

Teoria de Resposta ao Item: E-Class

```
library(tidyverse)
library(mirt)
library(knitr)
```

Organização dos dados

```
ec <- seleclass %>%
  select(contains("A"))
```

Como são os dados

```
glimpse(ec)
```

```
## Observations: 192
## Variables: 30
## $ 1A <int> 4, 5, 5, 5, 5, 4, 5, 4, 4, 4, 5, 4, 5, 4, 5, 4, 5, 5, 3, 4...
## $ 2A <int> 2, 5, 5, 5, 5, 5, 3, 4, 3, 4, 5, 4, 5, 5, 4, 3, 5, 5, 4, 4...
## $ 3A <int> 3, 2, 1, 1, 2, 2, 2, 2, 2, 2, 4, 3, 2, 4, 1, 4, 4, 2, 2, 2...
## $ 4A <int> 4, 3, 5, 5, 3, 4, 2, 1, 4, 2, 2, 4, 1, 2, 2, 1, 2, 2, 2, 2...
## $ 5A <int> 4, 4, 5, 5, 4, 2, 3, 4, 3, 4, 4, 5, 5, 4, 5, 3, 5, 4, 3, 4...
## $ 6A <int> 2, 4, 5, 2, 4, 4, 3, 3, 2, 4, 4, 2, 5, 3, 4, 3, 3, 2, 4, 4...
## $ 7A <int> 4, 1, 5, 1, 1, 1, 4, 3, 3, 3, 5, 2, 2, 3, 1, 1, 2, 1, 1, 1...
## $ 8A <int> 4, 4, 5, 5, 4, 4, 4, 5, 4, 4, 5, 4, 5, 4, 4, 2, 5, 5, 4, 4...
## $ 9A <int> 4, 4, 5, 3, 5, 5, 3, 4, 5, 3, 2, 4, 4, 2, 5, 3, 5, 1, 3, 4...
## $ 10A <int> 2, 4, 4, 3, 3, 3, 2, 4, 2, 4, 3, 4, 1, 2, 5, 2, 2, 5, 4, 4...
## $ 11A <int> 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 4, 5, 5, 5, 4, 5, 1, 5, 5, 5...
## $ 12A <int> 1, 4, 1, 1, 2, 2, 3, 2, 2, 4, 3, 4, 5, 2, 1, 2, 1, 1, 1, 2...
## $ 13A <int> 4, 5, 5, 5, 3, 5, 2, 4, 5, 4, 3, 4, 5, 4, 4, 5, 5, 3, 4, 4...
## $ 14A <int> 2, 3, 1, 4, 4, 4, 2, 5, 2, 3, 4, 2, 5, 3, 4, 4, 5, 4, 3, 4...
## $ 15A <int> 4, 3, 5, 4, 4, 3, 1, 1, 3, 4, 4, 4, 3, 4, 4, 3, 4, 4, 4, 4...
## $ 16A <int> 3, 2, 1, 3, 1, 4, 4, 1, 1, 4, 2, 2, 5, 1, 3, 2, 2, 2, 1, 2...
## $ 17A <int> 4, 2, 5, 5, 4, 2, 5, 5, 5, 4, 3, 4, 5, 3, 5, 4, 4, 2, 2, 4...
## $ 18A <int> 4, 4, 4, 5, 4, 4, 3, 5, 2, 4, 3, 4, 5, 3, 5, 5, 5, 3, 5, 4...
## $ 19A <int> 4, 4, 1, 3, 4, 3, 4, 5, 3, 4, 3, 5, 5, 3, 5, 5, 1, 3, 5, 3...
## $ 20A <int> 2, 3, 1, 5, 5, 3, 5, 1, 4, 4, 1, 4, 4, 3, 5, 5, 1, 5, 3, 5...
## $ 21A <int> 4, 2, 1, 1, 1, 5, 2, 1, 5, 2, 1, 4, 1, 2, 2, 3, 1, 4, 4, 2...
## $ 22A <int> 4, 3, 5, 5, 5, 5, 4, 5, 3, 4, 5, 5, 4, 3, 4, 4, 5, 5, 4, 4...
## $ 23A <int> 3, 4, 5, 4, 4, 5, 2, 5, 4, 4, 3, 5, 5, 2, 4, 3, 4, 4, 4, 4...
## $ 24A <int> 2, 3, 5, 5, 5, 4, 2, 3, 5, 4, 3, 3, 3, 4, 5, 4, 1, 5, 5, 4...
## $ 25A <int> 1, 2, 1, 1, 1, 1, 1, 1, 1, 2, 3, 1, 5, 2, 1, 3, 1, 1, 1, 1...
## $ 26A <int> 4, 4, 5, 4, 5, 4, 4, 5, 5, 4, 4, 5, 5, 4, 5, 4, 5, 4, 5, 4...
## $ 27A <int> 2, 1, 1, 1, 2, 2, 3, 2, 4, 2, 5, 1, 1, 3, 2, 2, 1, 2, 1, 2...
## $ 28A <int> 3, 1, 1, 1, 1, 1, 4, 3, 3, 2, 3, 1, 4, 3, 1, 1, 4, 2, 1, 1...
## $ 29A <int> 4, 3, 1, 3, 1, 5, 4, 4, 5, 2, 5, 4, 3, 4, 3, 3, 5, 3, 2, 4...
## $ 30A <int> 4, 5, 5, 5, 5, 5, 5, 5, 3, 4, 5, 5, 3, 3, 5, 5, 5, 5, 5, 5...
```

Criação do modelo

```
ec.tri <- mirt(ec, 1, itemtype = 'graded', verbose=FALSE)
```

```
summary(ec.tri)
```

```
##           F1           h2
## 1A    0.5983 0.35791
## 2A    0.3247 0.10544
## 3A   -0.1973 0.03895
## 4A    0.1478 0.02184
## 5A    0.3412 0.11639
## 6A    0.1868 0.03490
## 7A   -0.5052 0.25526
## 8A    0.5209 0.27138
## 9A    0.3911 0.15297
## 10A   0.4662 0.21736
## 11A   0.2647 0.07006
## 12A  -0.5066 0.25661
## 13A   0.2184 0.04771
## 14A   0.4006 0.16049
## 15A   0.3612 0.13050
## 16A  -0.0751 0.00564
## 17A   0.0611 0.00373
## 18A   0.4264 0.18181
## 19A   0.1997 0.03988
## 20A   0.3491 0.12186
## 21A  -0.1781 0.03171
## 22A   0.5246 0.27522
## 23A   0.4359 0.19003
## 24A   0.3209 0.10300
## 25A  -0.3885 0.15094
## 26A   0.4006 0.16047
## 27A  -0.5446 0.29659
## 28A  -0.5533 0.30615
## 29A  -0.0936 0.00876
## 30A   0.6292 0.39590
##
## SS loadings:  4.509
## Proportion Var:  0.15
##
## Factor correlations:
##
##      F1
## F1  1
```

```
coef(ec.tri, simplify = TRUE)
```

```
## $items
##      a1      d1      d2      d3      d4      d5      d6
## 1A   1.271  5.993  4.145  2.925 -0.082    NA    NA
## 2A   0.584  2.527  1.254 -0.760     NA    NA    NA
## 3A  -0.343  1.359 -0.497 -1.175 -3.075    NA    NA
## 4A   0.254  2.027  0.767 -0.131 -1.407    NA    NA
```

```

## 5A  0.618  2.718  2.058  0.714 -1.100    NA    NA
## 6A  0.324  3.896  1.204 -0.300 -2.242    NA    NA
## 7A -0.996  0.763 -0.899 -1.699 -2.724    NA    NA
## 8A  1.039  5.078  3.738  2.190 -0.396    NA    NA
## 9A  0.723  5.498  2.603  1.198  0.049 -1.459    NA
## 10A 0.897  4.004  2.137  0.488 -1.450    NA    NA
## 11A 0.467  5.361  3.733  3.387  2.083    NA    NA
## 12A -1.000  0.211 -1.760 -2.521 -4.293    NA    NA
## 13A 0.381  5.313  3.911  2.045  1.101 -0.436    NA
## 14A 0.744  3.887  1.712  0.108 -1.648    NA    NA
## 15A 0.659  3.441  2.473  0.565 -1.029    NA    NA
## 16A -0.128  5.261  1.213 -0.260 -1.083 -2.409    NA
## 17A 0.104  3.440  1.375  0.655 -0.644    NA    NA
## 18A 0.802  3.734  1.995  0.226    NA    NA    NA
## 19A 0.347  3.333  2.600  1.264 -0.177    NA    NA
## 20A 0.634  2.316  1.251  0.370 -1.011    NA    NA
## 21A -0.308  1.270  0.043 -0.733 -2.499    NA    NA
## 22A 1.049  2.803  0.125    NA    NA    NA    NA
## 23A 0.824  4.869  3.165  1.432 -0.955    NA    NA
## 24A 0.577  5.414  2.622  1.594  0.776 -0.367 -5.421
## 25A -0.718  4.816 -0.025 -1.421 -2.393 -4.077    NA
## 26A 0.744  5.528  4.417  2.955  0.279    NA    NA
## 27A -1.105  0.999 -1.087 -2.287 -3.966    NA    NA
## 28A -1.131 -0.591 -2.192 -3.082 -4.006    NA    NA
## 29A -0.160  2.910  0.986 -0.032 -1.622    NA    NA
## 30A 1.378  5.416  5.003  3.457  1.637    NA    NA
##
## $means
## F1
## 0
##
## $cov
##      F1
## F1  1

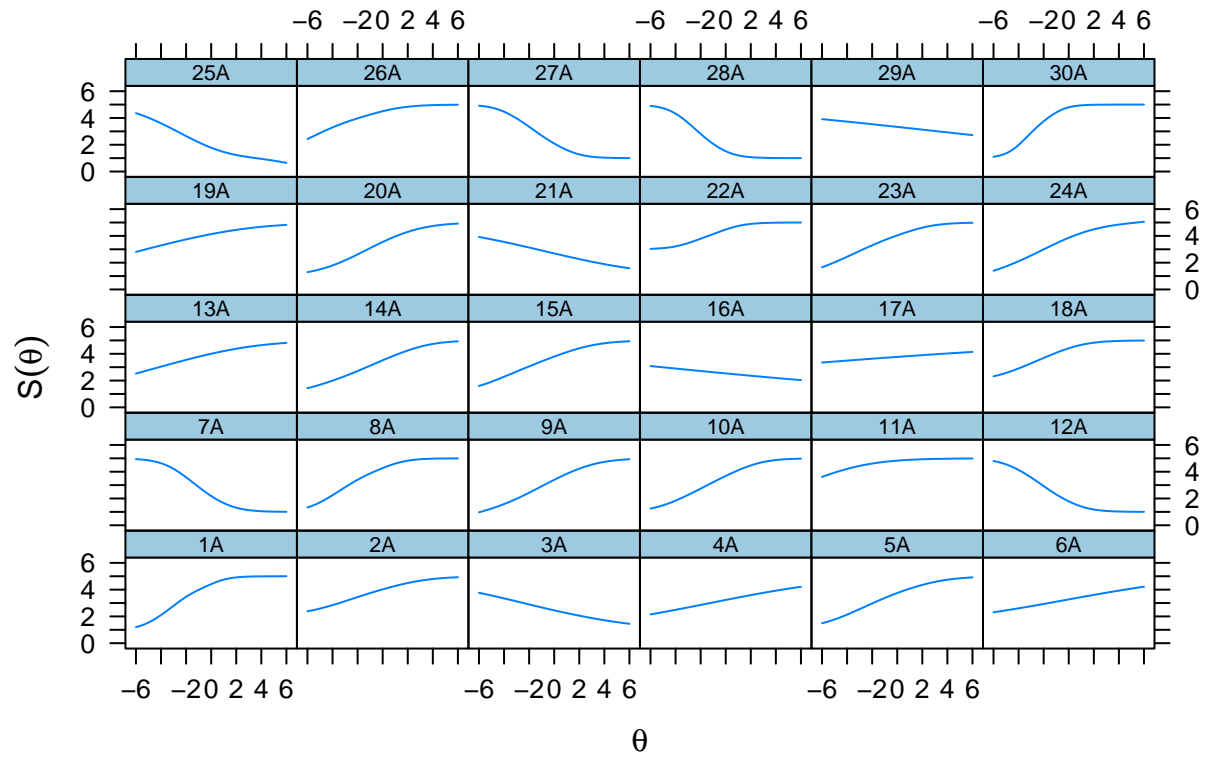
```

```

p1 <- plot(ec.tri, type="itemscore")
p1

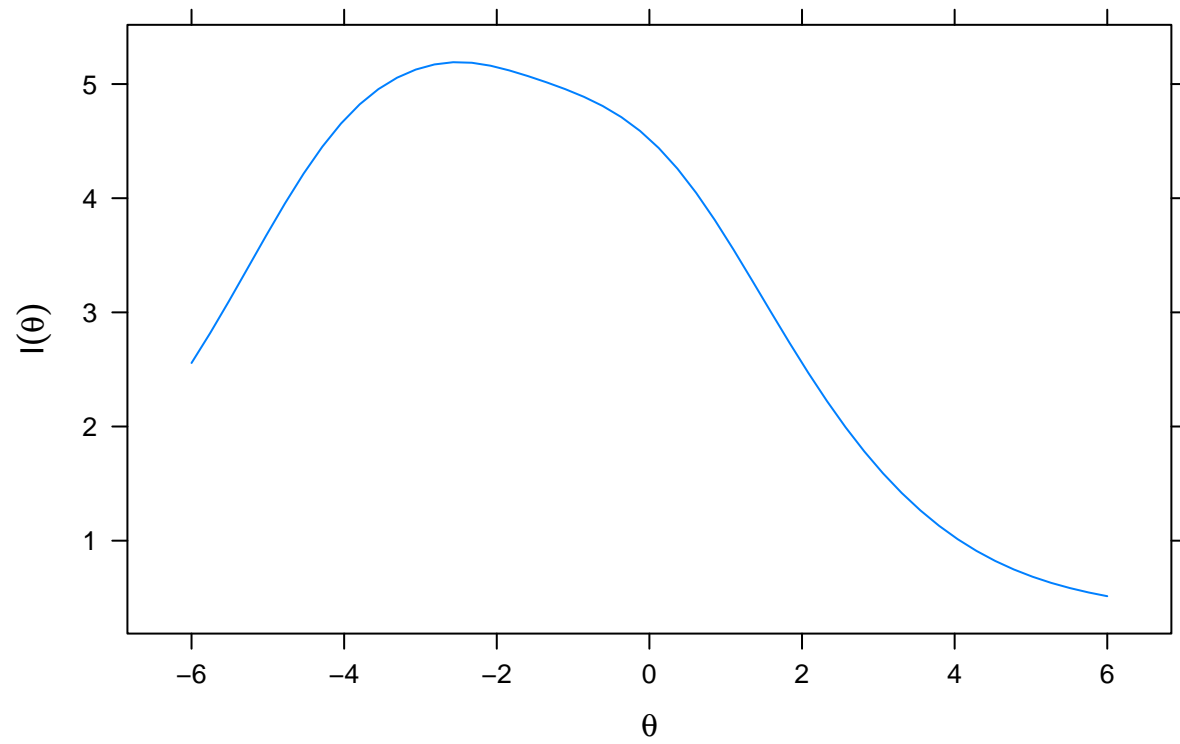
```

Expected item scoring function

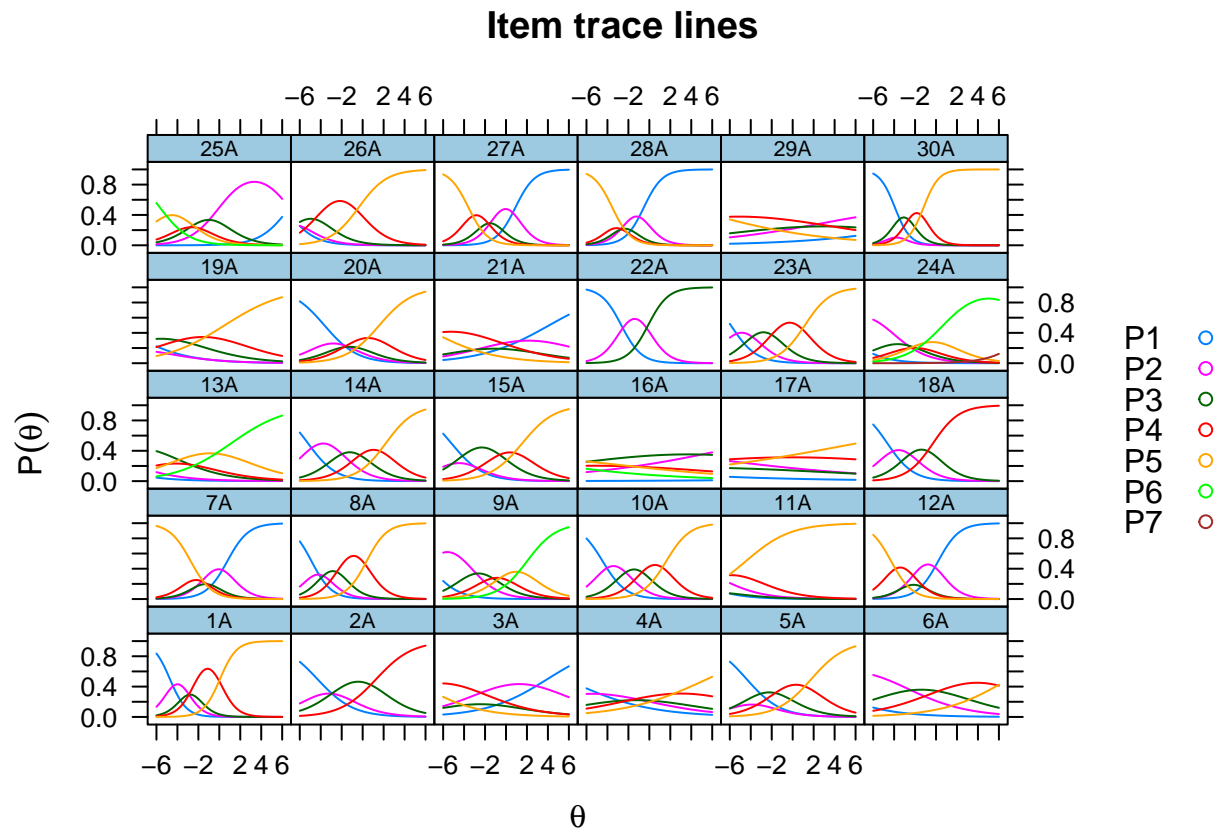


```
p2 <- plot(ec.tri, type="info")
p2
```

Test Information



```
p3 <- plot(ec.tri, type="trace")  
p3
```



Selecionando apenas os item com boa discriminação e carga fatorial alta

Cargas (loads)

1, 7,8, 22, 10, 22, 30

Melhor descriminação

1, 2, 5, 8, 9, 10, 14, 15, 18, 20, 22, 23, 24, 26, 30

Selecionados

`c(1,8,22,30)`

```
vars <- c("1A", "8A", "22A", "30A")
ecs <- seleclass %>%
  select(one_of(vars))
```

Como são os dados

```
glimpse(ecs)
```

```
## Observations: 192
## Variables: 4
## $ 1A <int> 4, 5, 5, 5, 5, 4, 5, 4, 4, 4, 5, 4, 5, 4, 5, 4, 5, 5, 3, 4...
```

```
## $ 8A <int> 4, 4, 5, 5, 4, 4, 4, 5, 4, 4, 5, 4, 5, 4, 4, 2, 5, 5, 4, 4...
## $ 22A <int> 4, 3, 5, 5, 5, 5, 4, 5, 3, 4, 5, 5, 4, 3, 4, 4, 5, 5, 4, 4...
## $ 30A <int> 4, 5, 5, 5, 5, 5, 5, 5, 3, 4, 5, 5, 3, 3, 5, 5, 5, 5, 5, 5...
```

Criação do modelo

```
ec.tris <- mirt(ecs, 1, itemtype = 'graded', verbose=FALSE)
```

```
summary(ec.tris)
```

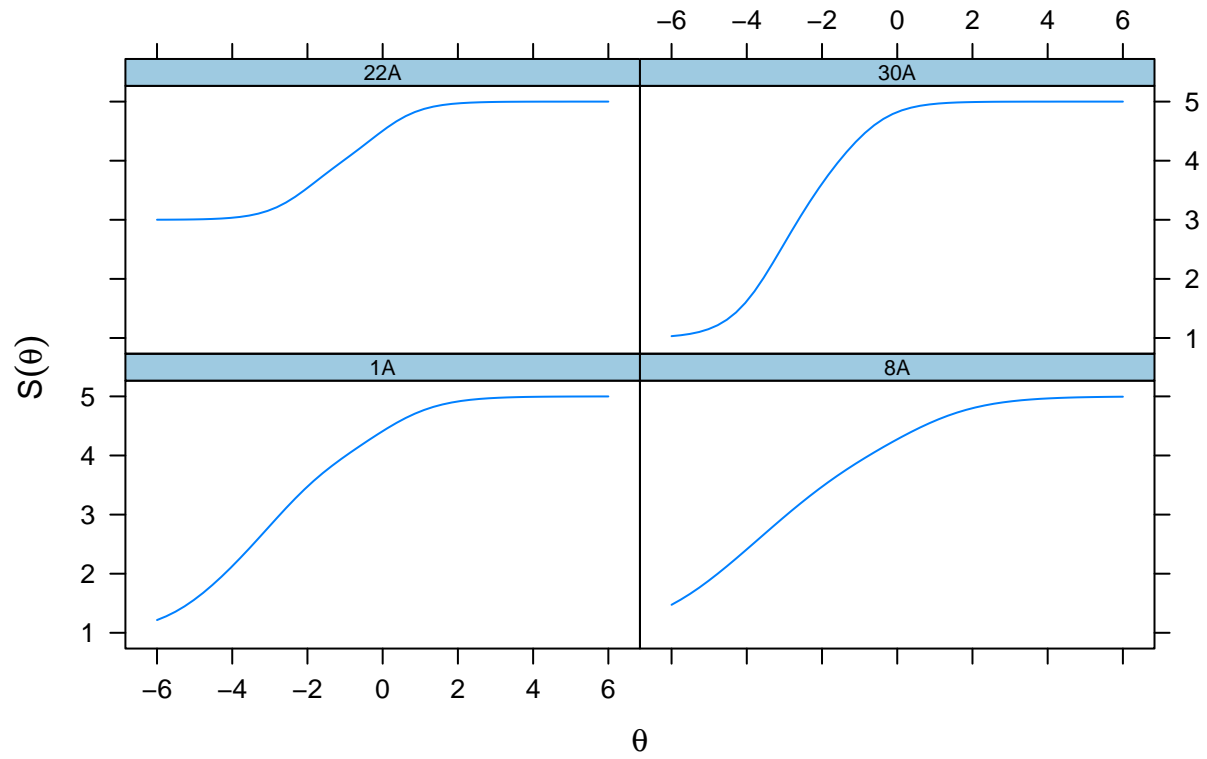
```
##          F1    h2
## 1A  0.595 0.354
## 8A  0.488 0.238
## 22A 0.703 0.494
## 30A 0.694 0.482
##
## SS loadings:  1.569
## Proportion Var:  0.392
##
## Factor correlations:
##
##          F1
## F1  1
```

```
coef(ec.tris, simplify = TRUE)
```

```
## $items
##          a1    d1    d2    d3    d4
## 1A  1.261 6.009 4.142 2.927 -0.074
## 8A  0.952 4.994 3.681 2.174 -0.374
## 22A 1.682 3.364 0.159    NA    NA
## 30A 1.643 5.825 5.402 3.745  1.767
##
## $means
## F1
## 0
##
## $cov
##          F1
## F1  1
```

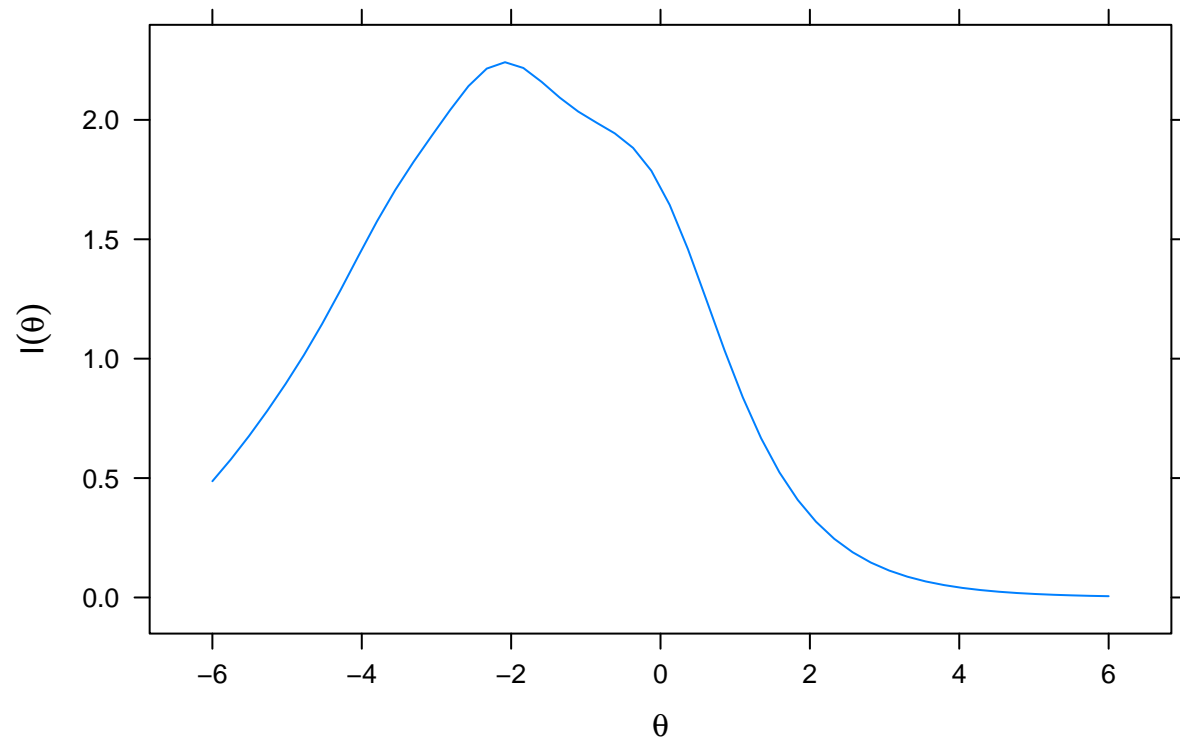
```
p1 <- plot(ec.tris, type="itemscore")
p1
```

Expected item scoring function



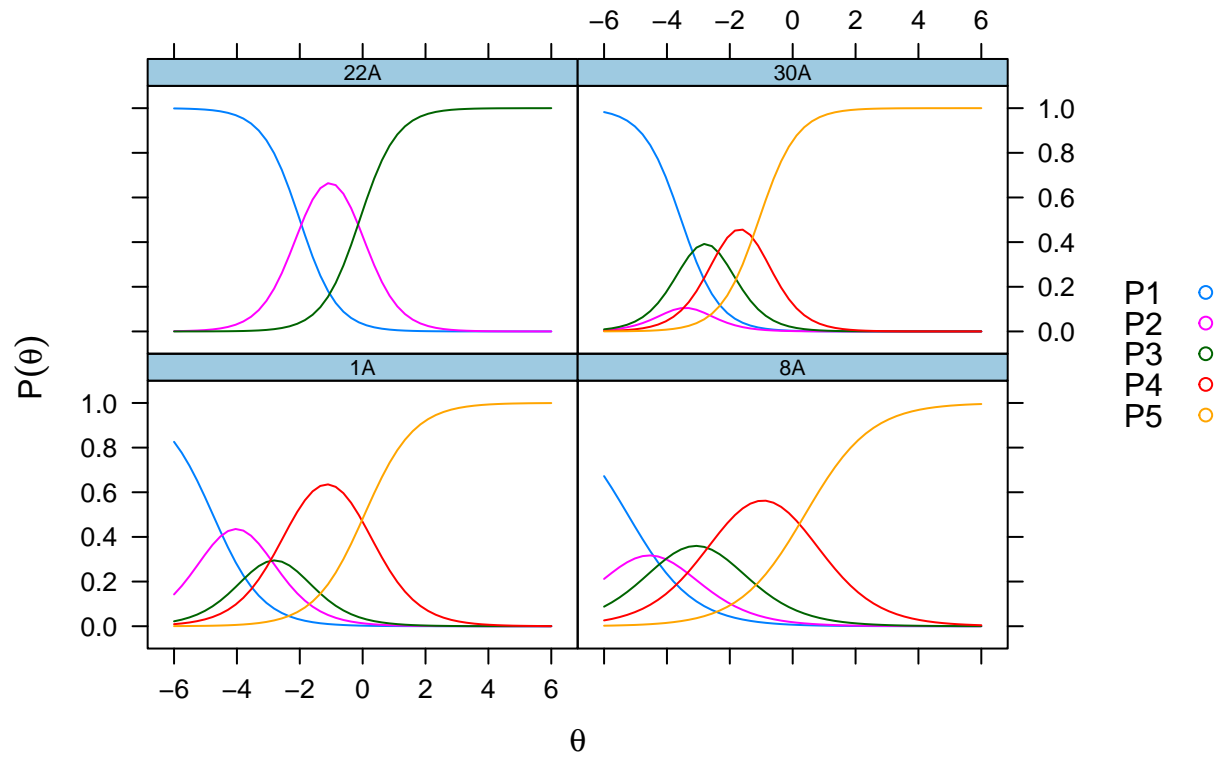
```
p2 <- plot(ec.tris, type="info")  
p2
```


Test Information



```
p3 <- plot(ec.tris, type="trace")  
p3
```

Item trace lines



```
sc <- fscores(ec.tris)
histogram(sc)
```

