Digital Payment Systems

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Contents

1 Pre-Processing

1.1 Import and Display Dataset

```r
library(readxl)
dataset <- as.data.frame(read_excel("Digital payment systems survey - Albania.xlsx",skip =1 ))
View(dataset)
```

1.2 Data Manipulation

```r
colnames(dataset)[1:5]<-c("timestamp","agree","pre_experience","sex","age")
colnames(dataset)[6:39]<-paste("Item",1:34)
dataset<-na.omit(dataset)
library(stringr)
for(i in 6:39){
  dataset[,i]<-str_split_fixed(dataset[,i]," ",n=2)[,1]
  dataset[,i]<-as.numeric(dataset[,i])
}
```

1.3 Group Items in Batteries

```r
batteries<-list(6:9,10:14,15:19,20:23,24:27,28:31,32:35,36:39)
```

2 Correlation, Graded Response Model and Linear Regression on Latent Variable θ

```r
library(corrplot)
library(psych)
library(mirt)
for(i in 1:8){
  print(noquote(paste("Correlation Matrix Battery",i,sep=" ")))
  matcor<-cor(dataset[batteries[[i]]])
  corrplot(matcor,col.lim=c(0,1),diag=F,main=" ",method="number",tl.col="black",tl.offset=0.5,tl.srt=0,
  print(noquote(" "))
  print(noquote(paste("Cronbach's Alpha Battery",i,sep=" ")))
  alpha<-alpha(dataset[,batteries[[i]]])
  print(round(alpha$total,2))
  print(round(alpha$alpha.drop,2))
  print(noquote(" "))
  print(noquote(paste("Graded Response Model (IRT) Battery",i,sep=" ")))
  model<-mirt(data=dataset[,batteries[[i]]],1,itemtype="graded",SE=T)
  a<-plot(model,type="trace",as.table=T, main=paste("Item Probability Function Battery",i,sep=" "))
  plot(a)
  a<-plot(model,type="infotrace",as.table=T,main=paste("Item Information Battery",i,sep=" "))
  plot(a)
  theta<-as.numeric(fscores(model))
  print(noquote(" "))
  print(noquote(paste("Linear Regression on Latent Variable",i,sep=" ")))
  data<-cbind(dataset[,4:5],theta)
  modello<-lm(theta~.,data=data)
  print(summary(modello))
}
```

```
## [1] Correlation Matrix Battery 1
```
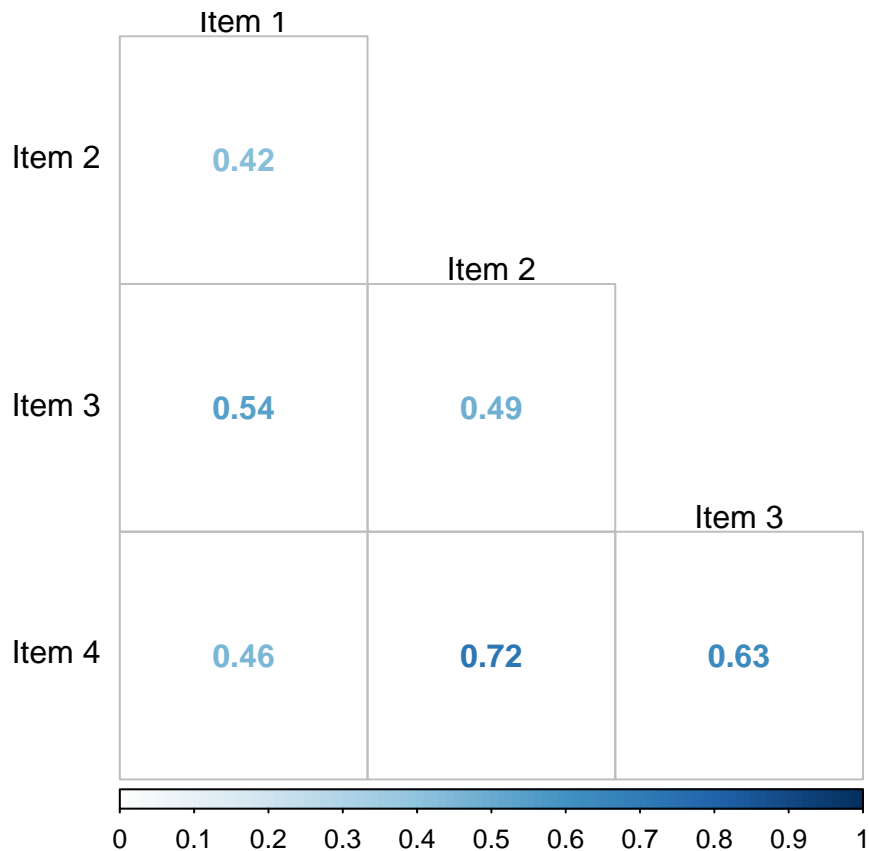
```
## [1]
## [1] Cronbach's Alpha Battery 1
##  raw_alpha std.alpha G6(smc) average_r  S/N  ase mean   sd median_r
##      0.82      0.83    0.81      0.54 4.77 0.02 3.64 0.92     0.51
##        raw_alpha std.alpha G6(smc) average_r  S/N alpha se var.r med.r
## Item 1      0.83      0.83    0.78      0.61 4.77      0.02  0.01  0.63
## Item 2      0.78      0.78    0.72      0.54 3.58      0.02  0.01  0.54
## Item 3      0.77      0.77    0.73      0.53 3.44      0.03  0.03  0.46
## Item 4      0.74      0.74    0.66      0.48 2.82      0.03  0.00  0.49
## [1]
## [1] Graded Response Model (IRT) Battery 1
## Iteration: 1, Log-Lik: -1349.927, Max-Change: 1.31561Iteration: 2, Log-Lik: -1289.664, Max-Change: 1
##
## Calculating information matrix...
```

4

Item Probability Function Battery 1
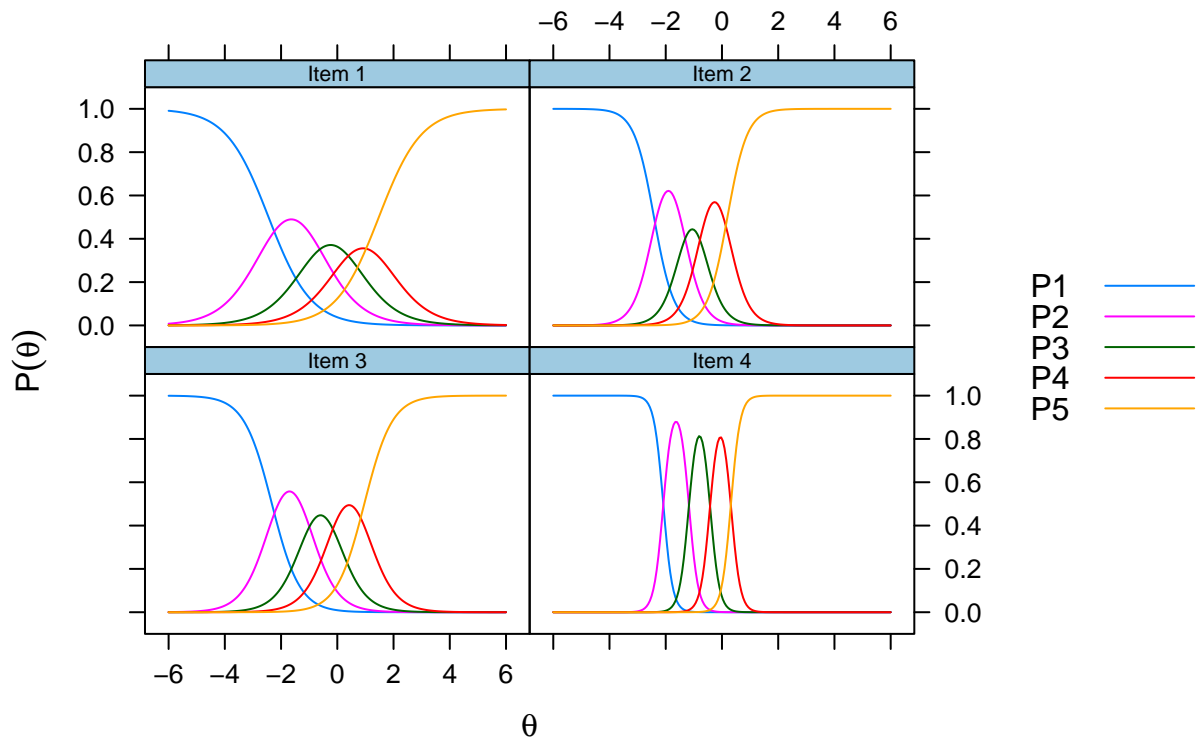
Item Information Battery 1
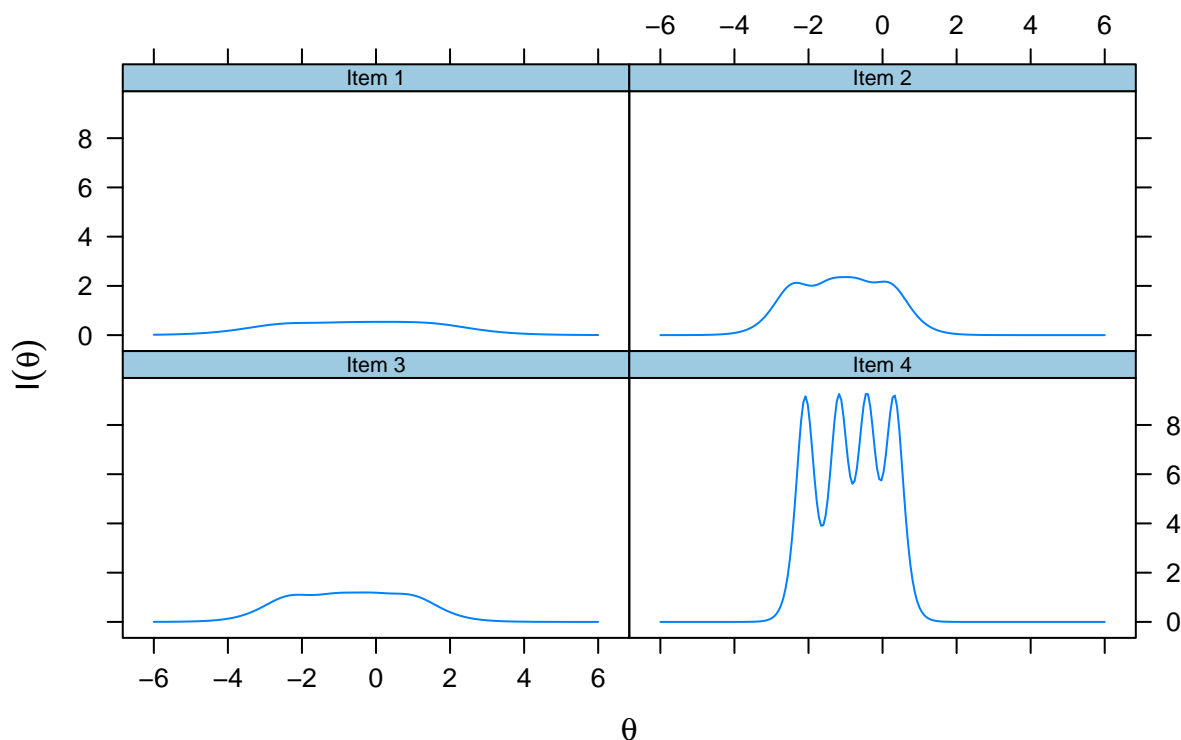

```
## [1]
## [1] Linear Regression on Latent Variable 1
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.21486 -0.58322  0.00699  0.66969  1.70651
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -0.16772    0.10855  -1.545   0.1236
## sexmale             0.07967    0.13603   0.586   0.5586
## age26-35 years old  0.15123    0.16424   0.921   0.3580
## age36-50 years old  0.33735    0.15070   2.239   0.0261 *
## ageover 50  years old 0.03590   0.18240   0.197   0.8441
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9268 on 249 degrees of freedom
## Multiple R-squared:  0.02573,    Adjusted R-squared:  0.01008
## F-statistic: 1.644 on 4 and 249 DF,  p-value: 0.1638
##
## [1] Correlation Matrix Battery 2
```

```
## [1]
## [1] Cronbach's Alpha Battery 2
##  raw_alpha std.alpha G6(smc) average_r  S/N  ase mean   sd median_r
##       0.89        0.9    0.89       0.64 8.87 0.01 3.75 0.91      0.71
##        raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 5      0.86      0.87    0.85      0.62  6.59       0.01  0.02  0.63
## Item 6      0.85      0.86    0.84      0.61  6.21       0.02  0.02  0.61
## Item 7      0.86      0.87    0.85      0.63  6.72       0.01  0.02  0.63
## Item 8      0.85      0.86    0.84      0.61  6.13       0.02  0.02  0.61
## Item 9      0.92      0.92    0.90      0.73 11.08       0.01  0.00  0.74
## [1]
## [1] Graded Response Model (IRT) Battery 2
## Iteration: 1, Log-Lik: -1557.113, Max-Change: 2.42357Iteration: 2, Log-Lik: -1414.608, Max-Change: 2
##
## Calculating information matrix...
```

Item Probability Function Battery 2
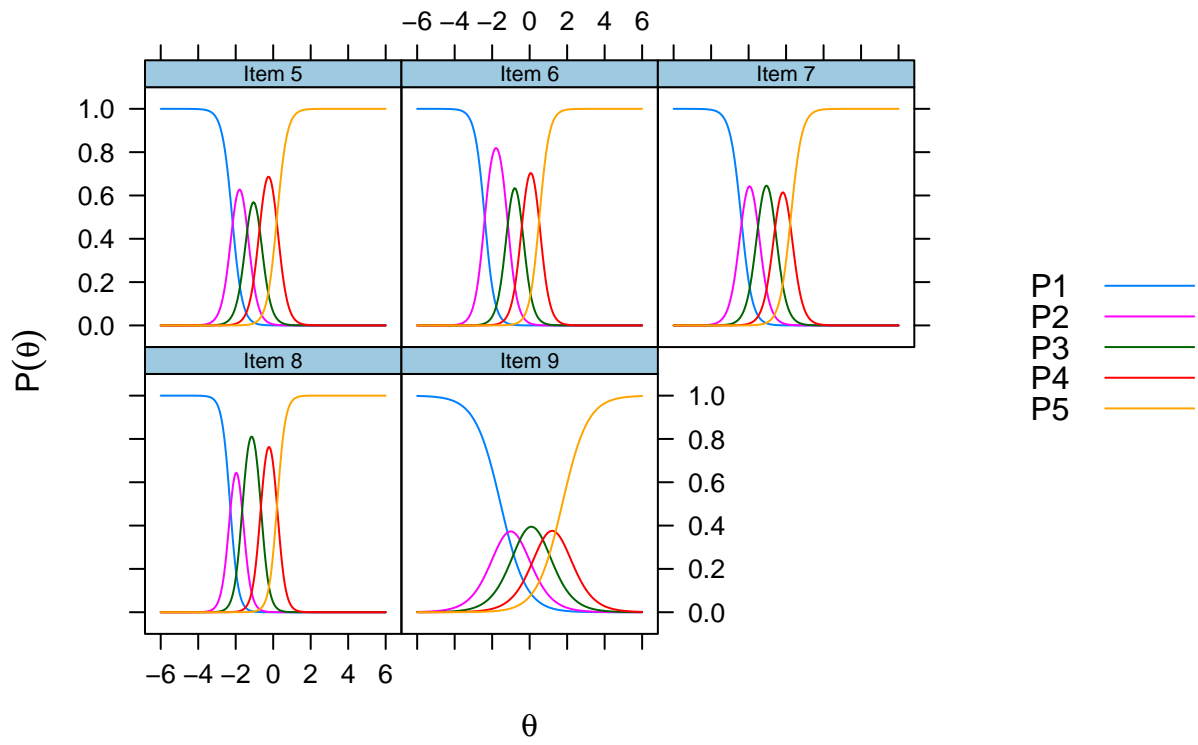
Item Information Battery 2
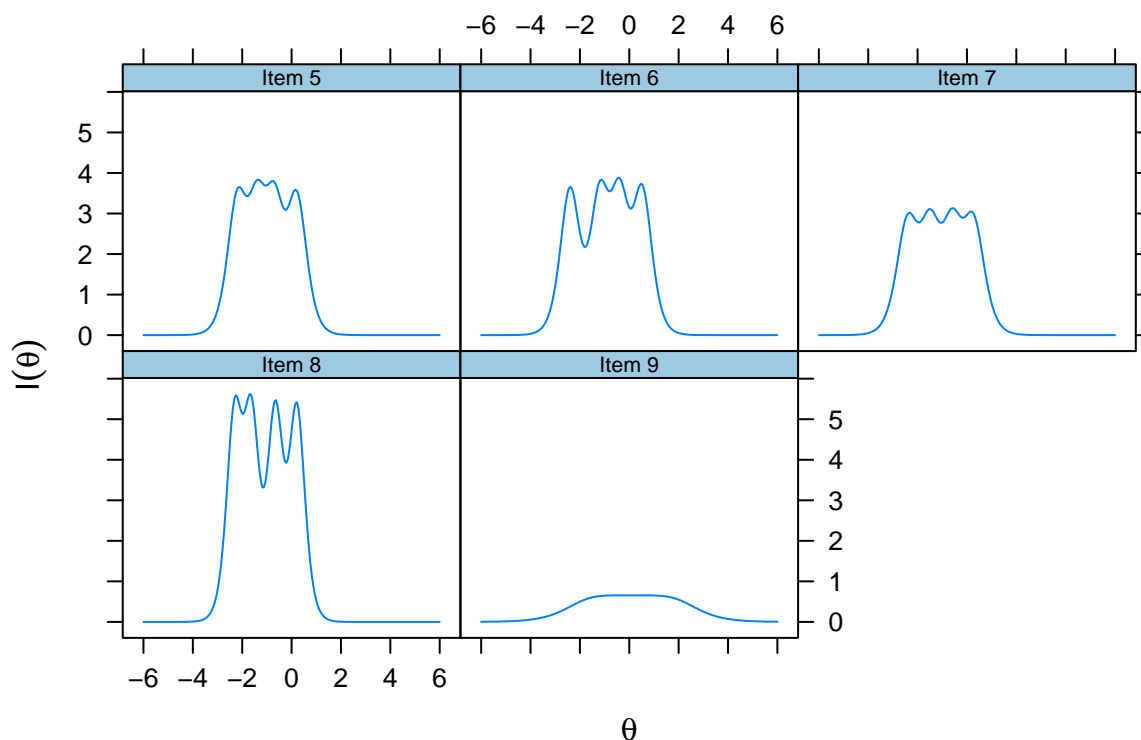

```
## [1]
## [1] Linear Regression on Latent Variable 2
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.21421 -0.68083 -0.04574  0.67490  1.57719
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.004218   0.111320   0.038    0.970
## sexmale               0.032909   0.139505   0.236    0.814
## age26-35 years old   -0.054519   0.168432  -0.324    0.746
## age36-50 years old    0.019653   0.154548   0.127    0.899
## ageover 50  years old -0.049158   0.187058  -0.263    0.793
##
## Residual standard error: 0.9505 on 249 degrees of freedom
## Multiple R-squared:  0.001312,   Adjusted R-squared:  -0.01473
## F-statistic: 0.08176 on 4 and 249 DF,  p-value: 0.9879
##
## [1] Correlation Matrix Battery 3
```

Item 10

	Item 10	Item 11	Item 12	Item 13
Item 11	0.76			
Item 12	0.80	0.78		
Item 13	0.81	0.80	0.86	
Item 14	0.65	0.68	0.76	0.79

0   0.1   0.2   0.3   0.4   0.5   0.6   0.7   0.8   0.9   1

```
## [1]
## [1] Cronbach's Alpha Battery 3
##  raw_alpha std.alpha G6(smc) average_r    S/N  ase mean    sd median_r
##       0.94      0.94    0.94      0.77  16.75 0.01 3.28 1.04     0.79
##         raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 10      0.93      0.93    0.92      0.78 14.10     0.01     0  0.79
## Item 11      0.93      0.93    0.92      0.78 14.05     0.01     0  0.80
## Item 12      0.92      0.92    0.91      0.75 12.04     0.01     0  0.78
## Item 13      0.92      0.92    0.90      0.74 11.37     0.01     0  0.76
## Item 14      0.94      0.94    0.93      0.80 16.30     0.01     0  0.80
## [1]
## [1] Graded Response Model (IRT) Battery 3
## Iteration: 1, Log-Lik: -1672.616, Max-Change: 2.41921Iteration: 2, Log-Lik: -1422.996, Max-Change: 2
##
## Calculating information matrix...
```
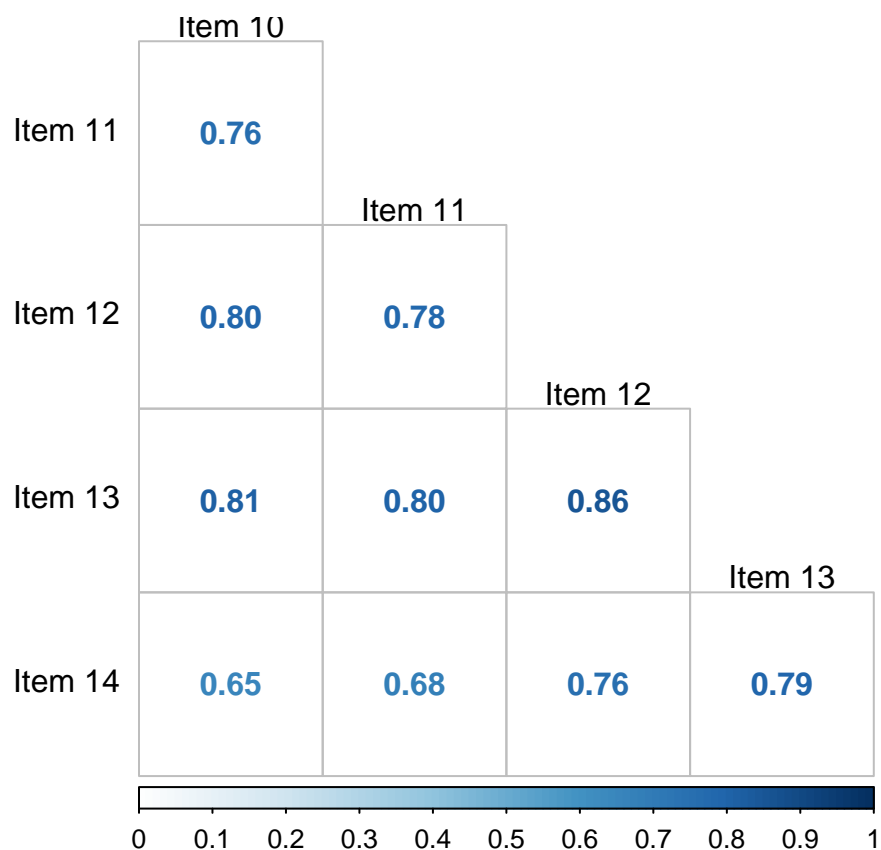
Item Probability Function Battery 3

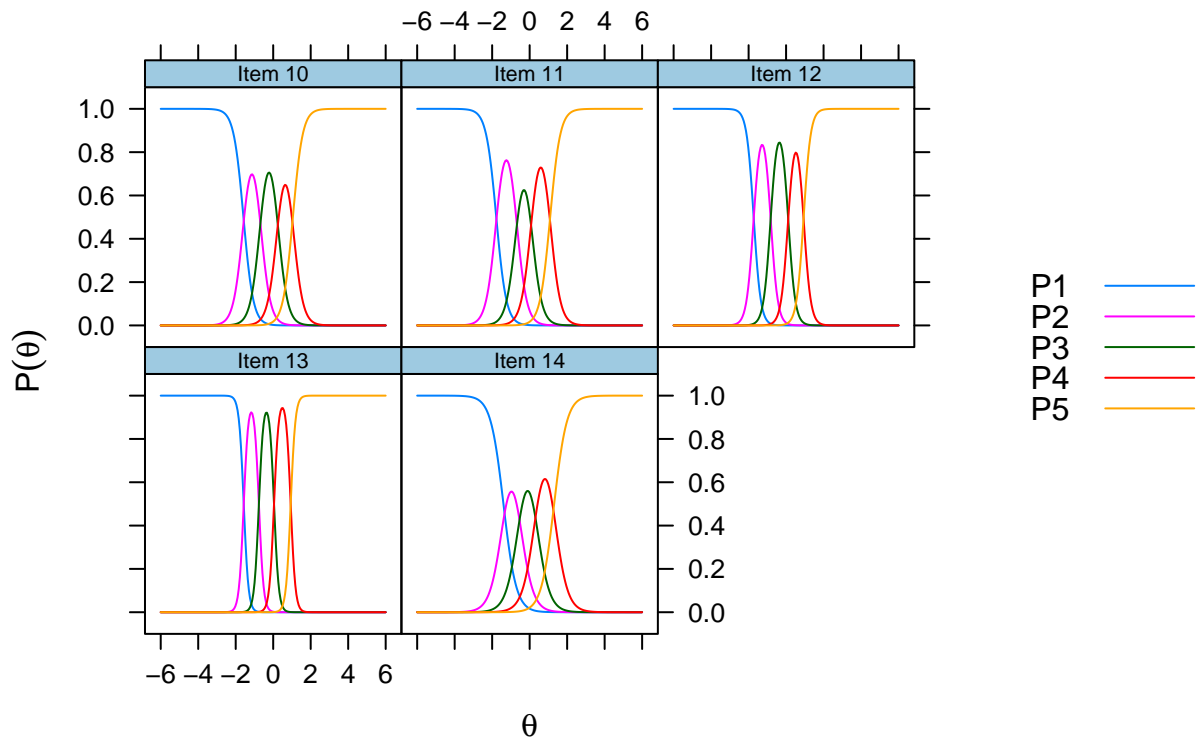# Item Information Battery 3
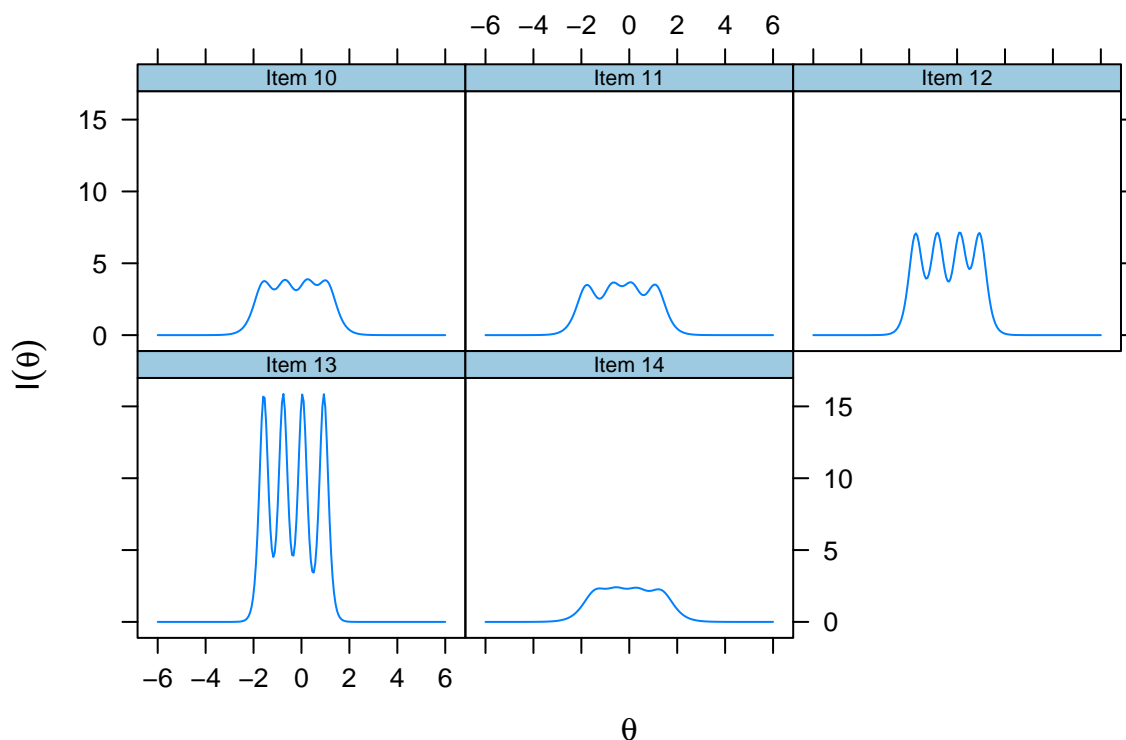

```
## [1]
## [1] Linear Regression on Latent Variable 3
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.4322 -0.5843 -0.1116  0.6283  2.1226
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.11625    0.11381   1.021   0.3081
## sexmale               0.09039    0.14262   0.634   0.5268
## age26-35 years old   -0.18832    0.17220  -1.094   0.2752
## age36-50 years old   -0.11111    0.15800  -0.703   0.4826
## ageover 50  years old -0.38129    0.19124  -1.994   0.0473 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9718 on 249 degrees of freedom
## Multiple R-squared:  0.01692,    Adjusted R-squared:  0.001126
## F-statistic: 1.071 on 4 and 249 DF,  p-value: 0.3712
##
## [1] Correlation Matrix Battery 4
```
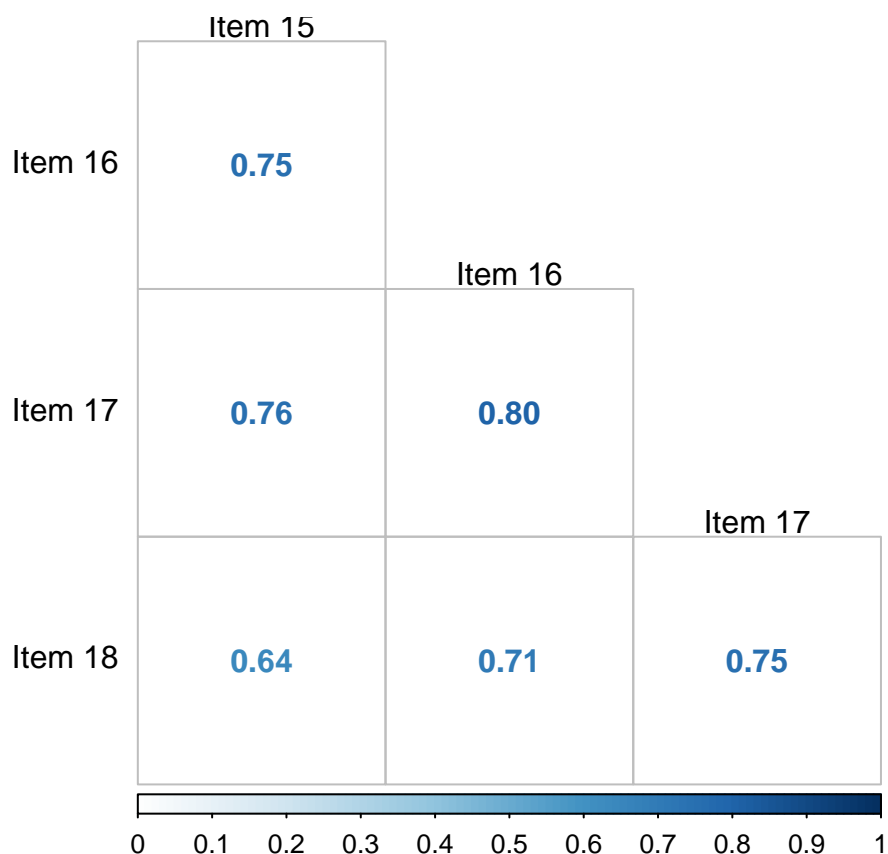
```
## [1]
## [1] Cronbach's Alpha Battery 4
##  raw_alpha std.alpha G6(smc) average_r   S/N  ase mean   sd median_r
##      0.92      0.92     0.9      0.73 11.09 0.01 3.57 1.03     0.75
##         raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 15      0.90      0.90    0.86      0.75  9.20     0.01     0  0.75
## Item 16      0.88      0.88    0.84      0.72  7.58     0.01     0  0.75
## Item 17      0.87      0.87    0.83      0.70  6.98     0.01     0  0.71
## Item 18      0.91      0.91    0.87      0.77 10.01     0.01     0  0.76
## [1]
## [1] Graded Response Model (IRT) Battery 4
## Iteration: 1, Log-Lik: -1341.687, Max-Change: 1.95337Iteration: 2, Log-Lik: -1197.662, Max-Change: 2
##
## Calculating information matrix...
```

Item Probability Function Battery 4

Item Information Battery 4
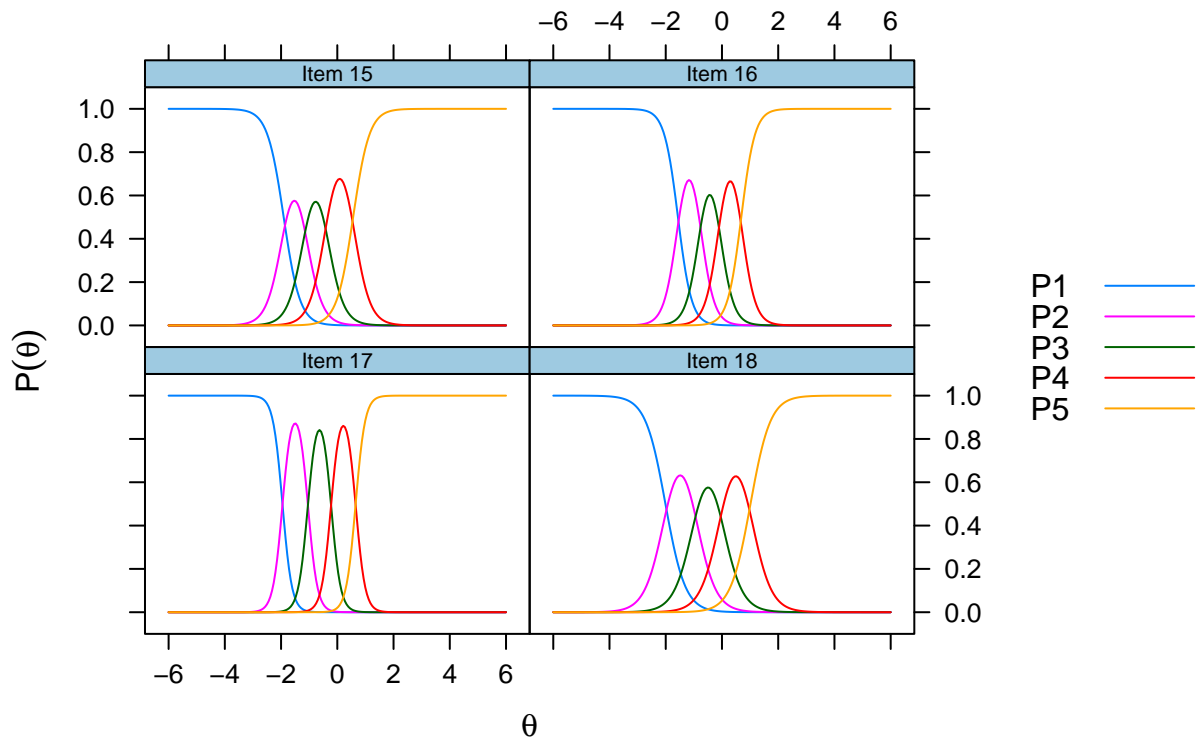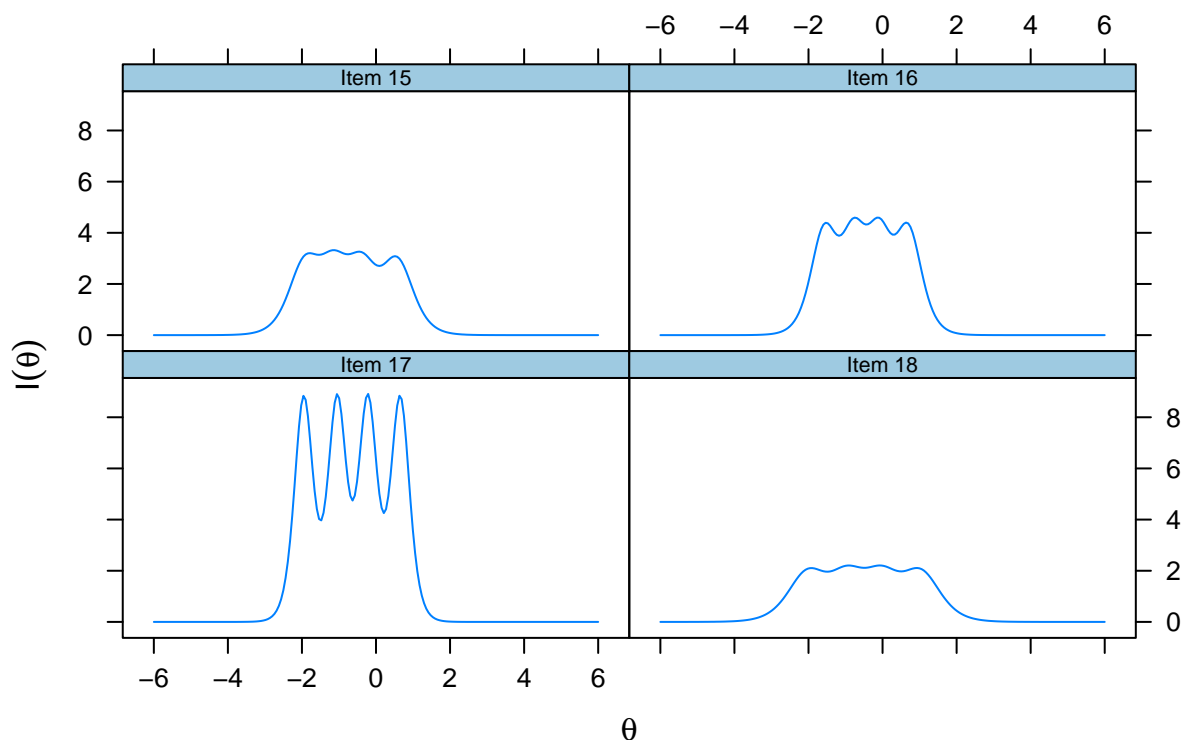


```
## [1]
## [1] Linear Regression on Latent Variable 4
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.46315 -0.61888 -0.02885  0.71956  1.71481
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -0.05211    0.11181  -0.466    0.642
## sexmale              0.03279    0.14012   0.234    0.815
## age26-35 years old   0.25588    0.16917   1.513    0.132
## age36-50 years old   0.01066    0.15523   0.069    0.945
## ageover 50  years old -0.09923    0.18788  -0.528    0.598
##
## Residual standard error: 0.9547 on 249 degrees of freedom
## Multiple R-squared:  0.01562,    Adjusted R-squared:  -0.0001927
## F-statistic: 0.9878 on 4 and 249 DF,  p-value: 0.4147
##
## [1] Correlation Matrix Battery 5
```
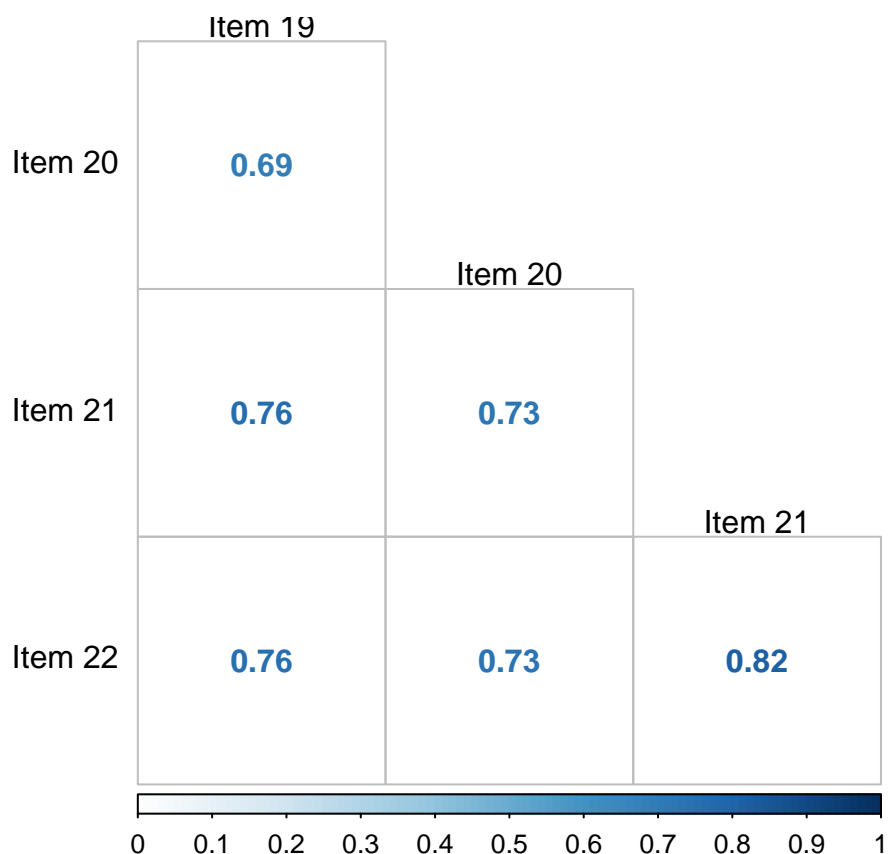
```
## [1]
## [1] Cronbach's Alpha Battery 5
##  raw_alpha std.alpha G6(smc) average_r   S/N  ase mean   sd median_r
##      0.92      0.92     0.9      0.75 11.94 0.01 4.09 0.85     0.75
##        raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 19      0.90      0.90    0.87      0.76  9.49     0.01     0  0.73
## Item 20      0.91      0.91    0.88      0.78 10.63     0.01     0  0.76
## Item 21      0.89      0.89    0.84      0.73  8.05     0.01     0  0.73
## Item 22      0.89      0.89    0.84      0.73  8.02     0.01     0  0.73
## [1]
## [1] Graded Response Model (IRT) Battery 5
## Iteration: 1, Log-Lik: -1111.128, Max-Change: 2.83191Iteration: 2, Log-Lik: -969.369, Max-Change: 2.8
##
## Calculating information matrix...
```

Item Probability Function Battery 5

Item Information Battery 5
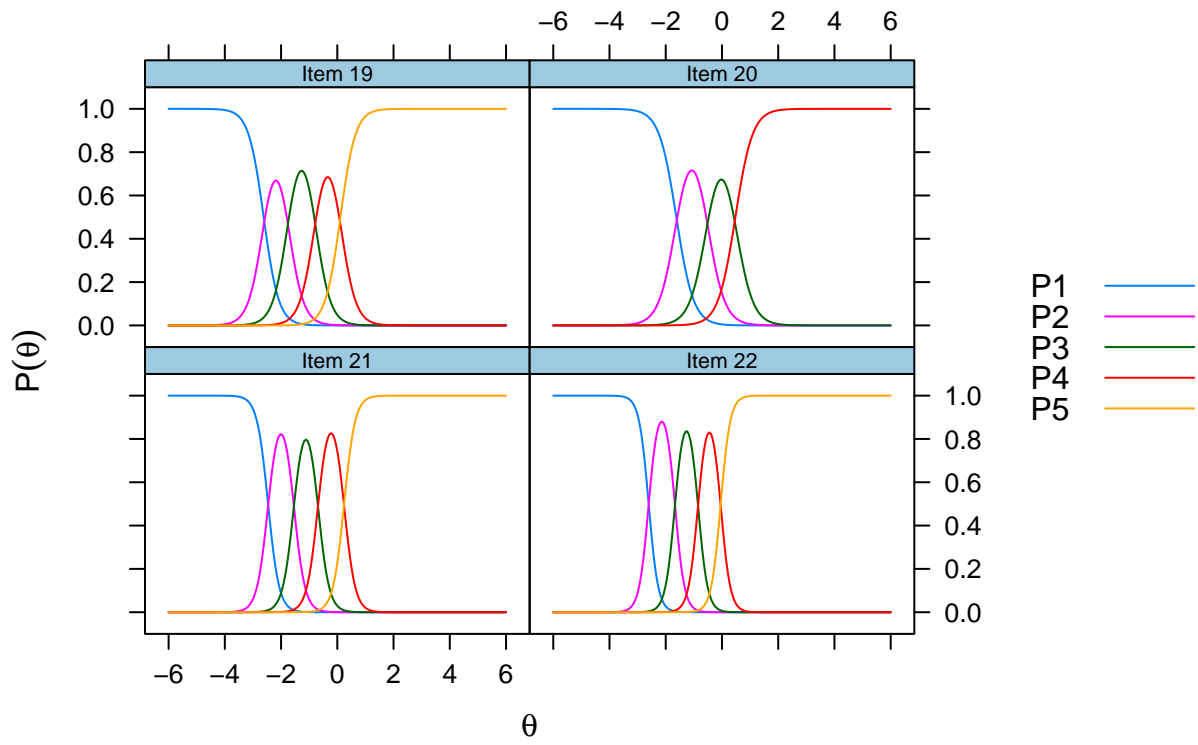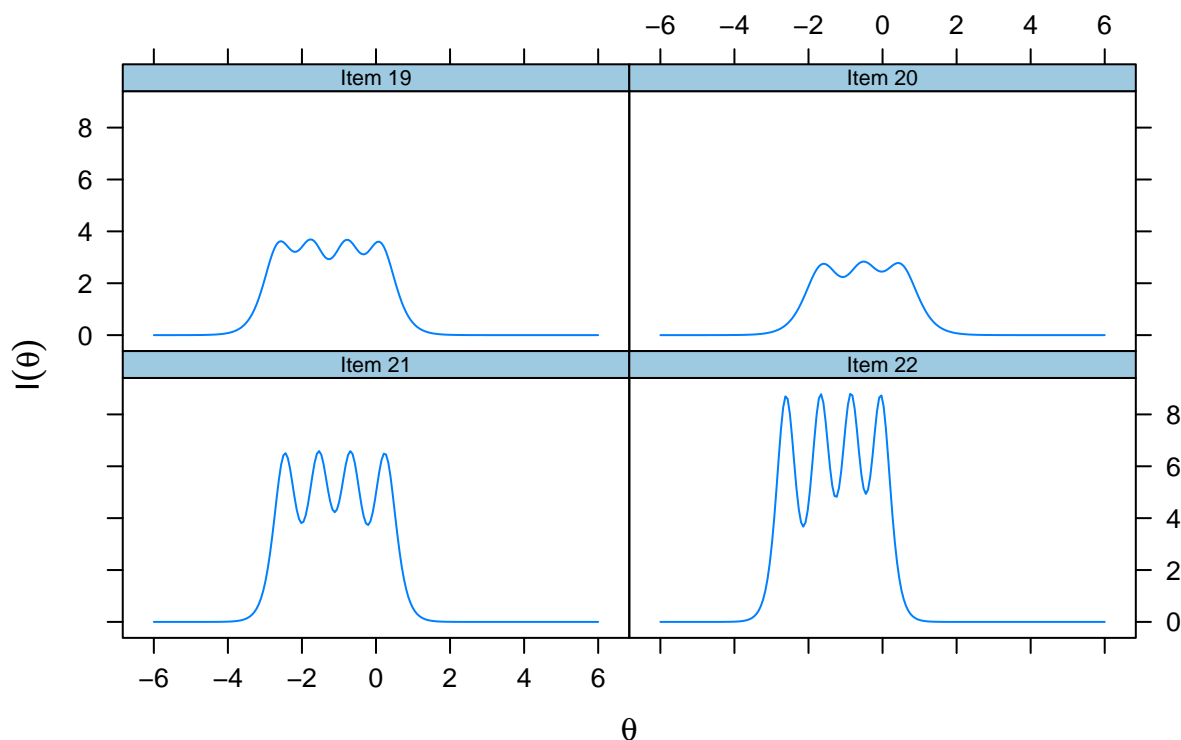


```
## [1]
## [1] Linear Regression on Latent Variable 5
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.41643 -0.58984 -0.07322  1.06733  1.27714
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -0.09137    0.10995  -0.831    0.407
## sexmale             0.04898    0.13779   0.355    0.723
## age26-35 years old  0.06055    0.16637   0.364    0.716
## age36-50 years old  0.16083    0.15265   1.054    0.293
## ageover 50  years old  0.08375    0.18476   0.453    0.651
##
## Residual standard error: 0.9388 on 249 degrees of freedom
## Multiple R-squared:  0.005736,   Adjusted R-squared:  -0.01024
## F-statistic: 0.3592 on 4 and 249 DF,  p-value: 0.8375
##
## [1] Correlation Matrix Battery 6
```

	Item 23		
Item 24	0.84		
		Item 24	
Item 25	0.62	0.65	
			Item 25
Item 26	0.70	0.67	0.79

```
0   0.1  0.2  0.3  0.4  0.5  0.6  0.7  0.8  0.9  1
```

```
## [1]
## [1] Cronbach's Alpha Battery 6
##  raw_alpha std.alpha G6(smc) average_r  S/N  ase mean   sd median_r
##      0.91      0.91    0.91      0.71 9.97 0.01 4.15 0.83     0.69
##        raw_alpha std.alpha G6(smc) average_r  S/N alpha se var.r med.r
## Item 23      0.88      0.88    0.84      0.71 7.19     0.01  0.01  0.67
## Item 24      0.88      0.88    0.84      0.70 7.17     0.01  0.01  0.70
## Item 25      0.89      0.89    0.86      0.74 8.46     0.01  0.01  0.70
## Item 26      0.88      0.88    0.85      0.71 7.19     0.01  0.01  0.65
## [1]
## [1] Graded Response Model (IRT) Battery 6
## Iteration: 1, Log-Lik: -1099.082, Max-Change: 2.22050Iteration: 2, Log-Lik: -978.976, Max-Change: 2.0
##
## Calculating information matrix...
```
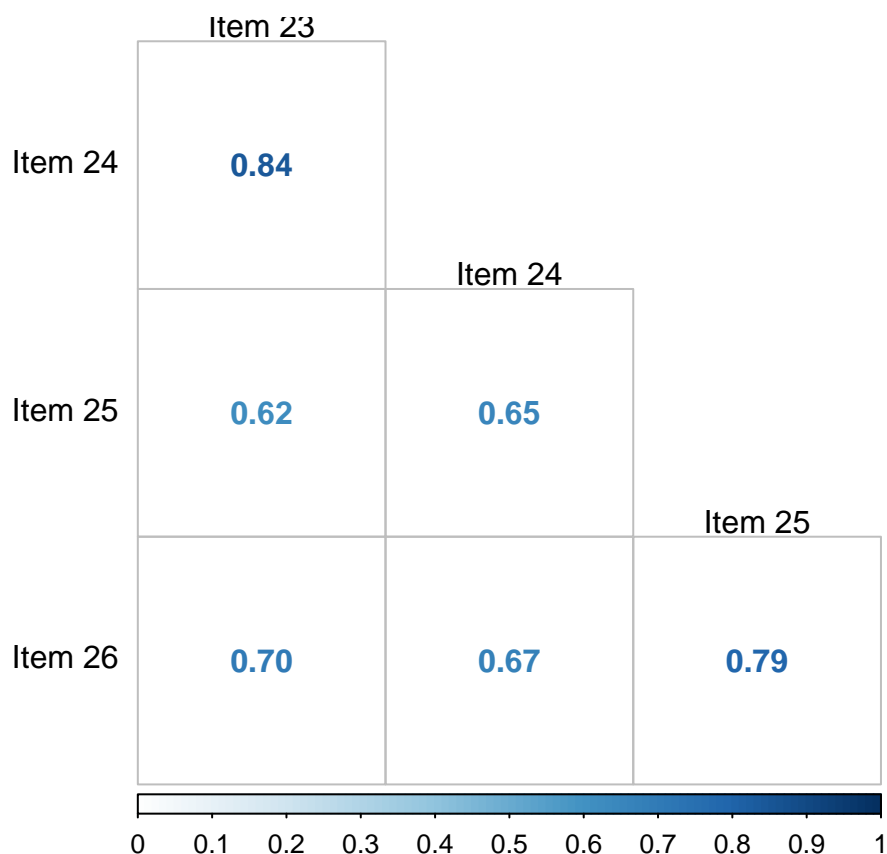
Item Probability Function Battery 6
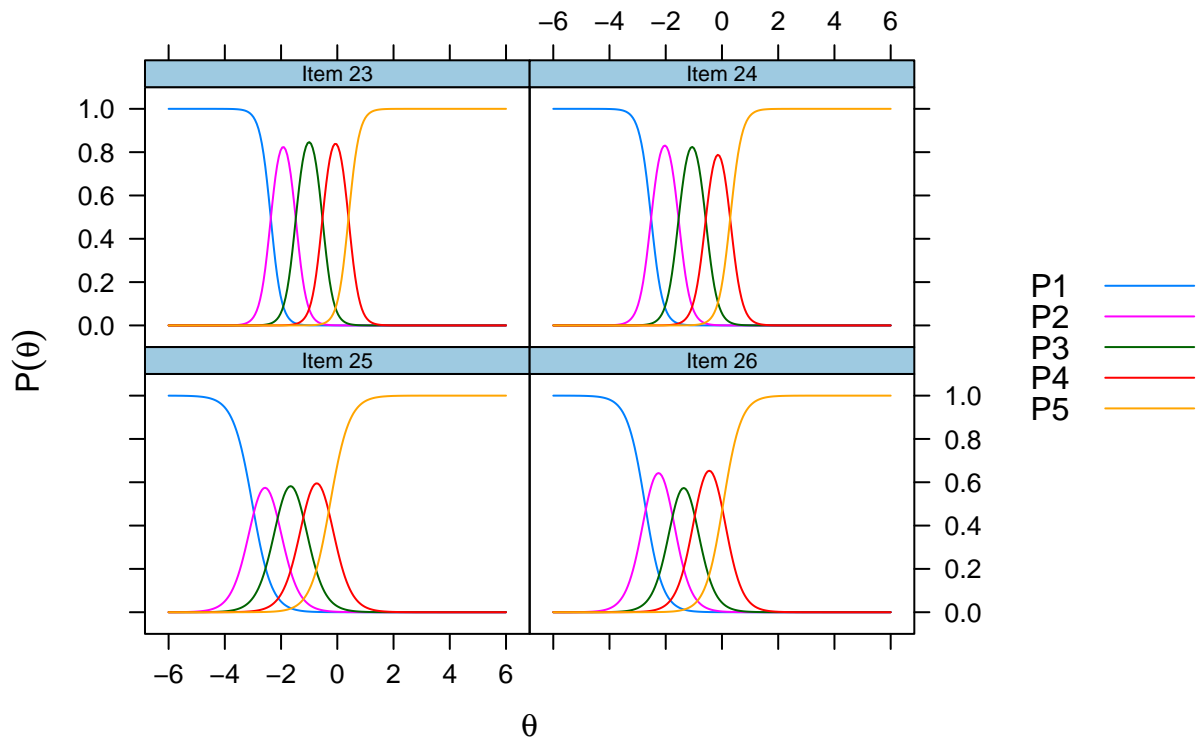
Item Information Battery 6
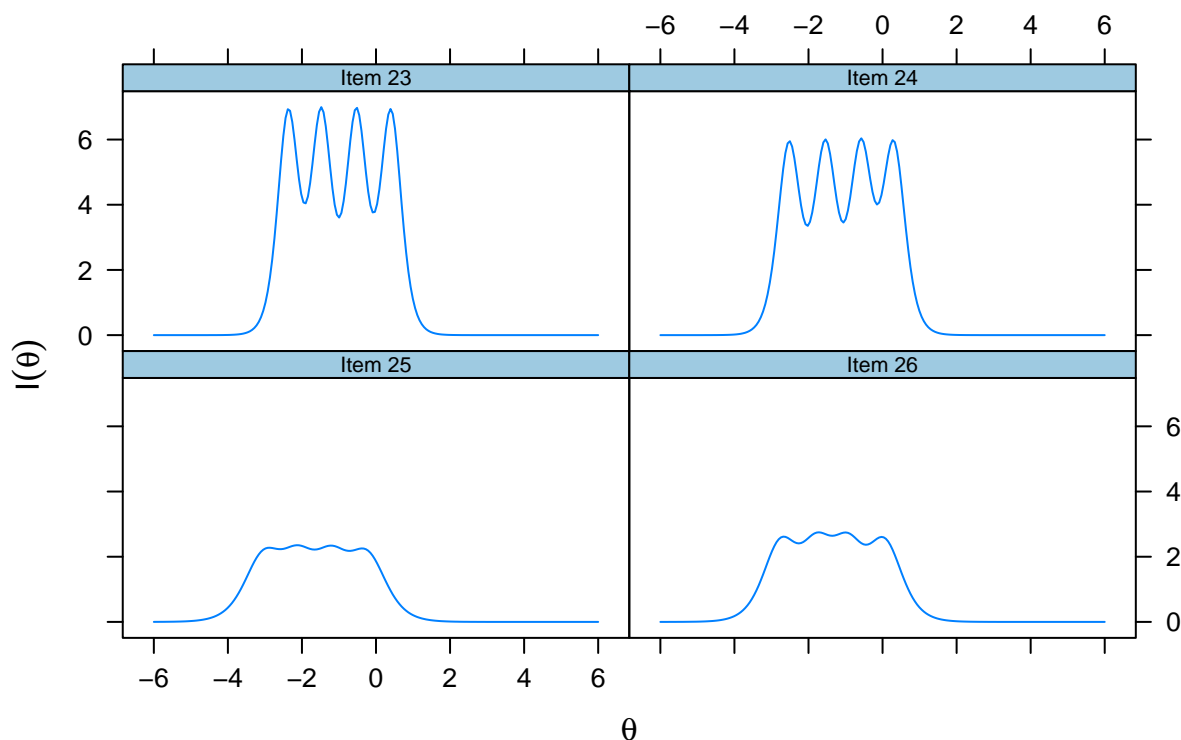

```
## [1]
## [1] Linear Regression on Latent Variable 6
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.0130 -0.5832 -0.1164  1.1079  1.3219
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         0.07119    0.10984   0.648    0.518
## sexmale            -0.03162    0.13765  -0.230    0.819
## age26-35 years old -0.10325    0.16619  -0.621    0.535
## age36-50 years old -0.03228    0.15249  -0.212    0.833
## ageover 50  years old -0.18232  0.18457  -0.988   0.324
##
## Residual standard error: 0.9378 on 249 degrees of freedom
## Multiple R-squared:  0.005367,   Adjusted R-squared:  -0.01061
## F-statistic: 0.3359 on 4 and 249 DF,  p-value: 0.8536
##
## [1] Correlation Matrix Battery 7
```
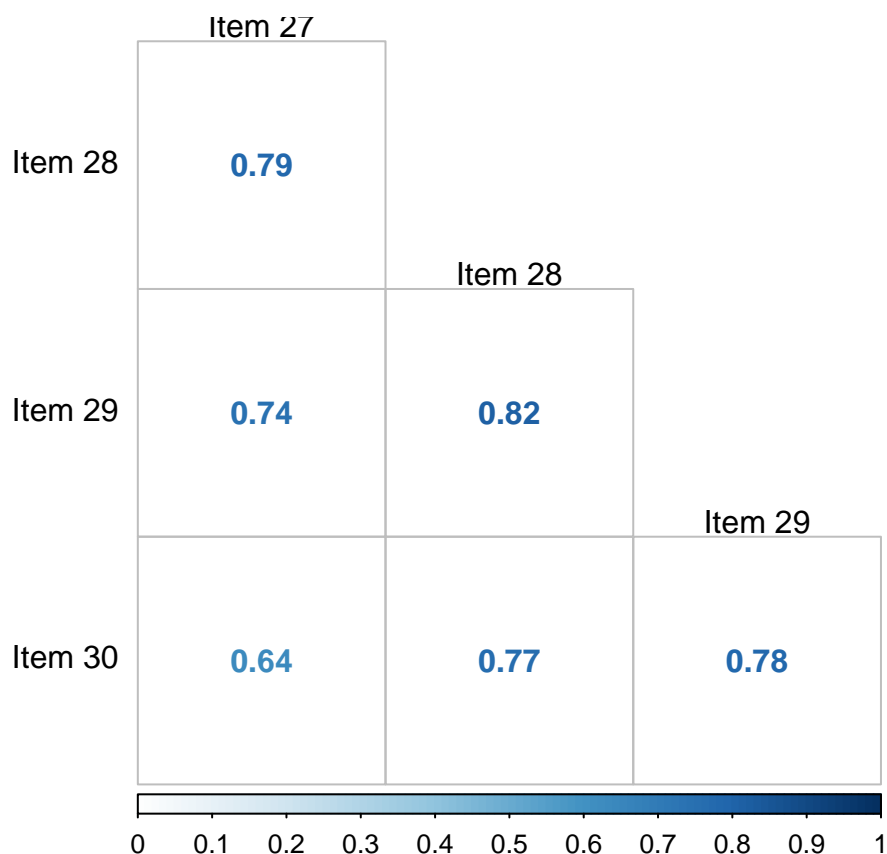
```
## [1]
## [1] Cronbach's Alpha Battery 7
##  raw_alpha std.alpha G6(smc) average_r    S/N  ase mean    sd median_r
##       0.92      0.93    0.91       0.76 12.33 0.01 4.11 0.94     0.77
##         raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 27      0.92      0.92    0.88      0.79 11.22     0.01  0.00  0.78
## Item 28      0.88      0.89    0.85      0.72  7.72     0.01  0.01  0.74
## Item 29      0.88      0.89    0.86      0.73  8.06     0.01  0.01  0.77
## Item 30      0.91      0.92    0.88      0.78 10.78     0.01  0.00  0.79
## [1]
## [1] Graded Response Model (IRT) Battery 7
## Iteration: 1, Log-Lik: -1135.482, Max-Change: 2.63677Iteration: 2, Log-Lik: -991.317, Max-Change: 3.(
##
## Calculating information matrix...
```

Item Probability Function Battery 7

Item Information Battery 7
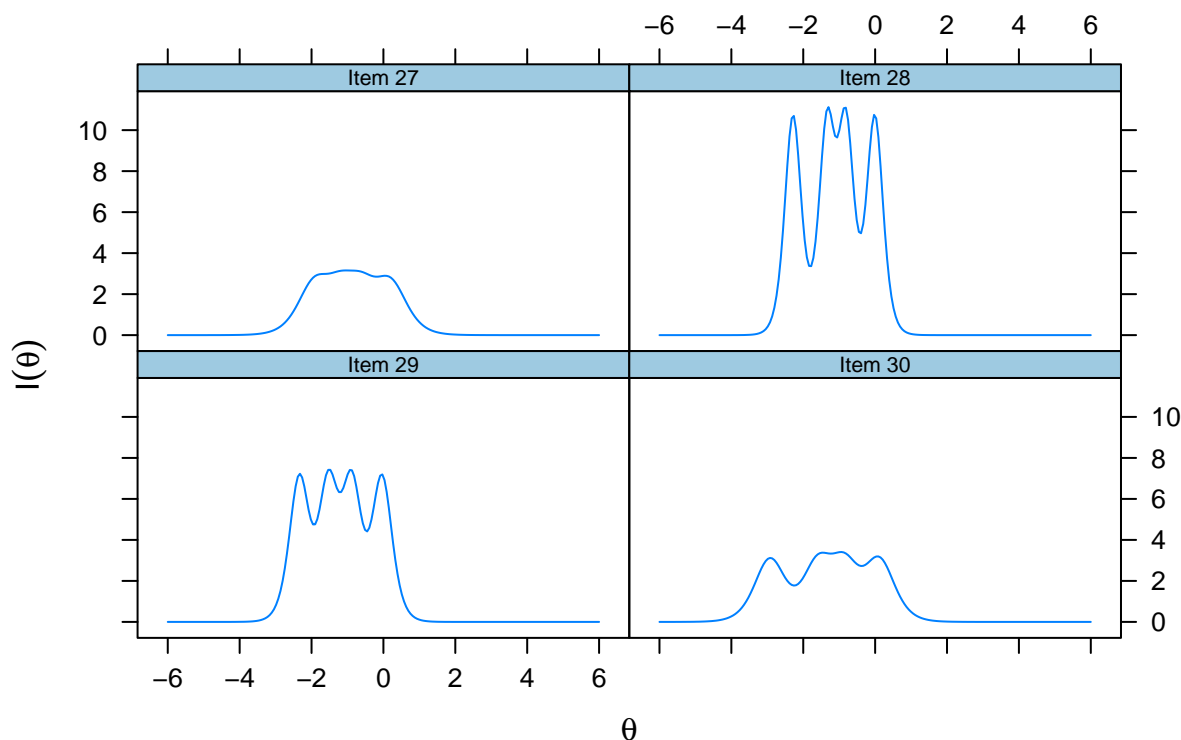

```
## [1]
## [1] Linear Regression on Latent Variable 7
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.56515 -0.54143 -0.07803  0.89410  1.24529
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -0.17992    0.10749  -1.674   0.0954 .
## sexmale              0.09624    0.13470   0.714   0.4756
## age26-35 years old   0.16469    0.16263   1.013   0.3122
## age36-50 years old   0.35119    0.14923   2.353   0.0194 *
## ageover 50  years old  0.03828    0.18062   0.212   0.8323
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9178 on 249 degrees of freedom
## Multiple R-squared:  0.02907,    Adjusted R-squared:  0.01347
## F-statistic: 1.864 on 4 and 249 DF,  p-value: 0.1173
##
## [1] Correlation Matrix Battery 8
```
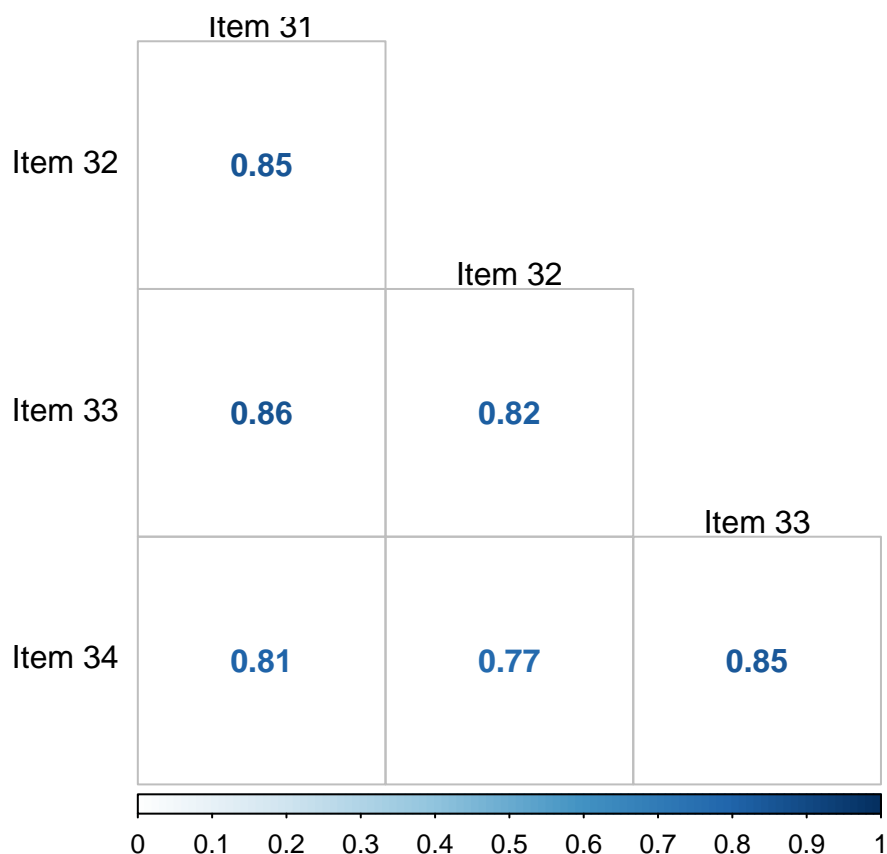
```
## [1]
## [1] Cronbach's Alpha Battery 8
##  raw_alpha std.alpha G6(smc) average_r   S/N  ase mean   sd median_r
##      0.95      0.95    0.94      0.83 19.19 0.01 4.17 0.88     0.83
##        raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 31      0.93      0.93    0.90      0.81 13.14     0.01     0  0.82
## Item 32      0.94      0.94    0.92      0.84 15.72     0.01     0  0.85
## Item 33      0.93      0.93    0.90      0.81 12.84     0.01     0  0.81
## Item 34      0.94      0.94    0.92      0.85 16.43     0.01     0  0.85
## [1]
## [1] Graded Response Model (IRT) Battery 8
## Iteration: 1, Log-Lik: -1067.168, Max-Change: 3.32754Iteration: 2, Log-Lik: -877.774, Max-Change: 4.0
##
## Calculating information matrix...
```

Item Probability Function Battery 8
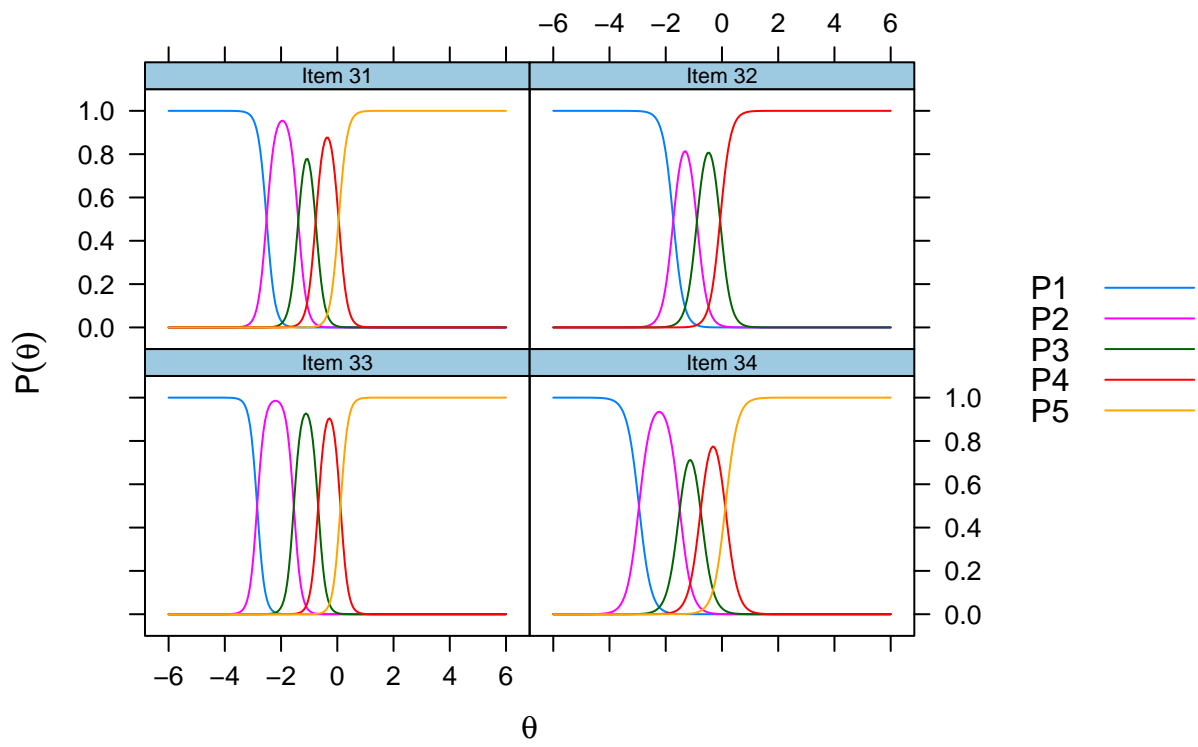
Item Information Battery 8
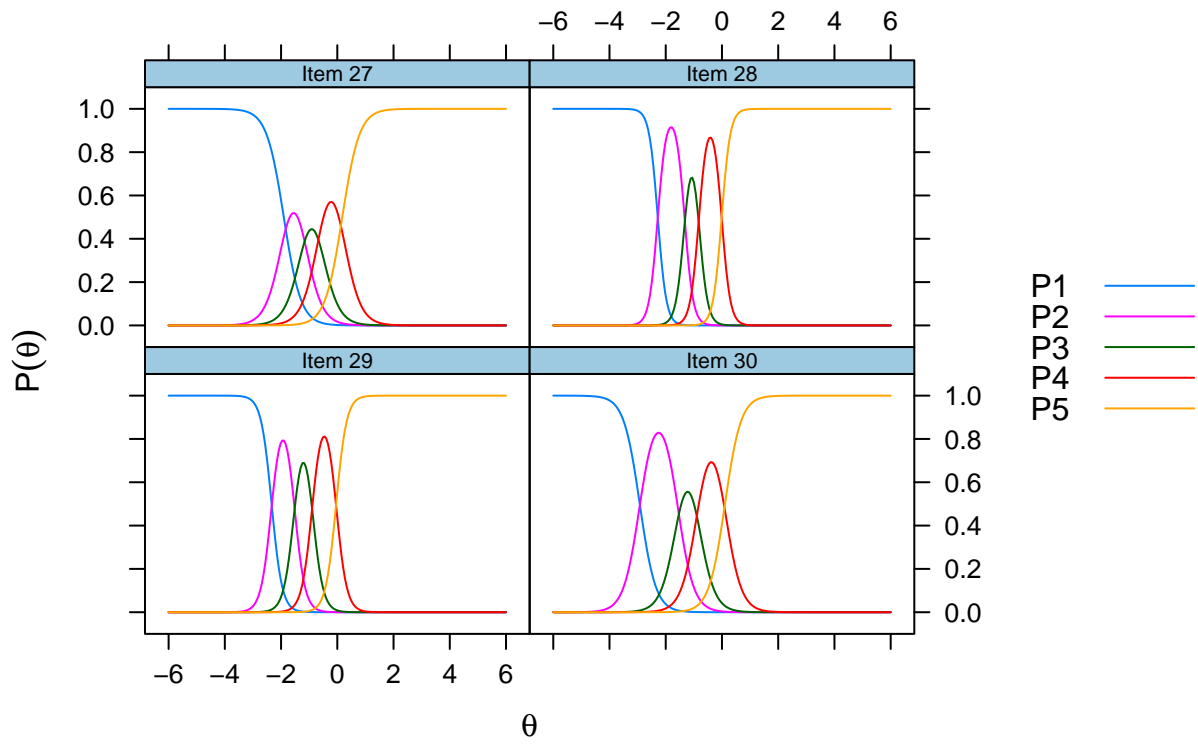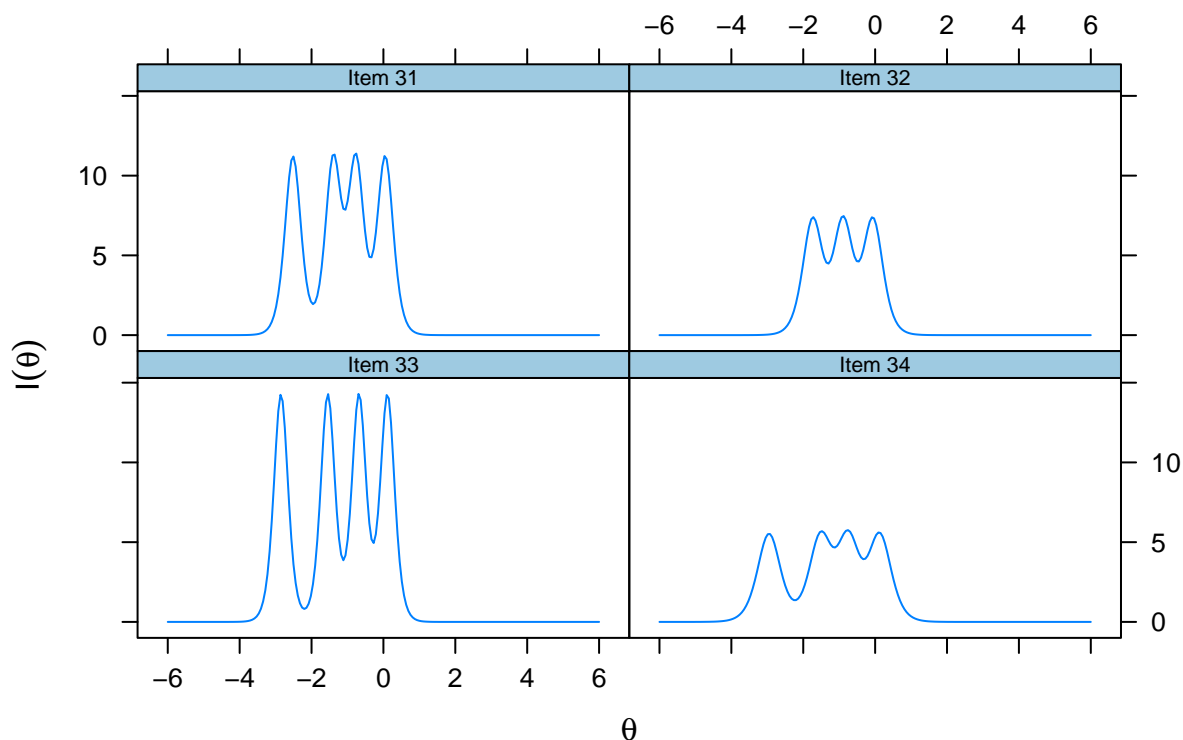


```
## [1]
## [1] Linear Regression on Latent Variable 8
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -3.10003 -0.55218 -0.07527  0.94001  1.19548
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -0.09952    0.10880  -0.915    0.361
## sexmale              0.11626    0.13635   0.853    0.395
## age26-35 years old   0.11282    0.16462   0.685    0.494
## age36-50 years old   0.17767    0.15105   1.176    0.241
## ageover 50  years old -0.07780    0.18282  -0.426    0.671
##
## Residual standard error: 0.929 on 249 degrees of freedom
## Multiple R-squared:  0.01395,    Adjusted R-squared:  -0.001889
## F-statistic: 0.8807 on 4 and 249 DF,  p-value: 0.476
```

3 Proportional Odds Model

```r
library(MASS)
for(i in 6:39){
  y<-as.factor(dataset[,i])
  x<-model.matrix(~ sex + age, data = dataset)[,-1]
  model<-polr(y~x,Hess=T)
  print(noquote("----------------------------------------------------------------------"))
  print(noquote(paste("POM Item",i-5,sep=" ")))
  print(summary_polr(model)$`Coefficients:`)
}
```

```
## [1] ----------------------------------------------------------------------
## [1] POM Item 1
##                         Value Std. Error  t value   p-value Signif.
## xsexmale              0.23478    0.25598  0.91717 3.591e-01
## xage26-35 years old   0.05259    0.31009  0.16960 8.653e-01
## xage36-50 years old   0.12778    0.28570  0.44726 6.547e-01
## xageover 50  years old -0.04077   0.36556 -0.11153 9.112e-01
## 1|2                  -2.41222    0.29064 -8.29962 1.044e-16     ***
## 2|3                  -0.64821    0.21353 -3.03575 2.399e-03      **
## 3|4                   0.49926    0.21317  2.34201 1.918e-02       *
## 4|5                   1.62636    0.23947  6.79142 1.110e-11     ***
## [1] ----------------------------------------------------------------------
## [1] POM Item 2
##                         Value Std. Error  t value   p-value Signif.
## xsexmale              0.06578    0.27112  0.24263 8.083e-01
## xage26-35 years old   0.11063    0.32066  0.34502 7.301e-01
## xage36-50 years old   0.46587    0.30217  1.54176 1.231e-01
## xageover 50  years old -0.16737   0.35894 -0.46629 6.410e-01
## 1|2                  -3.77083    0.48276 -7.81103 5.672e-15     ***
## 2|3                  -1.75453    0.25352 -6.92068 4.495e-12     ***
## 3|4                  -0.77838    0.22017 -3.53544 4.071e-04     ***
## 4|5                   0.46023    0.21483  2.14236 3.216e-02       *
## [1] ----------------------------------------------------------------------
## [1] POM Item 3
##                         Value Std. Error  t value   p-value Signif.
## xsexmale              0.09469    0.26517  0.35708 7.210e-01
## xage26-35 years old  -0.00608    0.30751 -0.01977 9.842e-01
## xage36-50 years old   0.23977    0.29013  0.82643 4.086e-01
## xageover 50  years old 0.04117    0.36363  0.11321 9.099e-01
## 1|2                  -3.09597    0.36331 -8.52164 1.573e-17     ***
## 2|3                  -1.23361    0.22557 -5.46892 4.528e-08     ***
## 3|4                  -0.02573    0.20831 -0.12353 9.017e-01
## 4|5                   1.32307    0.22820  5.79798 6.712e-09     ***
## [1] ----------------------------------------------------------------------
## [1] POM Item 4
##                         Value Std. Error  t value   p-value Signif.
## xsexmale              0.15197    0.27197  0.55879 5.763e-01
## xage26-35 years old   0.40976    0.32013  1.27998 2.006e-01
## xage36-50 years old   0.84252    0.30133  2.79605 5.173e-03      **
## xageover 50  years old 0.15118    0.35729  0.42312 6.722e-01
## 1|2                  -3.54593    0.47803 -7.41777 1.191e-13     ***
```

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## 2|3                      -1.49390   0.24408 -6.12065 9.319e-10    ***
## 3|4                      -0.25573   0.21454 -1.19202 2.333e-01
## 4|5                       0.94904   0.22323  4.25138 2.125e-05    ***
## [1] -----------------------------------------------------------------
## [1] POM Item 5
##                            Value Std. Error  t value   p-value Signif.
## xsexmale                 0.03098    0.26836  0.11543  9.081e-01
## xage26-35 years old     -0.05399    0.32456 -0.16636  8.679e-01
## xage36-50 years old      0.01467    0.29804  0.04921  9.608e-01
## xageover 50  years old  -0.59928    0.36763 -1.63013  1.031e-01
## 1|2                     -3.84119    0.45545 -8.43385  3.345e-17    ***
## 2|3                     -2.15751    0.27413 -7.87034  3.537e-15    ***
## 3|4                     -1.14738    0.23544 -4.87326  1.098e-06    ***
## 4|5                      0.22815    0.22242  1.02574  3.050e-01
## [1] -----------------------------------------------------------------
## [1] POM Item 6
##                            Value Std. Error  t value   p-value Signif.
## xsexmale                 0.07456    0.26045  0.28627  7.747e-01
## xage26-35 years old     -0.28665    0.31703 -0.90417  3.659e-01
## xage36-50 years old     -0.30531    0.29403 -1.03836  2.991e-01
## xageover 50  years old  -0.34422    0.36507 -0.94289  3.457e-01
## 1|2                     -4.63407    0.61126 -7.58117  3.425e-14    ***
## 2|3                     -1.94242    0.25870 -7.50845  5.983e-14    ***
## 3|4                     -0.75011    0.22799 -3.29013  1.001e-03     **
## 4|5                      0.59984    0.22548  2.66034  7.806e-03     **
## [1] -----------------------------------------------------------------
## [1] POM Item 7
##                            Value Std. Error  t value   p-value Signif.
## xsexmale                 0.03220    0.26908  0.11965  9.048e-01
## xage26-35 years old      0.05693    0.32388  0.17576  8.605e-01
## xage36-50 years old      0.26601    0.29550  0.90020  3.680e-01
## xageover 50  years old   0.23668    0.35882  0.65961  5.095e-01
## 1|2                     -4.28987    0.60538 -7.08623  1.378e-12    ***
## 2|3                     -2.07646    0.27113 -7.65856  1.880e-14    ***
## 3|4                     -0.65421    0.21879 -2.99011  2.789e-03     **
## 4|5                      0.52767    0.21770  2.42385  1.536e-02      *
## [1] -----------------------------------------------------------------
## [1] POM Item 8
##                            Value Std. Error  t value   p-value Signif.
## xsexmale                 0.15638    0.27199  0.57495  5.653e-01
## xage26-35 years old      0.11333    0.31908  0.35516  7.225e-01
## xage36-50 years old      0.25635    0.29736  0.86208  3.886e-01
## xageover 50  years old   0.01532    0.37109  0.04127  9.671e-01
## 1|2                     -4.28508    0.60627 -7.06791  1.573e-12    ***
## 2|3                     -2.49189    0.30546 -8.15777  3.413e-16    ***
## 3|4                     -0.86020    0.22570 -3.81118  1.383e-04    ***
## 4|5                      0.48517    0.22075  2.19777  2.797e-02      *
## [1] -----------------------------------------------------------------
## [1] POM Item 9
##                            Value Std. Error  t value   p-value Signif.
## xsexmale                -0.07733    0.25861 -0.29900  7.649e-01
## xage26-35 years old     -0.24538    0.30542 -0.80341  4.217e-01
## xage36-50 years old     -0.09239    0.28969 -0.31893  7.498e-01
## xageover 50  years old  -0.21044    0.35834 -0.58727  5.570e-01
```

```
## 1|2                       -1.76228   0.24394 -7.22426 5.038e-13     ***
## 2|3                       -0.55604   0.21464 -2.59054 9.583e-03      **
## 3|4                        0.64189   0.21481  2.98810 2.807e-03      **
## 4|5                        1.80466   0.25099  7.19001 6.479e-13     ***
## [1] ------------------------------------------------------------------
## [1] POM Item 10
##                           Value Std. Error  t value   p-value Signif.
## xsexmale                -0.09011   0.26294 -0.34269 7.318e-01
## xage26-35 years old     -0.61282   0.31898 -1.92116 5.471e-02       .
## xage36-50 years old     -0.36679   0.29278 -1.25278 2.103e-01
## xageover 50  years old  -1.28197   0.36981 -3.46655 5.272e-04     ***
## 1|2                     -3.08869   0.31488 -9.80906 1.029e-22     ***
## 2|3                     -1.50785   0.24043 -6.27161 3.573e-10     ***
## 3|4                     -0.06194   0.22175 -0.27933 7.800e-01
## 4|5                      1.19071   0.23908  4.98039 6.346e-07     ***
## [1] ------------------------------------------------------------------
## [1] POM Item 11
##                           Value Std. Error  t value   p-value Signif.
## xsexmale                 0.11134   0.26454  0.42088 6.738e-01
## xage26-35 years old     -0.24838   0.31446 -0.78986 4.296e-01
## xage36-50 years old      0.00563   0.28797  0.01954 9.844e-01
## xageover 50  years old  -0.58826   0.36678 -1.60385 1.087e-01
## 1|2                     -2.98422   0.33031 -9.03452 1.647e-19     ***
## 2|3                     -1.17177   0.22858 -5.12638 2.954e-07     ***
## 3|4                      0.00368   0.21364  0.01721 9.863e-01
## 4|5                      1.55021   0.24061  6.44279 1.173e-10     ***
## [1] ------------------------------------------------------------------
## [1] POM Item 12
##                           Value Std. Error  t value   p-value Signif.
## xsexmale                 0.13069   0.26219  0.49845 6.182e-01
## xage26-35 years old     -0.27253   0.31641 -0.86131 3.891e-01
## xage36-50 years old     -0.20319   0.29083 -0.69868 4.848e-01
## xageover 50  years old  -0.60899   0.36352 -1.67525 9.389e-02       .
## 1|2                     -3.12502   0.34112 -9.16099 5.142e-20     ***
## 2|3                     -1.48374   0.24017 -6.17779 6.501e-10     ***
## 3|4                     -0.02951   0.21958 -0.13438 8.931e-01
## 4|5                      1.27852   0.23643  5.40762 6.387e-08     ***
## [1] ------------------------------------------------------------------
## [1] POM Item 13
##                           Value Std. Error  t value   p-value Signif.
## xsexmale                 0.16111   0.26264  0.61341 5.396e-01
## xage26-35 years old     -0.31478   0.31484 -0.99980 3.174e-01
## xage36-50 years old     -0.19472   0.29040 -0.67052 5.025e-01
## xageover 50  years old  -0.64452   0.36684 -1.75692 7.893e-02       .
## 1|2                     -2.91273   0.31903 -9.12985 6.859e-20     ***
## 2|3                     -1.44185   0.23859 -6.04322 1.511e-09     ***
## 3|4                     -0.10938   0.21961 -0.49807 6.184e-01
## 4|5                      1.33001   0.23747  5.60079 2.134e-08     ***
## [1] ------------------------------------------------------------------
## [1] POM Item 14
##                           Value Std. Error  t value   p-value Signif.
## xsexmale                 0.07004   0.26450  0.26479 7.912e-01
## xage26-35 years old     -0.42630   0.30792 -1.38446 1.662e-01
## xage36-50 years old     -0.16907   0.28666 -0.58979 5.553e-01
```

```
## xageover 50  years old -0.21286    0.36364 -0.58537 5.583e-01
## 1|2                     -2.18265    0.26286 -8.30345 1.011e-16      ***
## 2|3                     -0.90911    0.21807 -4.16889 3.061e-05      ***
## 3|4                      0.26939    0.21173  1.27233 2.033e-01
## 4|5                      1.74587    0.25032  6.97464 3.067e-12      ***
## [1] ------------------------------------------------------------------
## [1] POM Item 15
##                         Value Std. Error  t value   p-value Signif.
## xsexmale               -0.25025    0.27202 -0.91998 3.576e-01
## xage26-35 years old     0.53366    0.31892  1.67332 9.426e-02       .
## xage36-50 years old     0.14897    0.28899  0.51549 6.062e-01
## xageover 50  years old -0.36362    0.36826 -0.98740 3.234e-01
## 1|2                     -3.09244    0.35567 -8.69465 3.479e-18      ***
## 2|3                     -1.65079    0.24278 -6.79960 1.049e-11      ***
## 3|4                     -0.49875    0.21419 -2.32850 1.989e-02       *
## 4|5                      0.90271    0.22238  4.05932 4.922e-05      ***
## [1] ------------------------------------------------------------------
## [1] POM Item 16
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.08363    0.26255  0.31851 7.501e-01
## xage26-35 years old     0.48538    0.31313  1.55010 1.211e-01
## xage36-50 years old    -0.06993    0.28323 -0.24690 8.050e-01
## xageover 50  years old -0.25340    0.36842 -0.68780 4.916e-01
## 1|2                     -2.47530    0.29133 -8.49668 1.951e-17      ***
## 2|3                     -1.03733    0.21789 -4.76089 1.927e-06      ***
## 3|4                      0.00869    0.20667  0.04205 9.665e-01
## 4|5                      1.13672    0.22239  5.11145 3.197e-07      ***
## [1] ------------------------------------------------------------------
## [1] POM Item 17
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.11714    0.26511  0.44185 6.586e-01
## xage26-35 years old     0.37432    0.31587  1.18503 2.360e-01
## xage36-50 years old     0.10041    0.28667  0.35028 7.261e-01
## xageover 50  years old  0.05622    0.37051  0.15175 8.794e-01
## 1|2                     -3.41987    0.41857 -8.17041 3.073e-16      ***
## 2|3                     -1.52764    0.24090 -6.34149 2.276e-10      ***
## 3|4                     -0.16286    0.21434 -0.75982 4.474e-01
## 4|5                      1.20549    0.22874  5.27009 1.364e-07      ***
## [1] ------------------------------------------------------------------
## [1] POM Item 18
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.13776    0.27039  0.50948 6.104e-01
## xage26-35 years old     0.33978    0.31438  1.08082 2.798e-01
## xage36-50 years old    -0.19446    0.28701 -0.67754 4.981e-01
## xageover 50  years old -0.43136    0.36111 -1.19451 2.323e-01
## 1|2                     -3.14470    0.35591 -8.83562 9.954e-19      ***
## 2|3                     -1.36764    0.23292 -5.87182 4.310e-09      ***
## 3|4                     -0.01584    0.21236 -0.07458 9.405e-01
## 4|5                      1.43069    0.23486  6.09176 1.117e-09      ***
## [1] ------------------------------------------------------------------
## [1] POM Item 19
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.19295    0.28003  0.68903 4.908e-01
## xage26-35 years old     0.18416    0.32764  0.56208 5.741e-01
```

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## xage36-50 years old    0.21076    0.30427  0.69268 4.885e-01
## xageover 50  years old -0.17681    0.36965 -0.47830 6.324e-01
## 1|2                    -4.72029    0.73234 -6.44545 1.153e-10    ***
## 2|3                    -2.64812    0.32157 -8.23501 1.795e-16    ***
## 3|4                    -1.02634    0.23409 -4.38439 1.163e-05    ***
## 4|5                     0.30533    0.22383  1.36415 1.725e-01
## [1] ------------------------------------------------------------
## [1] POM Item 20
##                        Value Std. Error  t value   p-value Signif.
## xsexmale               0.09217    0.26881  0.34290 7.317e-01
## xage26-35 years old    0.04888    0.32141  0.15207 8.791e-01
## xage36-50 years old    0.21351    0.29223  0.73064 4.650e-01
## xageover 50  years old 0.20789    0.37744  0.55078 5.818e-01
## 2|3                    -2.32779    0.29161 -7.98251 1.434e-15    ***
## 3|4                    -0.56946    0.22421 -2.53985 1.109e-02      *
## 4|5                     0.84495    0.22779  3.70942 2.077e-04    ***
## [1] ------------------------------------------------------------
## [1] POM Item 21
##                        Value Std. Error  t value   p-value Signif.
## xsexmale              -0.07821    0.27079 -0.28880 7.727e-01
## xage26-35 years old    0.20983    0.32403  0.64755 5.173e-01
## xage36-50 years old    0.40503    0.29607  1.36803 1.713e-01
## xageover 50  years old 0.24414    0.36822  0.66304 5.073e-01
## 1|2                    -4.65221    0.73018 -6.37134 1.874e-10    ***
## 2|3                    -2.32963    0.29347 -7.93814 2.052e-15    ***
## 3|4                    -0.85760    0.22412 -3.82646 1.300e-04    ***
## 4|5                     0.59635    0.22041  2.70559 6.818e-03     **
## [1] ------------------------------------------------------------
## [1] POM Item 22
##                        Value Std. Error  t value   p-value Signif.
## xsexmale               0.01016    0.28042  0.03622 9.711e-01
## xage26-35 years old    0.21438    0.33443  0.64104 5.215e-01
## xage36-50 years old    0.43711    0.30569  1.42989 1.527e-01
## xageover 50  years old 0.18458    0.36637  0.50380 6.144e-01
## 1|2                    -5.32744    1.01669 -5.24001 1.606e-07    ***
## 2|3                    -2.63365    0.32540 -8.09371 5.787e-16    ***
## 3|4                    -1.12472    0.23208 -4.84627 1.258e-06    ***
## 4|5                     0.18408    0.21819  0.84364 3.989e-01
## [1] ------------------------------------------------------------
## [1] POM Item 23
##                        Value Std. Error  t value   p-value Signif.
## xsexmale              -0.27300    0.27005 -1.01093 3.120e-01
## xage26-35 years old   -0.32476    0.32166 -1.00964 3.127e-01
## xage36-50 years old   -0.02820    0.29330 -0.09615 9.234e-01
## xageover 50  years old -0.38797    0.38173 -1.01635 3.095e-01
## 1|2                    -4.37423    0.53999 -8.10052 5.472e-16    ***
## 2|3                    -2.69396    0.30160 -8.93232 4.172e-19    ***
## 3|4                    -1.08529    0.23008 -4.71710 2.392e-06    ***
## 4|5                     0.45392    0.22081  2.05574 3.981e-02      *
## [1] ------------------------------------------------------------
## [1] POM Item 24
##                        Value Std. Error  t value   p-value Signif.
## xsexmale               0.07898    0.27430  0.28794 7.734e-01
## xage26-35 years old   -0.24240    0.32500 -0.74584 4.558e-01
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## xage36-50 years old   -0.43884   0.29415 -1.49192 1.357e-01
## xageover 50  years old -0.52967   0.37749 -1.40313 1.606e-01
## 1|2                    -4.70537   0.61295 -7.67657 1.634e-14    ***
## 2|3                    -2.78951   0.30734 -9.07643 1.122e-19    ***
## 3|4                    -1.17366   0.23320 -5.03279 4.834e-07    ***
## 4|5                     0.22741   0.22103  1.02884 3.036e-01
## [1] ------------------------------------------------------------
## [1] POM Item 25
##                        Value Std. Error  t value   p-value Signif.
## xsexmale                0.05404   0.30205  0.17891 8.580e-01
## xage26-35 years old     0.09637   0.33738  0.28565 7.751e-01
## xage36-50 years old     0.61971   0.32745  1.89257 5.842e-02      .
## xageover 50  years old -0.02165   0.38398 -0.05638 9.550e-01
## 1|2                    -4.64215   0.73175 -6.34391 2.240e-10    ***
## 2|3                    -2.99885   0.36853 -8.13742 4.038e-16    ***
## 3|4                    -1.60524   0.25090 -6.39804 1.574e-10    ***
## 4|5                    -0.17036   0.22043 -0.77282 4.396e-01
## [1] ------------------------------------------------------------
## [1] POM Item 26
##                        Value Std. Error  t value   p-value Signif.
## xsexmale               -0.07534   0.28380 -0.26547 7.906e-01
## xage26-35 years old     0.10804   0.32859  0.32880 7.423e-01
## xage36-50 years old     0.48600   0.30550  1.59081 1.117e-01
## xageover 50  years old -0.11854   0.36914 -0.32113 7.481e-01
## 1|2                    -4.31101   0.60618 -7.11180 1.145e-12    ***
## 2|3                    -2.58299   0.30949 -8.34604 7.059e-17    ***
## 3|4                    -1.31257   0.22991 -5.70901 1.136e-08    ***
## 4|5                     0.19866   0.21251  0.93479 3.499e-01
## [1] ------------------------------------------------------------
## [1] POM Item 27
##                        Value Std. Error  t value   p-value Signif.
## xsexmale                0.15219   0.27361  0.55621 5.781e-01
## xage26-35 years old     0.51869   0.31829  1.62961 1.032e-01
## xage36-50 years old     0.85697   0.30158  2.84161 4.489e-03     **
## xageover 50  years old  0.29136   0.36731  0.79322 4.276e-01
## 1|2                    -2.58688   0.33433 -7.73756 1.013e-14    ***
## 2|3                    -1.27640   0.23602 -5.40793 6.376e-08    ***
## 3|4                    -0.34849   0.21404 -1.62819 1.035e-01
## 4|5                     0.78017   0.21935  3.55681 3.754e-04    ***
## [1] ------------------------------------------------------------
## [1] POM Item 28
##                        Value Std. Error  t value   p-value Signif.
## xsexmale                0.16165   0.28144  0.57438 5.657e-01
## xage26-35 years old     0.18804   0.32231  0.58340 5.596e-01
## xage36-50 years old     0.66727   0.31014  2.15153 3.143e-02      *
## xageover 50  years old  0.04883   0.36883  0.13239 8.947e-01
## 1|2                    -4.16311   0.60388 -6.89390 5.428e-12    ***
## 2|3                    -1.90093   0.26633 -7.13740 9.511e-13    ***
## 3|4                    -0.99082   0.22635 -4.37739 1.201e-05    ***
## 4|5                     0.32421   0.21597  1.50116 1.333e-01
## [1] ------------------------------------------------------------
## [1] POM Item 29
##                        Value Std. Error  t value   p-value Signif.
## xsexmale                0.23081   0.29068  0.79401 4.272e-01
```

```
## xage26-35 years old     0.36532    0.32725  1.11634 2.643e-01
## xage36-50 years old     0.73144    0.31213  2.34338 1.911e-02          *
## xageover 50  years old  0.10292    0.37073  0.27762 7.813e-01
## 1|2                    -4.08859    0.60303 -6.78011 1.201e-11      ***
## 2|3                    -2.17708    0.28764 -7.56881 3.767e-14      ***
## 3|4                    -1.06495    0.22510 -4.73096 2.235e-06      ***
## 4|5                     0.34324    0.21440  1.60089 1.094e-01
## [1] --------------------------------------------------------------------
## [1] POM Item 30
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.06049    0.27781  0.21775 8.276e-01
## xage26-35 years old     0.06237    0.32158  0.19396 8.462e-01
## xage36-50 years old     0.38078    0.30372  1.25373 2.099e-01
## xageover 50  years old -0.20553    0.37279 -0.55133 5.814e-01
## 1|2                    -5.43767    1.01735 -5.34494 9.045e-08      ***
## 2|3                    -2.36133    0.29170 -8.09508 5.723e-16      ***
## 3|4                    -1.18186    0.22942 -5.15155 2.583e-07      ***
## 4|5                     0.29182    0.21512  1.35654 1.749e-01
## [1] --------------------------------------------------------------------
## [1] POM Item 31
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.05997    0.27569  0.21754 8.278e-01
## xage26-35 years old     0.41898    0.33139  1.26429 2.061e-01
## xage36-50 years old     0.63871    0.30670  2.08252 3.729e-02          *
## xageover 50  years old -0.11239    0.36029 -0.31195 7.551e-01
## 1|2                    -4.59020    0.72981 -6.28959 3.183e-10      ***
## 2|3                    -2.05755    0.27620 -7.44943 9.374e-14      ***
## 3|4                    -1.00118    0.22809 -4.38941 1.137e-05      ***
## 4|5                     0.42137    0.22035  1.91222 5.585e-02          .
## [1] --------------------------------------------------------------------
## [1] POM Item 32
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.07454    0.28250  0.26385 7.919e-01
## xage26-35 years old     0.20226    0.33588  0.60218 5.471e-01
## xage36-50 years old     0.44573    0.31076  1.43434 1.515e-01
## xageover 50  years old -0.12862    0.36590 -0.35152 7.252e-01
## 2|3                    -2.84406    0.34616 -8.21612 2.102e-16      ***
## 3|4                    -1.28890    0.24134 -5.34056 9.266e-08      ***
## 4|5                     0.12162    0.22285  0.54577 5.852e-01
## [1] --------------------------------------------------------------------
## [1] POM Item 33
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.25908    0.27360  0.94690 3.437e-01
## xage26-35 years old     0.02375    0.33142  0.07166 9.429e-01
## xage36-50 years old     0.23349    0.29810  0.78325 4.335e-01
## xageover 50  years old -0.23851    0.36256 -0.65786 5.106e-01
## 1|2                    -5.44793    1.01654 -5.35928 8.355e-08      ***
## 2|3                    -2.54229    0.30660 -8.29178 1.116e-16      ***
## 3|4                    -1.02832    0.22723 -4.52540 6.028e-06      ***
## 4|5                     0.33504    0.21781  1.53825 1.240e-01
## [1] --------------------------------------------------------------------
## [1] POM Item 34
##                         Value Std. Error  t value   p-value Signif.
## xsexmale                0.22147    0.27372  0.80912 4.184e-01
```

```
## xage26-35 years old   -0.11712   0.32598 -0.35927 7.194e-01
## xage36-50 years old    0.03681   0.29855  0.12329 9.019e-01
## xageover 50  years old -0.29086   0.37238 -0.78110 4.347e-01
## 1|2                    -5.54692   1.01483 -5.46585 4.607e-08    ***
## 2|3                    -2.46965   0.29439 -8.38904 4.901e-17    ***
## 3|4                    -1.19812   0.22996 -5.21003 1.888e-07    ***
## 4|5                     0.22434   0.21581  1.03952 2.986e-01
```

4 IRT All in One

```
alpha<-alpha(dataset[,6:39])
round(alpha$total,2)
```

```
##  raw_alpha std.alpha G6(smc) average_r   S/N ase mean   sd median_r
##       0.97      0.97    0.99       0.51 35.97   0 3.83 0.76      0.5
```

```
round(alpha$alpha.drop,2)
```

```
##          raw_alpha std.alpha G6(smc) average_r   S/N alpha se var.r med.r
## Item 1       0.97      0.97    0.99       0.52 36.08       0  0.01  0.50
## Item 2       0.97      0.97    0.99       0.52 35.76       0  0.01  0.50
## Item 3       0.97      0.97    0.99       0.52 35.25       0  0.01  0.50
## Item 4       0.97      0.97    0.99       0.52 35.37       0  0.01  0.50
## Item 5       0.97      0.97    0.99       0.51 34.82       0  0.01  0.49
## Item 6       0.97      0.97    0.99       0.51 34.94       0  0.01  0.50
## Item 7       0.97      0.97    0.99       0.51 34.69       0  0.01  0.49
## Item 8       0.97      0.97    0.99       0.51 34.50       0  0.01  0.49
## Item 9       0.97      0.97    0.99       0.52 35.81       0  0.01  0.50
## Item 10      0.97      0.97    0.99       0.52 35.04       0  0.01  0.50
## Item 11      0.97      0.97    0.99       0.51 34.84       0  0.01  0.50
## Item 12      0.97      0.97    0.99       0.52 35.07       0  0.01  0.50
## Item 13      0.97      0.97    0.99       0.51 34.95       0  0.01  0.50
## Item 14      0.97      0.97    0.99       0.52 35.37       0  0.01  0.50
## Item 15      0.97      0.97    0.99       0.52 35.32       0  0.01  0.50
## Item 16      0.97      0.97    0.99       0.52 35.36       0  0.01  0.50
## Item 17      0.97      0.97    0.99       0.52 35.07       0  0.01  0.50
## Item 18      0.97      0.97    0.99       0.52 35.41       0  0.01  0.50
## Item 19      0.97      0.97    0.99       0.51 34.60       0  0.01  0.49
## Item 20      0.97      0.97    0.99       0.51 34.41       0  0.01  0.49
## Item 21      0.97      0.97    0.99       0.51 34.60       0  0.01  0.49
## Item 22      0.97      0.97    0.99       0.51 34.59       0  0.01  0.49
## Item 23      0.97      0.97    0.99       0.51 34.45       0  0.01  0.49
## Item 24      0.97      0.97    0.99       0.51 34.49       0  0.01  0.49
## Item 25      0.97      0.97    0.99       0.52 35.07       0  0.01  0.50
## Item 26      0.97      0.97    0.99       0.51 34.72       0  0.01  0.50
## Item 27      0.97      0.97    0.99       0.51 34.96       0  0.01  0.50
## Item 28      0.97      0.97    0.99       0.51 34.58       0  0.01  0.49
## Item 29      0.97      0.97    0.99       0.51 34.44       0  0.01  0.50
## Item 30      0.97      0.97    0.99       0.51 34.50       0  0.01  0.49
## Item 31      0.97      0.97    0.99       0.51 34.45       0  0.01  0.49
## Item 32      0.97      0.97    0.99       0.51 34.64       0  0.01  0.50
## Item 33      0.97      0.97    0.99       0.51 34.49       0  0.01  0.49
## Item 34      0.97      0.97    0.99       0.51 34.45       0  0.01  0.49
```

```
model<-mirt(data=dataset[,6:39],1,itemtype="graded",SE=T)
```
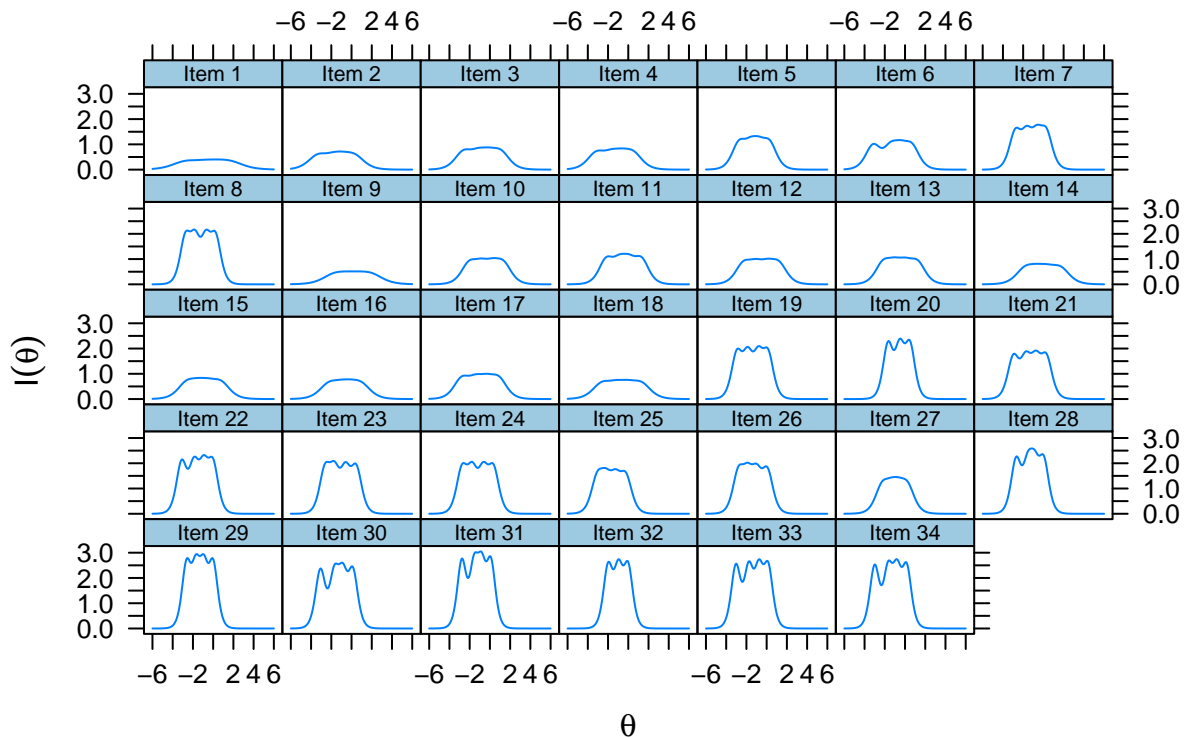
```
## Iteration: 1, Log-Lik: -9445.082, Max-Change: 3.42119Iteration: 2, Log-Lik: -8977.972, Max-Change: 1
##
## Calculating information matrix...
```

```
plot(model,type="trace",as.table=T, main="Item Probability Function")
```

Item Probability Function
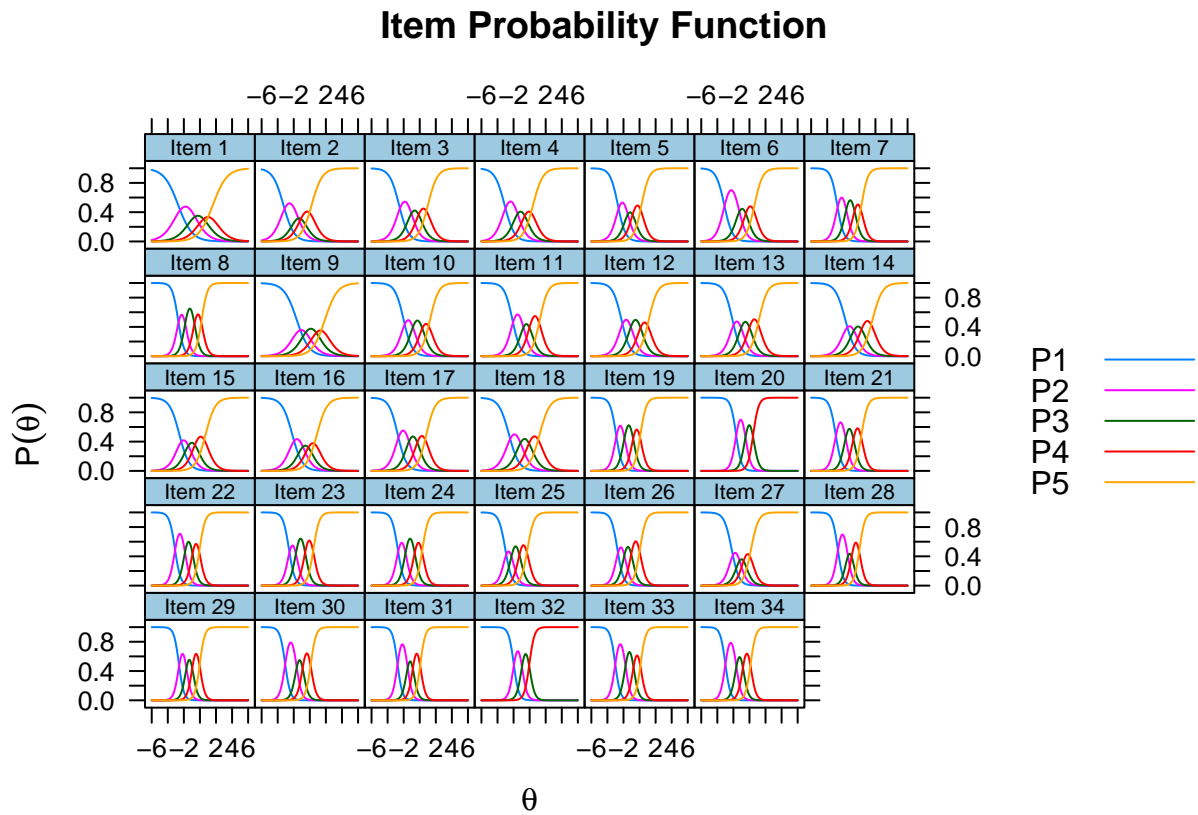

```
plot(model,type="infotrace",as.table=T,main="Item Information")
```

Item Information


```r
theta<-as.numeric(fscores(model))
data<-cbind(dataset[,4:5],theta)
modello<-lm(theta~.,data=data)
print(summary(modello))
```

```
##
## Call:
## lm(formula = theta ~ ., data = data)
##
## Residuals:
##      Min       1Q    Median       3Q      Max
## -2.44520 -0.58526 -0.00578  0.65228  2.67105
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -0.05903    0.11603  -0.509    0.611
## sexmale                0.12849    0.14540   0.884    0.378
## age26-35 years old     0.01747    0.17555   0.100    0.921
## age36-50 years old     0.09803    0.16108   0.609    0.543
## ageover 50  years old -0.07365    0.19497  -0.378    0.706
##
## Residual standard error: 0.9907 on 249 degrees of freedom
## Multiple R-squared:  0.006903,   Adjusted R-squared:  -0.00905
## F-statistic: 0.4327 on 4 and 249 DF,  p-value: 0.7849
```

5 Linear Regression on Score of Items (All)

```
score<-rowMeans(dataset[,6:39])
data<-cbind(dataset[,4:5],score)
model<-lm(score~.,data=data)
summary(model)
```

```
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##     Min      1Q   Median      3Q     Max
## -2.08115 -0.39679  0.08702  0.58702  1.31527
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)           3.80856    0.08913  42.732   <2e-16 ***
## sexmale               0.05052    0.11169   0.452    0.651
## age26-35 years old    0.02373    0.13485   0.176    0.860
## age36-50 years old    0.07501    0.12374   0.606    0.545
## ageover 50  years old -0.15324    0.14977  -1.023    0.307
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.761 on 249 degrees of freedom
## Multiple R-squared:  0.01053,    Adjusted R-squared:  -0.005369
## F-statistic: 0.6622 on 4 and 249 DF,  p-value: 0.6188
```

6   Linear Regression on Score of Items (Batteries)

```
for(i in 1:8){
  score<-rowMeans(dataset[,batteries[[i]]])
  data<-cbind(dataset[,4:5],score)
  model<-lm(score~.,data=data)
  print(summary(model))
}
```

```
## 
## Call:
## lm(formula = score ~ ., data = data)
## 
## Residuals:
##     Min      1Q  Median      3Q     Max 
## -2.3422 -0.6140  0.1387  0.7107  1.5127 
## 
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)    
## (Intercept)           3.53935    0.10758  32.900   <2e-16 ***
## sexmale               0.10487    0.13482   0.778    0.437    
## age26-35 years old    0.07470    0.16277   0.459    0.647    
## age36-50 years old    0.21711    0.14936   1.454    0.147    
## ageover 50  years old -0.05204   0.18077  -0.288    0.774    
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 0.9186 on 249 degrees of freedom
## Multiple R-squared:  0.01595,    Adjusted R-squared:  0.000147 
## F-statistic: 1.009 on 4 and 249 DF,  p-value: 0.4032
## 
## 
## Call:
## lm(formula = score ~ ., data = data)
## 
## Residuals:
##      Min       1Q   Median       3Q      Max 
## -2.37420 -0.57420  0.09914  0.67580  1.35671 
## 
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)    
## (Intercept)           3.766102   0.106822  35.256   <2e-16 ***
## sexmale               0.034234   0.133868   0.256    0.798    
## age26-35 years old   -0.041906   0.161626  -0.259    0.796    
## age36-50 years old    0.008094   0.148304   0.055    0.957    
## ageover 50  years old -0.122816   0.179500  -0.684    0.494    
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 0.9121 on 249 degrees of freedom
## Multiple R-squared:  0.002724,    Adjusted R-squared:  -0.0133 
## F-statistic:  0.17 on 4 and 249 DF,  p-value: 0.9536
## 
```

```
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.42356 -0.69078 -0.03788  0.74547  2.00182
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)           3.42356    0.12176  28.116   <2e-16 ***
## sexmale               0.06333    0.15259   0.415   0.6785
## age26-35 years old   -0.23469    0.18423  -1.274   0.2039
## age36-50 years old   -0.13277    0.16905  -0.785   0.4330
## ageover 50  years old -0.42538    0.20461  -2.079   0.0386 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.04 on 249 degrees of freedom
## Multiple R-squared:  0.01851,    Adjusted R-squared:  0.002744
## F-statistic: 1.174 on 4 and 249 DF,  p-value: 0.3228
##
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.55796 -0.73101 -0.01842  0.91706  1.65077
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)           3.55406    0.11995  29.630   <2e-16 ***
## sexmale               0.01955    0.15032   0.130   0.897
## age26-35 years old    0.25390    0.18148   1.399   0.163
## age36-50 years old   -0.03564    0.16653  -0.214   0.831
## ageover 50  years old -0.20483    0.20155  -1.016   0.310
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.024 on 249 degrees of freedom
## Multiple R-squared:  0.02023,    Adjusted R-squared:  0.004493
## F-statistic: 1.285 on 4 and 249 DF,  p-value: 0.2762
##
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.50664 -0.50664  0.06981  0.79463  0.99336
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)            4.00664    0.09998  40.075   <2e-16 ***
## sexmale                0.02517    0.12529   0.201    0.841
## age26-35 years old     0.08573    0.15127   0.567    0.571
## age36-50 years old     0.17355    0.13880   1.250    0.212
## ageover 50  years old  0.03079    0.16800   0.183    0.855
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8537 on 249 degrees of freedom
## Multiple R-squared:  0.007489,   Adjusted R-squared:  -0.008454
## F-statistic: 0.4697 on 4 and 249 DF,  p-value: 0.7579
##
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.98526 -0.45358  0.06656  0.77040  1.06656
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            4.20358    0.09755  43.092   <2e-16 ***
## sexmale               -0.05182    0.12225  -0.424    0.672
## age26-35 years old    -0.07548    0.14759  -0.511    0.610
## age36-50 years old     0.02602    0.13543   0.192    0.848
## ageover 50  years old -0.21832    0.16392  -1.332    0.184
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8329 on 249 degrees of freedom
## Multiple R-squared:  0.01211,    Adjusted R-squared:  -0.003761
## F-statistic: 0.763 on 4 and 249 DF,  p-value: 0.5502
##
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.8784 -0.4699  0.1868  0.7483  1.0764
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            3.96993    0.10926  36.336   <2e-16 ***
## sexmale                0.10055    0.13692   0.734    0.4634
## age26-35 years old     0.15852    0.16531   0.959    0.3385
## age36-50 years old     0.28175    0.15168   1.857    0.0644 .
## ageover 50  years old -0.04634    0.18359  -0.252    0.8009
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9329 on 249 degrees of freedom
## Multiple R-squared:  0.02304,    Adjusted R-squared:  0.007347
```

```
## F-statistic: 1.468 on 4 and 249 DF,  p-value: 0.2124
##
##
## Call:
## lm(formula = score ~ ., data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -2.8621 -0.3621  0.1481  0.7573  1.0144
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)           4.11211    0.10332  39.799   <2e-16 ***
## sexmale               0.10916    0.12948   0.843    0.400
## age26-35 years old    0.05005    0.15633   0.320    0.749
## age36-50 years old    0.13063    0.14345   0.911    0.363
## ageover 50  years old -0.12654    0.17362  -0.729    0.467
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8822 on 249 degrees of freedom
## Multiple R-squared:  0.01262,    Adjusted R-squared:  -0.003243
## F-statistic: 0.7956 on 4 and 249 DF,  p-value: 0.529
```