70 0.87 1.00 46.9 54.1 46.4 49.8 1  
## 26 1.36 0.94 1.00 57.4 64.5 49.9 55.3 1  
## 27 -0.84 -0.57 0.33 33.6 33.3 41.0 36.3 0  
## 28 -0.68 0.03 0.33 38.9 38.5 41.2 39.0 1  
## 29 -0.17 0.31 1.00 65.4 67.1 75.5 71.5 0  
## 30 0.06 0.28 1.00 60.1 59.3 56.2 60.7 1  
## 31 -0.14 0.56 1.00 54.8 61.9 54.6 47.1 1  
## 32 0.96 0.03 0.67 44.2 51.5 43.2 44.4 1  
## 33 0.23 -0.26 0.00 52.1 61.9 56.3 58.0 1  
## 34 0.66 0.00 1.00 52.1 48.9 48.5 44.4 1  
## 35 0.08 0.59 1.00 57.4 56.7 53.9 60.7 1  
## 36 -0.90 0.03 0.67 36.3 44.3 36.1 33.6 1  
## 37 0.06 0.03 0.67 62.7 61.9 58.8 60.7 1  
## 38 0.04 -0.47 0.67 33.6 59.3 44.7 47.1 1  
## 39 0.66 0.34 1.00 60.1 51.5 53.0 63.4 0  
## 40 0.46 0.03 1.00 57.4 67.1 47.7 55.8 1  
## 41 -0.14 -0.24 0.67 54.8 38.5 57.0 52.6 0  
## 42 0.26 -0.57 1.00 41.6 58.6 54.6 55.3 1  
## 43 0.02 -0.14 0.00 60.1 64.5 67.0 58.5 1  
## 44 1.11 0.34 1.00 65.4 64.5 64.1 66.1 0  
## 45 1.16 -0.81 0.67 65.4 64.5 48.0 63.4 0  
## 46 -0.40 0.65 0.67 44.2 43.7 38.6 33.6 0  
## 47 -0.38 0.34 0.67 38.9 28.1 35.3 39.0 0  
## 48 1.13 0.03 1.00 38.9 54.1 47.5 49.8 0  
## 49 0.08 0.94 0.33 49.5 52.8 50.6 48.8 0  
## 50 0.06 0.94 1.00 52.1 51.5 57.9 60.7 0  
## 51 -0.64 -0.51 0.67 49.5 56.7 47.7 44.4 1  
## 52 0.46 0.03 1.00 70.7 56.7 51.3 71.5 0  
## 53 -1.13 -0.55 0.33 44.2 46.9 45.5 39.0 0  
## 54 -1.05 -1.65 0.00 46.9 46.3 38.6 47.1 1  
## 55 -0.84 0.03 0.00 36.3 59.3 47.7 39.0 1  
## 56 0.06 0.65 0.33 47.4 64.5 53.9 55.8 1  
## 57 -1.30 0.13 0.33 44.2 41.1 51.8 47.1 0  
## 58 0.91 -0.47 0.67 44.2 41.1 50.5 58.0 0  
## 59 0.28 0.03 1.00 54.8 59.3 49.5 63.4 0  
## 60 -0.40 0.03 0.00 54.8 49.5 55.3 47.1 1  
## 61 -0.86 0.28 1.00 36.3 48.9 54.4 60.7 0  
## 62 0.46 0.94 1.00 65.4 61.9 67.9 66.1 0  
## 63 0.50 -0.22 1.00 54.8 61.9 61.3 60.7 1  
## 64 0.27 -1.05 0.33 60.1 54.1 56.3 55.3 0  
## 65 -0.86 1.19 0.33 33.6 28.1 31.8 39.6 0  
## 66 -0.89 0.56 0.33 44.2 41.1 40.3 49.8 0  
## 67 -1.28 1.19 1.00 41.6 41.1 45.9 44.4 0  
## 68 1.36 0.87 1.00 36.3 43.7 37.2 41.7 1  
## 69 0.46 0.65 1.00 49.5 48.9 60.5 55.3 0  
## 70 0.25 -0.26 0.33 49.5 30.7 40.3 33.6 0  
## 71 0.23 0.03 1.00 62.7 61.9 55.5 55.3 1  
## 72 -1.33 -0.60 0.33 34.7 35.2 40.2 50.9 1  
## 73 0.32 -1.17 0.33 52.1 54.1 58.1 47.1 1  
## 74 -0.44 -0.31 0.67 49.5 59.3 42.1 52.6 0  
## 75 0.25 0.65 0.00 49.5 48.9 50.4 63.4 0  
## 76 -0.37 -1.90 0.67 54.8 36.5 37.7 49.8 0  
## 77 0.06 1.19 1.00 65.4 64.5 67.9 63.4 0  
## 78 -0.60 0.32 1.00 38.9 56.7 41.2 33.6 1  
## 79 0.71 0.03 0.33 46.9 59.3 63.0 52.6 0  
## 80 -1.78 0.56 1.00 28.3 46.3 42.8 44.4 1  
## 81 0.04 0.03 0.67 65.4 51.5 61.2 68.8 0  
## 82 0.66 -0.60 0.00 42.6 56.7 40.3 49.8 1  
## 83 -1.09 -0.90 0.67 57.4 59.9 50.5 52.6 1  
## 84 0.06 0.03 1.00 62.7 64.5 71.3 55.3 0  
## 85 -0.66 -0.08 1.00 44.7 33.3 33.7 39.0 0  
## 86 0.71 1.19 0.67 54.8 48.9 52.4 58.0 0  
## 87 0.75 1.19 1.00 68.0 61.9 52.2 60.7 0  
## 88 0.06 -0.60 0.67 62.7 56.0 57.3 60.7 1  
## 89 0.43 -1.09 0.67 63.3 64.5 52.1 58.0 1  
## 90 0.30 0.56 1.00 44.2 33.3 37.7 30.9 0  
## 91 0.26 0.94 0.00 54.8 38.5 46.8 36.3 1  
## 92 0.46 -0.30 1.00 53.2 60.6 61.2 56.9 0  
## 93 -0.90 -2.54 0.00 44.2 43.7 40.2 39.6 1  
## 94 -0.19 -0.73 0.67 73.3 60.6 64.7 66.1 0  
## 95 0.45 0.56 1.00 52.1 43.7 41.9 47.1 1  
## 96 0.30 -0.60 1.00 49.5 59.3 53.1 60.7 1  
## 97 -1.78 0.56 0.33 37.3 43.7 45.4 39.0 0  
## 98 0.91 0.59 1.00 65.4 67.1 67.1 66.1 0  
## 99 -0.60 -0.47 0.67 46.9 54.1 49.0 52.6 1  
## 100 0.68 0.03 0.00 44.2 35.9 43.6 47.1 1  
## 101 0.06 -1.07 0.00 38.9 48.9 45.2 44.4 1  
## 102 0.00 0.34 0.33 46.9 59.3 53.7 58.0 1  
## 103 0.46 0.03 1.00 60.1 64.5 56.3 63.4 1  
## 104 -0.63 0.44 0.33 41.6 43.7 46.8 36.3 1  
## 105 -0.40 -0.26 0.33 52.1 54.1 55.3 52.6 1  
## 106 0.44 0.03 1.00 55.3 51.5 48.0 58.0 1  
## 107 0.91 0.65 0.33 54.8 48.9 41.9 52.6 1  
## 108 -1.15 -0.47 0.67 44.2 56.7 52.2 44.4 1  
## 109 -0.03 0.63 0.67 52.1 54.1 48.2 55.3 0  
## 110 -0.40 -0.47 1.00 54.8 59.3 51.8 41.7 1  
## 111 0.02 0.13 0.33 73.3 59.9 70.5 60.7 0  
## 112 1.36 0.44 0.67 70.7 58.0 65.4 63.4 0  
## 113 -0.14 0.13 0.67 41.6 56.7 51.3 47.1 1  
## 114 -0.17 -0.84 0.67 62.7 56.7 54.3 58.0 0  
## 115 0.93 -1.63 0.67 38.9 41.1 40.3 34.1 0  
## 116 -1.99 0.03 0.00 39.4 54.1 38.7 47.1 1  
## 117 0.31 1.19 1.00 40.5 46.9 40.4 39.0 1  
## 118 0.71 0.03 1.00 54.8 61.2 53.7 48.8 0  
## 119 0.52 0.34 1.00 65.4 54.1 61.4 58.0 1  
## 120 0.42 0.56 0.67 70.7 56.0 62.0 67.7 0  
## 121 -1.74 0.61 0.33 45.8 34.6 37.9 39.0 0  
## 122 0.06 0.03 1.00 41.6 46.3 46.2 39.0 1  
## 123 1.13 0.87 1.00 57.4 54.7 51.7 49.8 0  
## 124 0.75 1.19 1.00 60.1 61.9 67.1 49.8 1  
## 125 1.16 1.19 1.00 70.7 64.5 72.2 66.1 1  
## 126 0.46 0.63 0.67 46.9 52.8 49.3 53.1 0  
## 127 -0.45 -0.60 0.67 52.1 59.9 49.5 48.8 0  
## 128 -1.50 0.03 0.67 33.6 48.9 38.6 42.3 0  
## 129 0.71 0.34 0.00 62.7 64.5 57.4 60.7 1  
## 130 0.46 -0.55 0.33 41.6 54.1 50.3 49.8 1  
## 131 0.71 1.19 0.33 54.8 59.3 62.5 68.8 0  
## 132 1.36 1.19 1.00 65.4 48.9 66.3 58.0 0  
## 133 0.30 0.03 0.67 36.8 59.3 40.7 49.8 1  
## 134 0.93 0.65 1.00 62.7 59.3 71.3 68.8 1  
## 135 0.55 0.90 1.00 62.7 61.9 59.6 60.7 1  
## 136 0.27 0.03 0.67 57.4 41.1 57.0 55.3 1  
## 137 0.44 -0.16 0.67 62.7 48.9 48.8 66.1 0  
## 138 -1.34 1.19 1.00 44.2 41.1 44.2 44.4 1  
## 139 0.06 0.94 0.67 45.3 54.7 44.3 33.6 1  
## 140 0.26 0.03 1.00 60.1 64.5 55.7 63.4 1  
## 141 -1.33 0.65 0.00 40.5 38.5 47.1 44.4 0  
## 142 -1.10 -0.28 0.67 38.9 41.1 45.9 47.1 1  
## 143 0.96 0.63 1.00 65.4 64.5 70.3 66.1 0  
## 144 0.06 0.90 0.67 38.9 52.8 54.4 49.8 1  
## 145 0.46 0.03 0.00 73.3 61.9 73.1 68.8 0  
## 146 0.68 0.03 0.67 71.2 63.2 60.2 65.5 0  
## 147 0.68 0.32 1.00 36.3 56.7 41.9 49.8 1  
## 148 -0.44 -1.13 1.00 54.8 61.9 69.6 60.7 1  
## 149 0.55 -0.60 1.00 54.8 54.1 51.3 41.7 1  
## 150 -0.33 0.38 0.67 62.7 59.3 56.5 55.3 0  
## 151 0.50 0.03 0.67 68.0 59.3 58.8 66.1 1  
## 152 1.11 -0.09 0.00 44.2 48.9 48.0 49.8 0  
## 153 -0.43 0.03 1.00 52.1 44.3 53.1 58.0 0  
## 154 0.00 -0.42 0.67 49.5 51.5 52.9 39.0 1  
## 155 0.71 0.34 0.67 68.0 61.9 64.5 68.8 1  
## 156 0.00 -1.09 0.67 62.7 51.5 45.9 47.1 1  
## 157 0.91 -0.28 1.00 60.1 67.1 56.2 37.4 1  
## 158 0.06 0.03 1.00 41.6 54.1 41.2 41.7 1  
## 159 -0.59 0.03 0.33 33.6 54.1 41.0 41.7 1  
## 160 0.69 0.34 1.00 52.1 56.7 53.4 60.7 1  
## 161 0.68 0.03 1.00 65.4 64.5 51.3 66.1 0  
## 162 -0.82 0.63 1.00 36.8 36.5 41.5 33.1 0  
## 163 -0.66 -0.47 1.00 52.7 41.1 40.2 58.0 0  
## 164 0.03 0.32 1.00 44.7 56.7 50.3 30.9 0  
## 165 0.71 -0.29 0.67 57.4 61.9 55.5 58.0 1  
## 166 0.47 -0.09 0.33 33.6 33.9 38.8 39.6 1  
## 167 -1.10 0.03 1.00 38.9 38.5 42.8 41.7 0  
## 168 -0.40 -0.76 0.67 52.1 35.9 50.3 47.1 0  
## 169 0.23 0.44 1.00 49.5 51.5 45.5 49.8 1  
## 170 0.68 -0.47 0.33 46.9 61.9 60.5 68.8 0  
## 171 1.36 0.59 1.00 62.7 67.1 69.6 68.8 0  
## 172 -0.21 -1.38 0.00 34.2 46.3 44.5 39.0 0  
## 173 0.06 0.56 0.33 46.9 41.1 45.3 47.1 0  
## 174 0.91 -1.67 0.33 57.4 54.1 54.8 60.7 1  
## 175 -0.40 0.88 0.33 54.8 45.0 45.9 58.0 0  
## 176 0.29 0.39 0.33 41.6 33.3 37.6 28.2 0  
## 177 -0.39 1.19 1.00 40.5 59.3 41.9 33.6 1  
## 178 0.30 -0.59 1.00 54.8 46.3 45.5 58.0 0  
## 179 0.31 0.63 1.00 38.9 56.7 46.3 58.0 1  
## 180 0.69 0.03 0.67 49.5 39.8 38.6 49.3 0  
## 181 0.52 -0.28 0.67 38.9 41.7 33.7 30.9 1  
## 182 -0.38 0.03 0.00 52.1 43.7 49.4 55.3 0  
## 183 0.10 1.19 1.00 52.1 56.7 62.3 66.1 1  
## 184 0.10 0.03 0.33 49.5 56.7 48.0 47.1 1  
## 185 -0.42 -0.60 1.00 54.8 56.7 64.7 58.0 0  
## 186 0.33 -0.26 1.00 52.1 67.1 57.0 63.4 1  
## 187 0.06 -0.59 0.00 44.2 41.1 59.8 44.4 0  
## 188 1.14 1.19 1.00 65.9 67.1 67.1 60.7 1  
## 189 0.46 0.03 0.67 52.1 56.7 53.0 47.1 1  
## 190 0.46 0.34 0.67 62.2 56.7 51.9 54.7 0  
## 191 0.68 0.94 1.00 62.7 52.1 66.1 68.8 0  
## 192 0.10 0.56 0.67 54.8 61.9 60.4 55.3 0  
## 193 0.05 0.15 1.00 44.2 49.5 40.5 39.0 1  
## 194 0.00 0.65 1.00 68.0 64.5 58.3 58.5 1  
## 195 -0.60 0.34 0.00 49.5 41.7 50.3 36.3 0  
## 196 -1.57 0.65 0.33 52.1 56.7 45.2 55.3 0  
## 197 1.36 0.94 1.00 52.1 48.9 51.3 41.7 1  
## 198 0.00 0.65 0.67 46.9 33.3 50.4 47.1 0  
## 199 -0.93 -0.80 0.33 52.1 51.5 49.5 55.3 0  
## 200 0.32 0.90 0.67 52.1 59.3 58.1 47.1 1  
## 201 0.26 0.03 1.00 57.4 51.5 55.3 60.7 0  
## 202 0.20 -0.47 0.67 56.4 49.5 51.9 47.1 0  
## 203 0.23 0.15 0.33 49.5 51.5 48.0 52.6 0  
## 204 -0.16 0.65 1.00 68.0 61.9 69.7 71.5 0  
## 205 -0.61 0.36 0.00 44.2 48.9 46.1 47.1 1  
## 206 0.66 0.34 0.67 54.8 56.7 61.9 63.4 1  
## 207 0.46 0.03 0.67 54.8 54.7 56.9 58.0 0  
## 208 0.29 0.03 1.00 49.5 48.9 56.2 47.1 1  
## 209 -0.66 -1.07 0.67 49.5 61.9 60.4 47.1 1  
## 210 0.26 1.19 1.00 52.1 52.8 37.6 52.6 0  
## 211 0.44 -0.47 0.33 62.7 64.5 48.0 63.4 0  
## 212 -0.19 -0.85 0.00 54.8 60.6 55.5 58.0 1  
## 213 0.52 0.65 0.33 54.3 62.5 56.6 54.7 0  
## 214 0.91 0.34 1.00 52.1 54.1 58.1 55.8 0  
## 215 0.06 0.32 0.67 49.5 43.7 55.5 68.8 0  
## 216 -1.55 0.03 0.00 36.3 41.1 43.5 33.6 0  
## 217 0.42 -0.47 0.33 73.3 61.2 57.4 54.7 1  
## 218 0.67 0.03 0.67 52.1 56.7 51.1 55.3 1  
## 219 0.06 0.59 1.00 52.1 51.5 45.4 39.0 1  
## 220 -0.16 0.03 0.33 44.2 59.3 49.5 55.3 0  
## 221 0.49 1.19 1.00 46.9 51.5 50.6 49.8 0  
## 222 -0.80 0.15 0.33 41.6 41.1 39.5 47.1 1  
## 223 -0.47 0.28 1.00 65.4 61.9 47.1 60.7 1  
## 224 0.46 0.03 1.00 41.6 64.5 47.1 53.1 1  
## 225 -0.34 0.59 1.00 38.9 33.9 35.1 44.4 1  
## 226 0.10 1.19 1.00 38.9 35.9 46.8 39.0 1  
## 227 0.52 -0.59 0.67 41.6 59.3 38.6 36.3 1  
## 228 0.23 0.03 1.00 52.1 59.3 52.9 60.7 1  
## 229 0.49 0.94 1.00 49.5 39.8 44.5 55.3 0  
## 230 0.08 0.03 1.00 54.8 67.1 47.4 49.8 1  
## 231 0.48 0.69 0.67 62.7 43.0 58.9 65.0 0  
## 232 0.57 -2.62 0.00 38.9 28.1 38.4 44.4 1  
## 233 -0.38 0.37 0.67 44.2 43.7 46.1 47.1 1  
## 234 1.11 -1.05 0.33 70.7 67.1 63.0 63.4 1  
## 235 -0.04 -0.29 0.67 41.6 38.5 40.2 33.6 1  
## 236 0.46 0.59 1.00 52.1 62.5 53.6 56.3 1  
## 237 -0.83 1.19 0.67 38.9 38.5 44.4 26.0 0  
## 238 0.00 0.34 1.00 62.7 59.9 65.4 53.6 1  
## 239 0.28 0.32 1.00 52.1 54.1 56.5 55.3 0  
## 240 -0.22 -1.34 0.67 46.9 31.3 43.6 36.3 0  
## 241 0.00 -0.18 0.00 62.7 59.3 55.5 45.5 1  
## 242 -0.44 -0.55 0.33 46.9 38.5 47.1 41.7 0  
## 243 0.26 0.88 1.00 65.4 59.3 62.3 60.7 0  
## 244 0.46 -0.47 0.00 49.5 61.9 41.4 55.3 1  
## 245 1.16 1.19 0.33 55.3 46.9 49.1 54.2 0  
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## 247 0.93 0.03 1.00 65.9 67.1 70.5 52.6 1  
## 248 1.16 -0.72 0.67 56.9 64.5 72.2 54.2 1  
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## 250 0.89 0.32 0.67 46.9 44.3 48.7 53.1 0  
## 251 0.91 0.03 1.00 57.4 59.3 55.5 55.3 1  
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## 253 0.46 0.03 0.00 49.5 46.3 46.2 41.7 0  
## 254 -0.22 0.32 0.33 35.2 38.5 39.9 34.7 1  
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## 256 0.73 -1.42 0.33 38.9 41.1 41.0 36.3 1  
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## 259 0.93 0.34 1.00 46.9 54.1 54.6 55.3 0  
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## 261 -0.49 0.03 0.00 46.9 37.2 42.8 41.7 1  
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## 263 -0.59 0.28 1.00 46.9 51.5 48.5 49.8 1  
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## 265 -0.23 0.69 0.67 46.9 61.9 48.0 39.0 1  
## 266 0.45 0.03 0.67 60.1 61.9 51.9 53.1 1  
## 267 0.28 -0.06 0.33 44.2 30.7 35.3 47.1 0  
## 268 -0.49 0.03 0.33 65.4 59.3 56.8 66.1 0  
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## 272 0.48 -0.47 0.33 52.1 61.9 55.5 60.7 1  
## 273 -0.39 -0.28 0.67 44.2 51.5 51.1 63.4 0  
## 274 -0.43 0.13 0.33 38.9 44.3 51.6 43.9 1  
## 275 0.75 -0.72 0.67 42.6 46.3 41.2 28.2 1  
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## 298 0.49 0.44 0.67 53.7 43.7 51.1 52.0 0  
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## 537 -0.45 -0.64 0.33 65.4 56.7 55.2 52.6 0  
## 538 -0.19 1.19 1.00 60.1 61.9 54.6 60.7 1  
## 539 -1.33 0.03 1.00 36.3 28.1 53.7 33.6 0  
## 540 -0.38 0.03 1.00 38.9 41.7 37.7 44.4 0  
## 541 0.45 0.03 1.00 49.5 46.3 52.9 52.6 1  
## 542 0.06 0.03 0.00 38.9 41.1 32.7 41.7 1  
## 543 -0.18 0.28 0.33 44.2 51.5 46.1 47.1 1  
## 544 0.66 0.34 0.33 33.6 38.5 42.9 47.1 0  
## 545 0.71 0.03 0.33 46.9 46.9 41.0 41.7 0  
## 546 0.06 0.03 0.67 46.9 60.6 51.3 63.4 1  
## 547 0.23 -0.60 1.00 57.4 67.1 68.0 59.1 1  
## 548 -0.24 0.03 0.67 45.8 54.1 49.5 47.1 1  
## 549 1.11 0.90 0.33 55.3 50.2 41.7 58.5 1  
## 550 0.68 0.88 1.00 46.9 61.9 53.0 52.6 1  
## 551 0.66 0.34 1.00 56.9 49.5 49.5 50.9 1  
## 552 1.16 0.65 1.00 65.4 67.1 63.1 55.3 1  
## 553 -0.44 -0.47 1.00 54.8 65.1 66.1 49.8 1  
## 554 -0.14 -0.60 0.33 44.2 48.9 54.3 49.8 1  
## 555 0.46 0.56 0.67 44.2 54.1 52.2 44.4 1  
## 556 -0.68 -0.26 0.00 60.1 51.5 56.8 60.7 0  
## 557 0.46 0.34 1.00 76.0 52.1 64.1 63.9 0  
## 558 0.46 -0.47 0.67 50.0 41.1 45.1 44.4 1  
## 559 -0.41 0.03 0.67 49.5 51.5 45.1 58.0 1  
## 560 -0.60 -0.26 0.67 49.5 41.1 38.4 52.6 1  
## 561 -0.51 -1.98 0.00 60.1 57.3 58.8 58.0 0  
## 562 1.13 -0.60 0.67 73.3 67.1 71.3 63.4 0  
## 563 1.13 0.88 0.33 49.5 51.5 52.7 55.3 1  
## 564 0.89 0.65 0.67 68.0 48.9 56.3 63.4 1  
## 565 0.06 0.03 1.00 43.2 47.6 45.6 47.1 1  
## 566 -0.60 -1.43 1.00 38.9 51.5 38.6 39.0 0  
## 567 0.46 -1.17 0.00 68.0 62.5 65.4 60.7 1  
## 568 0.06 0.03 0.67 46.9 56.7 56.1 60.7 0  
## 569 0.26 -0.26 0.00 49.5 56.7 43.8 47.1 1  
## 570 0.05 -0.60 0.00 57.4 51.5 40.6 46.6 0  
## 571 0.47 0.03 0.67 62.7 59.3 48.8 55.3 0  
## 572 -0.03 -0.16 0.00 33.6 43.7 42.6 47.1 0  
## 573 0.20 -0.55 0.67 60.1 61.9 48.7 49.8 1  
## 574 -0.14 0.34 0.33 49.5 46.3 44.8 58.0 0  
## 575 -0.41 0.34 0.67 52.1 38.5 57.9 52.6 0  
## 576 -0.44 -0.22 0.00 44.2 33.3 40.9 47.1 0  
## 577 0.28 0.03 0.67 62.7 67.1 65.6 61.8 1  
## 578 -1.30 0.03 1.00 54.8 41.1 40.2 44.4 0  
## 579 -0.16 0.03 1.00 57.4 57.3 64.0 58.0 1  
## 580 0.46 -1.17 0.33 46.9 30.7 40.3 58.0 0  
## 581 0.71 -0.06 0.67 44.2 37.8 49.2 39.0 0  
## 582 0.20 -0.47 0.33 38.9 54.1 53.7 52.6 1  
## 583 -0.84 -1.09 0.33 41.6 41.7 45.1 36.3 0  
## 584 0.22 0.32 1.00 49.5 56.7 62.8 49.8 0  
## 585 0.47 0.01 1.00 68.0 64.5 61.5 55.3 0  
## 586 -0.82 -0.76 0.00 57.4 43.7 59.6 52.6 0  
## 587 -2.23 1.19 1.00 36.3 38.5 39.3 39.0 0  
## 588 0.09 -1.42 0.33 52.1 61.9 59.6 58.0 0  
## 589 0.10 0.32 0.67 40.0 40.4 42.4 48.8 1  
## 590 0.08 0.94 0.67 73.3 61.9 60.5 71.5 0  
## 591 0.06 0.03 1.00 54.8 59.3 46.2 47.1 1  
## 592 0.03 0.56 0.67 65.4 67.1 63.0 66.1 0  
## 593 -0.61 0.03 0.33 44.2 54.1 40.3 52.6 1  
## 594 0.02 0.03 0.33 62.7 54.1 64.7 58.0 0  
## 595 0.46 0.03 1.00 52.1 56.7 62.8 47.1 1  
## 596 0.94 -0.30 1.00 60.1 67.1 52.4 55.3 1  
## 597 0.23 0.03 1.00 65.4 56.7 65.4 58.0 1  
## 598 0.46 0.03 1.00 65.4 51.5 61.4 60.7 1  
## 599 0.51 0.03 1.00 54.8 54.1 66.4 41.7 1  
## 600 0.25 0.03 0.67 49.5 51.5 55.5 44.4 1

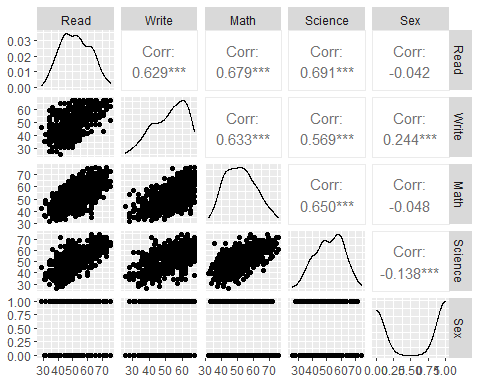
xtabs(~Sex, data = mm)

## Sex  
## 0 1   
## 273 327

psych <- mm[, 1:3]  
acad <- mm[, 4:8]  
  
ggpairs(psych)



ggpairs(acad)



matcor(psych, acad)

## $Xcor  
## Control Concept Motivation  
## Control 1.0000000 0.1711878 0.2451323  
## Concept 0.1711878 1.0000000 0.2885707  
## Motivation 0.2451323 0.2885707 1.0000000  
##   
## $Ycor  
## Read Write Math Science Sex  
## Read 1.00000000 0.6285909 0.6792757 0.6906929 -0.04174278  
## Write 0.62859089 1.0000000 0.6326664 0.5691498 0.24433183  
## Math 0.67927568 0.6326664 1.0000000 0.6495261 -0.04821830  
## Science 0.69069291 0.5691498 0.6495261 1.0000000 -0.13818587  
## Sex -0.04174278 0.2443318 -0.0482183 -0.1381859 1.00000000  
##   
## $XYcor  
## Control Concept Motivation Read Write Math  
## Control 1.0000000 0.17118778 0.24513227 0.37356505 0.35887684 0.3372690  
## Concept 0.1711878 1.00000000 0.28857075 0.06065584 0.01944856 0.0535977  
## Motivation 0.2451323 0.28857075 1.00000000 0.21060992 0.25424818 0.1950135  
## Read 0.3735650 0.06065584 0.21060992 1.00000000 0.62859089 0.6792757  
## Write 0.3588768 0.01944856 0.25424818 0.62859089 1.00000000 0.6326664  
## Math 0.3372690 0.05359770 0.19501347 0.67927568 0.63266640 1.0000000  
## Science 0.3246269 0.06982633 0.11566948 0.69069291 0.56914983 0.6495261  
## Sex 0.1134108 -0.12595132 0.09810277 -0.04174278 0.24433183 -0.0482183  
## Science Sex  
## Control 0.32462694 0.11341075  
## Concept 0.06982633 -0.12595132  
## Motivation 0.11566948 0.09810277  
## Read 0.69069291 -0.04174278  
## Write 0.56914983 0.24433183  
## Math 0.64952612 -0.04821830  
## Science 1.00000000 -0.13818587  
## Sex -0.13818587 1.00000000

cc1 <- cc(psych, acad)  
# display the canonical correlations  
cc1$cor

## [1] 0.4640861 0.1675092 0.1039911

dua dari tiga dimensi kanonik secara statistik signifikan pada tingkat 0,05. Dimensi 1 memiliki kanonik korelasi 0,46 antara set variabel, sedangkan untuk dimensi 2 korelasi kanonik jauh lebih rendah pada 0,17.

# raw canonical coefficients  
cc1[3:4]

## $xcoef  
## [,1] [,2] [,3]  
## Control -1.2538339 -0.6214776 -0.6616896  
## Concept 0.3513499 -1.1876866 0.8267210  
## Motivation -1.2624204 2.0272641 2.0002283  
##   
## $ycoef  
## [,1] [,2] [,3]  
## Read -0.044620600 -0.004910024 0.021380576  
## Write -0.035877112 0.042071478 0.091307329  
## Math -0.023417185 0.004229478 0.009398182  
## Science -0.005025152 -0.085162184 -0.109835014  
## Sex -0.632119234 1.084642326 -1.794647036

Peningkatan satu unit dalam read menyebabkan penurunan sebesar 0,0446 dalam variat kanonik pertama dari himpunan 2 ketika variabel lainnya dipertahankan konstan. Menjadi perempuan mengarah pada penurunan 0,6321 dalam dimensi 1 untuk kumpulan akademik dengan prediktor lain dianggap konstan

# compute canonical loadings  
cc2 <- comput(psych, acad, cc1)  
  
# display canonical loadings  
cc2[3:6]

## $corr.X.xscores  
## [,1] [,2] [,3]  
## Control -0.90404631 -0.3896883 -0.1756227  
## Concept -0.02084327 -0.7087386 0.7051632  
## Motivation -0.56715106 0.3508882 0.7451289  
##   
## $corr.Y.xscores  
## [,1] [,2] [,3]  
## Read -0.3900402 -0.06010654 0.01407661  
## Write -0.4067914 0.01086075 0.02647207  
## Math -0.3545378 -0.04990916 0.01536585  
## Science -0.3055607 -0.11336980 -0.02395489  
## Sex -0.1689796 0.12645737 -0.05650916  
##   
## $corr.X.yscores  
## [,1] [,2] [,3]  
## Control -0.419555307 -0.06527635 -0.01826320  
## Concept -0.009673069 -0.11872021 0.07333073  
## Motivation -0.263206910 0.05877699 0.07748681  
##   
## $corr.Y.yscores  
## [,1] [,2] [,3]  
## Read -0.8404480 -0.35882541 0.1353635  
## Write -0.8765429 0.06483674 0.2545608  
## Math -0.7639483 -0.29794884 0.1477611  
## Science -0.6584139 -0.67679761 -0.2303551  
## Sex -0.3641127 0.75492811 -0.5434036

# tests of canonical dimensions  
rho <- cc1$cor  
## Define number of observations, number of variables in first set, and number of variables in the second set.  
n <- dim(psych)[1]  
p <- length(psych)  
q <- length(acad)  
  
## Calculate p-values using the F-approximations of different test statistics:  
p.asym(rho, n, p, q, tstat = "Wilks")

## Wilks' Lambda, using F-approximation (Rao's F):  
## stat approx df1 df2 p.value  
## 1 to 3: 0.7543611 11.715733 15 1634.653 0.000000000  
## 2 to 3: 0.9614300 2.944459 8 1186.000 0.002905057  
## 3 to 3: 0.9891858 2.164612 3 594.000 0.091092180

p.asym(rho, n, p, q, tstat = "Hotelling")

## Hotelling-Lawley Trace, using F-approximation:  
## stat approx df1 df2 p.value  
## 1 to 3: 0.31429738 12.376333 15 1772 0.000000000  
## 2 to 3: 0.03980175 2.948647 8 1778 0.002806614  
## 3 to 3: 0.01093238 2.167041 3 1784 0.090013176

p.asym(rho, n, p, q, tstat = "Pillai")

## Pillai-Bartlett Trace, using F-approximation:  
## stat approx df1 df2 p.value  
## 1 to 3: 0.25424936 11.000571 15 1782 0.000000000  
## 2 to 3: 0.03887348 2.934093 8 1788 0.002932565  
## 3 to 3: 0.01081416 2.163421 3 1794 0.090440474

p.asym(rho, n, p, q, tstat = "Roy")

## Roy's Largest Root, using F-approximation:  
## stat approx df1 df2 p.value  
## 1 to 1: 0.2153759 32.61008 5 594 0  
##   
## F statistic for Roy's Greatest Root is an upper bound.

Seperti yang ditunjukkan pada tabel di atas, pengujian pertama dimensi kanonis menguji apakah ketiga dimensi tersebut signifikan (yaitu, F = 11,72), pengujian berikutnya menguji apakah kombinasi dimensi 2 dan 3 signifikan (yaitu, F = 2,94) . Terakhir, tes terakhir menguji apakah dimensi 3 dengan sendirinya signifikan (tidak). Oleh karena itu dimensi 1 dan 2 masing-masing harus signifikan sedangkan dimensi tiga tidak.

Ketika variabel dalam model memiliki standar deviasi yang sangat berbeda, koefisien standar memungkinkan perbandingan yang lebih mudah antar variabel. Selanjutnya, kami akan menghitung koefisien kanonik standar.

# standardized psych canonical coefficients diagonal matrix of psych sd's  
s1 <- diag(sqrt(diag(cov(psych))))  
s1 %\*% cc1$xcoef

## [,1] [,2] [,3]  
## [1,] -0.8404196 -0.4165639 -0.4435172  
## [2,] 0.2478818 -0.8379278 0.5832620  
## [3,] -0.4326685 0.6948029 0.6855370

# standardized acad canonical coefficients diagonal matrix of acad sd's  
s2 <- diag(sqrt(diag(cov(acad))))  
s2 %\*% cc1$ycoef

## [,1] [,2] [,3]  
## [1,] -0.45080116 -0.04960589 0.21600760  
## [2,] -0.34895712 0.40920634 0.88809662  
## [3,] -0.22046662 0.03981942 0.08848141  
## [4,] -0.04877502 -0.82659938 -1.06607828  
## [5,] -0.31503962 0.54057096 -0.89442764

Untuk variabel psikologis, dimensi kanonik pertama paling kuat dipengaruhi oleh locus of control (-.84) dan untuk dimensi kedua konsep diri (-.84) dan motivasi (.69). Untuk variabel akademik ditambah jenis kelamin, dimensi pertama terdiri dari membaca (-.45), menulis (-.35) dan jenis kelamin (-.32). Untuk penulisan dimensi kedua (0,41), sains (-,83) dan jenis kelamin (0,54) adalah variabel yang mendominasi.