Psychology 405: Psychometric Theory

Homework Problem Set #2

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Outline

The problem (Part 1)

1. A data set of 1,000 simulated cases may be found using the following commands in R
2. ```
   datafilename<-
      "http://personality-project.org/R/datasets/psychometrics.prob2.txt"
    dataset <- read.table(datafilename,header=TRUE)  #read the data file
   ```
3. Get the data set and find the basic descriptive statistics. Then plot GREV versus GREQ against each other.
4. Find the correlation matrix of all of the variables in the data set.
5. Show the scatter plot of all the variables
6. Find the multiple correlation of Verbal and Quant with MA
   ```

Read the data and describe it

```
datafilename<-
   "http://personality-project.org/R/datasets/psychometrics.prob2.txt"
 dataset <- read.table(datafilename,header=TRUE)  #read the data file
describe(dataset)
```

```
        var    n   mean     sd median trimmed    mad   min     max  range  skew
ID        1 1000 500.50 288.82 500.50  500.50 370.65   1.0 1000.00 999.00  0.00
GREV      2 1000 499.77 106.11 497.50  498.75 106.01 138.0  873.00 735.00  0.09
GREQ      3 1000 500.53 103.85 498.00  498.51 105.26 191.0  914.00 723.00  0.22
GREA      4 1000 498.13 100.45 495.00  498.67  99.33 207.0  848.00 641.00 -0.02
Ach       5 1000  49.93   9.84  50.00   49.88  10.38  16.0   79.00  63.00  0.00
Anx       6 1000  50.32   9.91  50.00   50.43  10.38  14.0   78.00  64.00 -0.14
Prelim    7 1000  10.03   1.06  10.00   10.02   1.48   7.0   13.00   6.00 -0.02
GPA       8 1000   4.00   0.50   4.02    4.01   0.53   2.5    5.38   2.88 -0.07
MA        9 1000   3.00   0.49   3.00    3.00   0.44   1.4    4.50   3.10 -0.07
```

Find the correlations

Many ways of doing this.

cor(dataset)
round(cor(dataset),2)
round(cor(dataset,use="pairwise"),2)
lowerCor(dataset)

```
> cor(dataset)
                  ID         GREV         GREQ         GREA          Ach
ID       1.000000000 -0.007259876 0.002827727 -0.005342069 -0.004044547 -0.00911
GREV    -0.007259876  1.000000000 0.728847119  0.641151694  0.005612846  0.01019
GREQ     0.002827727  0.728847119 1.000000000  0.596345026  0.006846819  0.00546
GREA    -0.005342069  0.641151694 0.596345026  1.000000000  0.453464501 -0.38962
Ach     -0.004044547  0.005612846 0.006846819  0.453464501  1.000000000 -0.55618
Anx     -0.009117778  0.010193145 0.005469727 -0.389629680 -0.556186667  1.00000
Prelim   0.017644273  0.428241464 0.383088099  0.572431898  0.303343378 -0.22788
GPA     -0.004907548  0.419468609 0.366971989  0.516206843  0.276380979 -0.22240
MA      -0.009435498  0.322297502 0.287387909  0.454549472  0.263466528 -0.21922
                 GPA          MA
ID      -0.004907548 -0.009435498
GREV     0.419468609  0.322297502
GREQ     0.366971989  0.287387909
GREA     0.516206843  0.454549472
Ach      0.276380979  0.263466528
Anx     -0.222404655 -0.219220334
```

Round the answer to 2 decimals

```
> round(cor(dataset),2)
```

	ID	GREV	GREQ	GREA	Ach	Anx	Prelim	GPA	MA
ID	1.00	-0.01	0.00	-0.01	0.00	-0.01	0.02	0.00	-0.01
GREV	-0.01	1.00	0.73	0.64	0.01	0.01	0.43	0.42	0.32
GREQ	0.00	0.73	1.00	0.60	0.01	0.01	0.38	0.37	0.29
GREA	-0.01	0.64	0.60	1.00	0.45	-0.39	0.57	0.52	0.45
Ach	0.00	0.01	0.01	0.45	1.00	-0.56	0.30	0.28	0.26
Anx	-0.01	0.01	0.01	-0.39	-0.56	1.00	-0.23	-0.22	-0.22
Prelim	0.02	0.43	0.38	0.57	0.30	-0.23	1.00	0.42	0.36
GPA	0.00	0.42	0.37	0.52	0.28	-0.22	0.42	1.00	0.31
MA	-0.01	0.32	0.29	0.45	0.26	-0.22	0.36	0.31	1.00

Use pairwise correlations (to handle missing data), round the output

```
> round(cor(dataset,use="pairwise"),2)
```

	ID	GREV	GREQ	GREA	Ach	Anx	Prelim	GPA	MA
ID	1.00	-0.01	0.00	-0.01	0.00	-0.01	0.02	0.00	-0.01
GREV	-0.01	1.00	0.73	0.64	0.01	0.01	0.43	0.42	0.32
GREQ	0.00	0.73	1.00	0.60	0.01	0.01	0.38	0.37	0.29
GREA	-0.01	0.64	0.60	1.00	0.45	-0.39	0.57	0.52	0.45
Ach	0.00	0.01	0.01	0.45	1.00	-0.56	0.30	0.28	0.26
Anx	-0.01	0.01	0.01	-0.39	-0.56	1.00	-0.23	-0.22	-0.22
Prelim	0.02	0.43	0.38	0.57	0.30	-0.23	1.00	0.42	0.36
GPA	0.00	0.42	0.37	0.52	0.28	-0.22	0.42	1.00	0.31
MA	-0.01	0.32	0.29	0.45	0.26	-0.22	0.36	0.31	1.00

Using the lowerCor function, combine these previous operations

```
> lowerCor(dataset)

          ID    GREV  GREQ  GREA  Ach   Anx   Prelm GPA   MA
ID         1.00
GREV      -0.01  1.00
GREQ       0.00  0.73  1.00
GREA      -0.01  0.64  0.60  1.00
Ach        0.00  0.01  0.01  0.45  1.00
Anx       -0.01  0.01  0.01 -0.39 -0.56  1.00
Prelim     0.02  0.43  0.38  0.57  0.30 -0.23  1.00
GPA        0.00  0.42  0.37  0.52  0.28 -0.22  0.42  1.00
MA        -0.01  0.32  0.29  0.45  0.26 -0.22  0.36  0.31  1.0
```

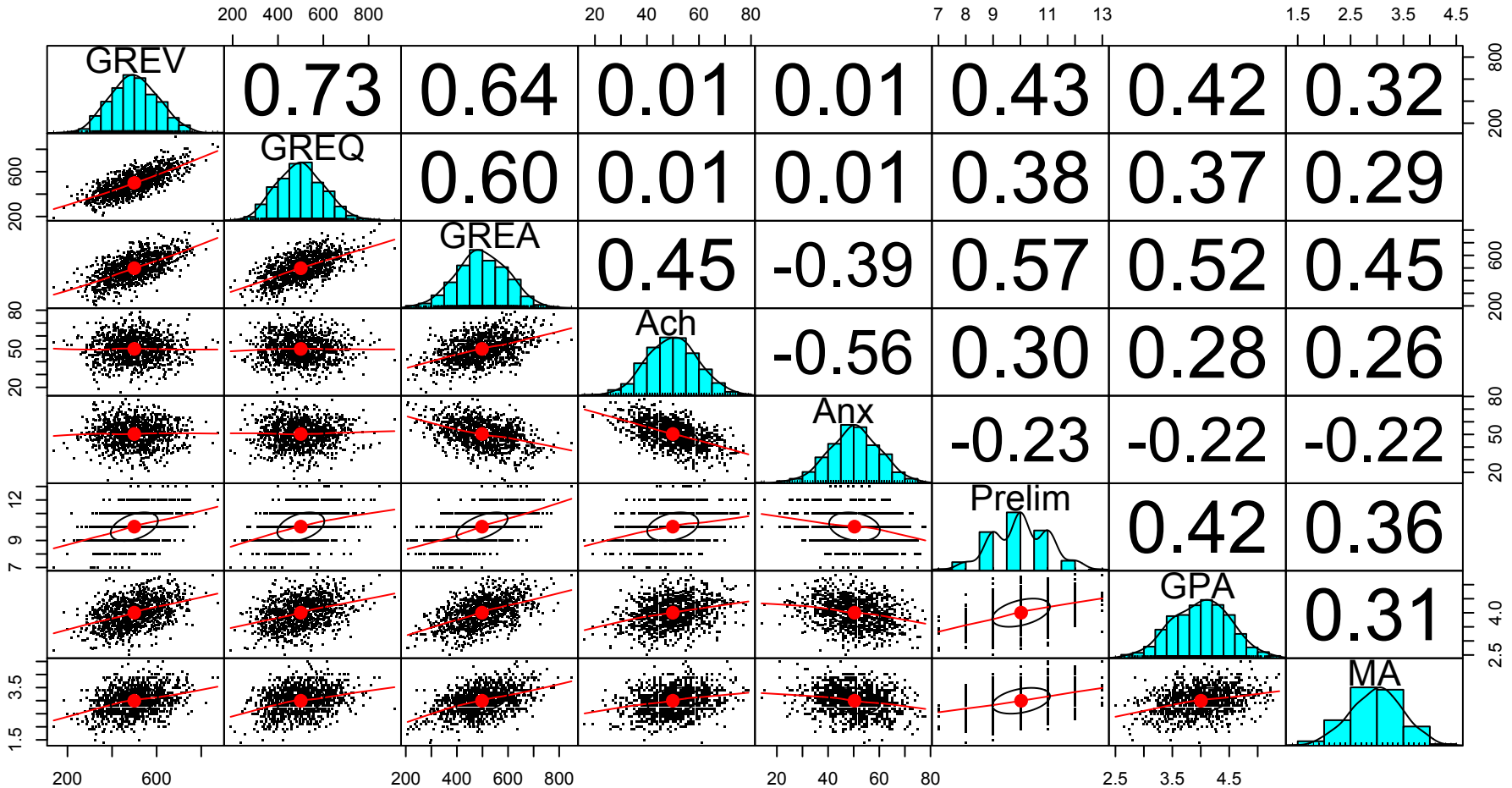
Do the significance tests

`cor.test` does one pair at a time, `corr.test` does it for all variables

```
> corr.test(dataset)
```

```
Call:corr.test(x = dataset)
Correlation matrix
          ID  GREV GREQ  GREA   Ach   Anx Prelim   GPA    MA
ID      1.00 -0.01 0.00 -0.01  0.00 -0.01   0.02  0.00 -0.01
GREV   -0.01  1.00 0.73  0.64  0.01  0.01   0.43  0.42  0.32
...
MA     -0.01  0.32 0.29  0.45  0.26 -0.22   0.36  0.31  1.00
Sample Size
         ID GREV GREQ GREA  Ach  Anx Prelim  GPA   MA
ID     1000 1000 1000 1000 1000 1000   1000 1000 1000
GREV   1000 1000 1000 1000 1000 1000   1000 1000 1000
...
MA     1000 1000 1000 1000 1000 1000   1000 1000 1000
Probability values (Entries above the diagonal are adjusted for multiple tests.
         ID GREV GREQ GREA Ach Anx Prelim GPA MA
ID     0.00 1.00 1.00    1   1   1      1   1  1
GREV   0.82 0.00 0.00    0   1   1      0   0  0
GREQ   0.93 0.00 0.00    0   1   1      0   0  0
GREA   0.87 0.00 0.00    0   0   0      0   0  0
```

pairs.panels(dataset[-1],pch=".",gap=0)



Multiple regression from data

1. Find the multiple R of GREV and GREQ predicting MA score
2. Find the multiple R of GREV, GREQ, GREA prediction prelims

Multiple R of GREV and GREQ predicting MA score

```
> mod1 <- lm(MA~GREV+ GREQ,data=dataset)
> summary(mod1)

Call:
lm(formula = MA ~ GREV + GREQ, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-1.47912 -0.31272  0.01348  0.31216  1.41784

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 2.1690912  0.0771484  28.116  < 2e-16 ***
GREV        0.0011211  0.0002033   5.515 4.44e-08 ***
GREQ        0.0005328  0.0002077   2.565   0.0105 *
---
Signif. codes:  0 Ô***Õ 0.001 Ô**Õ 0.01 Ô*Õ 0.05 Ô.Õ 0.1 Ô Õ 1

Residual standard error: 0.4668 on 997 degrees of freedom
Multiple R-squared:  0.1098, Adjusted R-squared:  0.108
F-statistic: 61.46 on 2 and 997 DF,  p-value: < 2.2e-16
```

Now, add GREA to the model

```
> mod2 <- lm(MA~GREV+ GREQ+ GREA,data=dataset)
> summary(mod2)

Call:
lm(formula = MA ~ GREV + GREQ + GREA, data = dataset)

Residuals:
     Min       1Q   Median       3Q      Max
-1.37779 -0.29802  0.01818  0.30276  1.38537

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.844e+00  7.842e-02  23.518   <2e-16 ***
GREV         2.555e-04  2.070e-04   1.235    0.217
GREQ        -1.986e-05  2.022e-04  -0.098    0.922
GREA         2.076e-03  1.865e-04  11.131   <2e-16 ***
---
Signif. codes:  0 Ô***Õ 0.001 Ô**Õ 0.01 Ô*Õ 0.05 Ô.Õ 0.1 Ô Õ 1

Residual standard error: 0.4404 on 996 degrees of freedom
Multiple R-squared:  0.2082, Adjusted R-squared:  0.2059
F-statistic: 87.32 on 3 and 996 DF,  p-value: < 2.2e-16
```

Compare these two models

```
> anova(mod1,mod2)

Analysis of Variance Table

Model 1: MA ~ GREV + GREQ
Model 2: MA ~ GREV + GREQ + GREA
  Res.Df    RSS Df Sum of Sq      F    Pr(>F)
1    997 217.25
2    996 193.22  1    24.035 123.89 < 2.2e-16 ***
---
Signif. codes:  0 Ô***Õ 0.001 Ô**Õ 0.01 Ô*Õ 0.05 Ô.Õ 0.1 Ô
```

Multiple DVs simultaneously

```
> R <- lowerCor(dataset[-1])
> set.cor(y=6:8,x=1:5,data=R)
Call: set.cor(y = 6:8, x = 1:5, data = R)
Multiple Regression from matrix input
Beta weights
     Prelim   GPA    MA
GREV   0.14  0.20  0.10
GREQ   0.04  0.05  0.03
GREA   0.40  0.29  0.31
Ach    0.11  0.12  0.10
Anx   -0.01 -0.05 -0.05

Multiple R
Prelim    GPA     MA
  0.59   0.54   0.47

Multiple R2
Prelim    GPA     MA
  0.34   0.29   0.22
Various estimates of between set correlations
Squared Canonical Correlations
[1] 0.4943 0.0036 0.0017
Chisq of canonical correlations
```