ltm()

latent trait models

Zuzana Komprdová (438469)

Kateřina Rečková (476222)

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Použití

- analýza **dichotomických** (1PL/Rasch, 2PL, 3PL) a **polytomických dat** (Graded Response Model)

- **Item Response Theory (IRT)**

Postup – 2PL (1/5)

- **install.packages("ltm")**
- **library(ltm)**
- **data(LSAT)** – *The Law School Admission Test*
- **head(LSAT)**

	Item 1	Item 2	Item 3	Item 4	Item 5
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	1
5	0	0	0	0	1
6	0	0	0	0	1

Postup – 2PL (2/5)

- **IRTmodel <- ltm(LSAT ~ z1, IRT.param = TRUE)**
- **summary(IRTmodel)** nebo **coef(IRTmodel)**

```
Coefficients:
                 value std.err  z.vals
Dffclt.Item 1 -3.3597  0.8669 -3.8754
Dffclt.Item 2 -1.3696  0.3073 -4.4565
Dffclt.Item 3 -0.2799  0.0997 -2.8083
Dffclt.Item 4 -1.8659  0.4341 -4.2982
Dffclt.Item 5 -3.1236  0.8700 -3.5904
Dscrmn.Item 1  0.8254  0.2581  3.1983
Dscrmn.Item 2  0.7229  0.1867  3.8721
Dscrmn.Item 3  0.8905  0.2326  3.8281
Dscrmn.Item 4  0.6886  0.1852  3.7186
Dscrmn.Item 5  0.6575  0.2100  3.1306
```

```
            Dffclt    Dscrmn
Item 1 -3.3597341 0.8253715
Item 2 -1.3696497 0.7229499
Item 3 -0.2798983 0.8904748
Item 4 -1.8659189 0.6885502
Item 5 -3.1235725 0.6574516
```
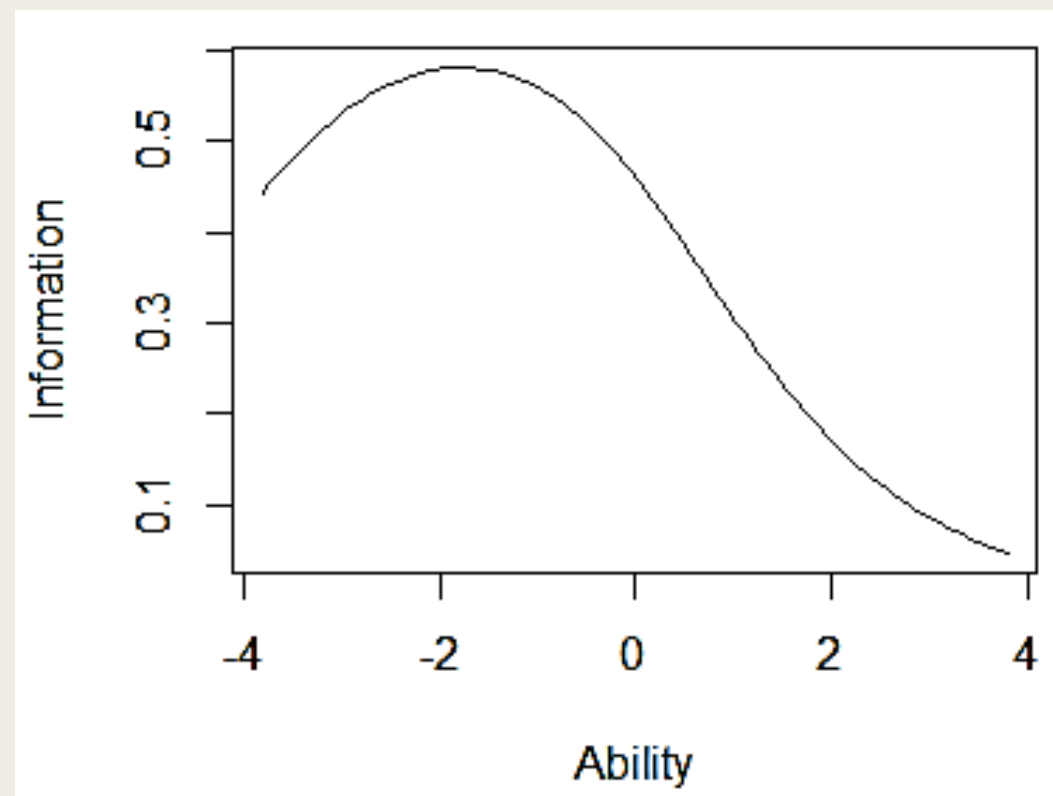
Postup – 2PL (3/5)

- **plot(IRTmodel, type = "ICC", items = _**
  - **bez *(všechny položky)***
  - **items = 3 *(3. položka)***
  - **items = c(1, 3, 5) *(vybrané položky)***
- *item characteristic curves*
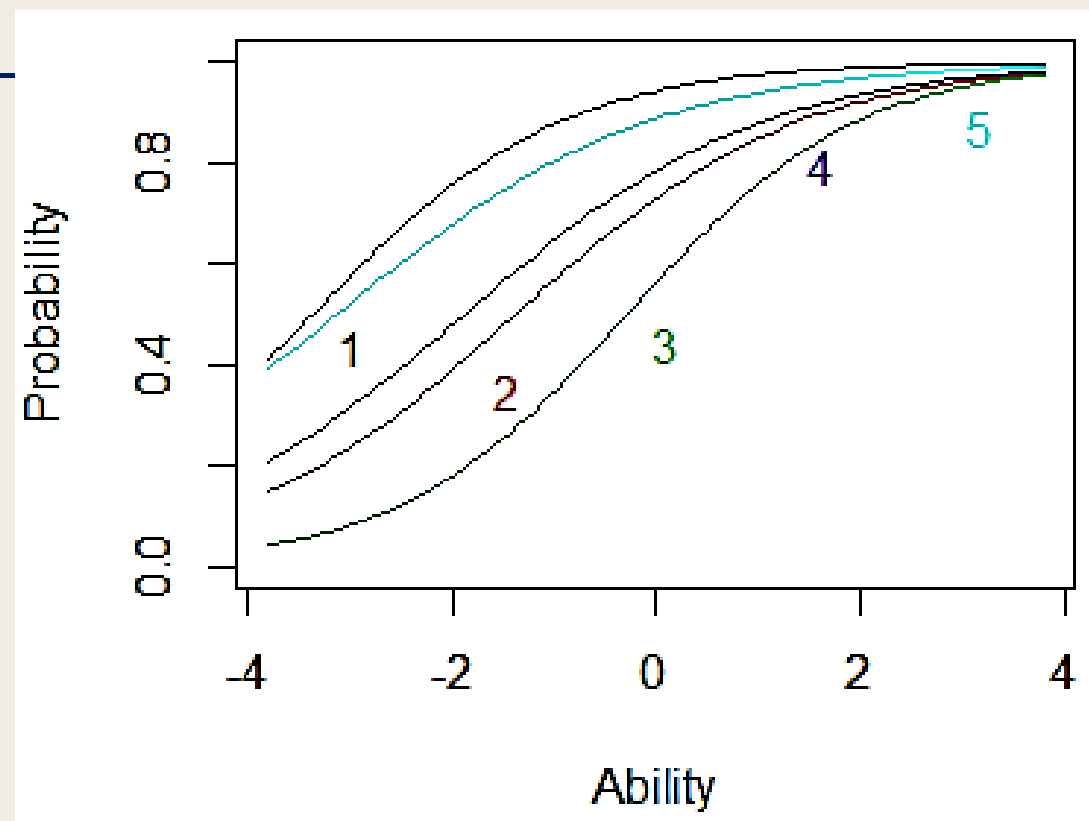
Postup – 2PL (4/5)

- **plot(IRTmodel, type = "IIC", items = 0)**

- *test information function*

Postup – 2PL (5/5)

- **factor.scores(IRTmodel)**

```
Factor-Scores for observed response patterns:
   Item 1 Item 2 Item 3 Item 4 Item 5 Obs    Exp      z1 se.z1
1       0      0      0      0      0   3   2.277 -1.895 0.795
2       0      0      0      0      1   6   5.861 -1.479 0.796
3       0      0      0      1      0   2   2.596 -1.460 0.796
4       0      0      0      1      1  11   8.942 -1.041 0.800
5       0      0      1      0      0   1   0.696 -1.331 0.797
6       0      0      1      0      1   1   2.614 -0.911 0.802
7       0      0      1      1      0   3   1.179 -0.891 0.803
8       0      0      1      1      1   4   5.955 -0.463 0.812
9       0      1      0      0      0   1   1.840 -1.438 0.796
10      0      1      0      0      1   8   6.431 -1.019 0.801
11      0      1      0      1      1  16  13.577 -0.573 0.809
12      0      1      1      0      1   3   4.370 -0.441 0.813
13      0      1      1      1      0   2   2.000 -0.420 0.813
14      0      1      1      1      1  15  13.920  0.023 0.828
15      1      0      0      0      0  10   9.480 -1.373 0.797
16      1      0      0      0      1  29  34.616 -0.953 0.802
17      1      0      0      1      0  14  15.590 -0.933 0.802
18      1      0      0      1      1  81  76.562 -0.506 0.811
19      1      0      1      0      0   3   4.659 -0.803 0.804
20      1      0      1      0      1  28  24.989 -0.373 0.815
21      1      0      1      1      0  15  11.463 -0.352 0.815
```

Postup – 3PL

- totéž + přidáváme *parametr pseudouhádnutelnosti (c)*
- **IRTmodel2 <- tpm(LSAT, type = "latent.trait", IRT.param = TRUE)**

coef(IRTmodel2)

```
          Gussng       Dffclt      Dscrmn
Item 1 0.03738668 -3.2964761 0.8286287
Item 2 0.07770994 -1.1451487 0.7603748
Item 3 0.01178206 -0.2490144 0.9015777
Item 4 0.03529306 -1.7657862 0.7006545
Item 5 0.05315665 -2.9902046 0.6657969
```

plot(IRTmodel2, type = "ICC")   **plot(IRTmodel2, type = "IIC", items =**
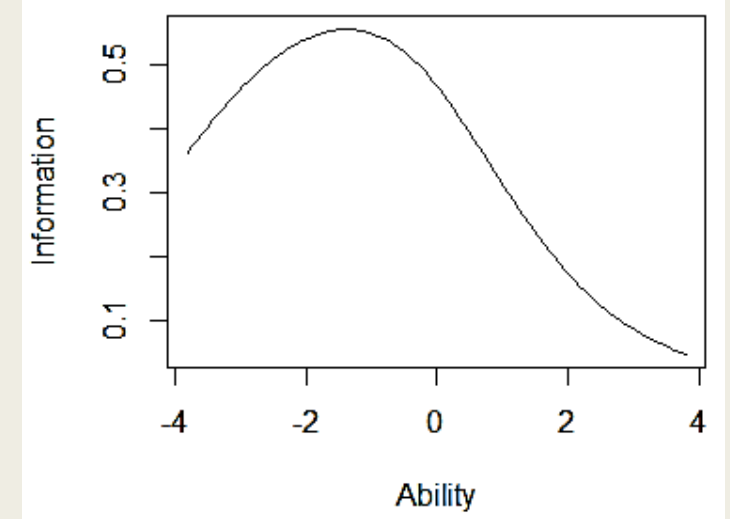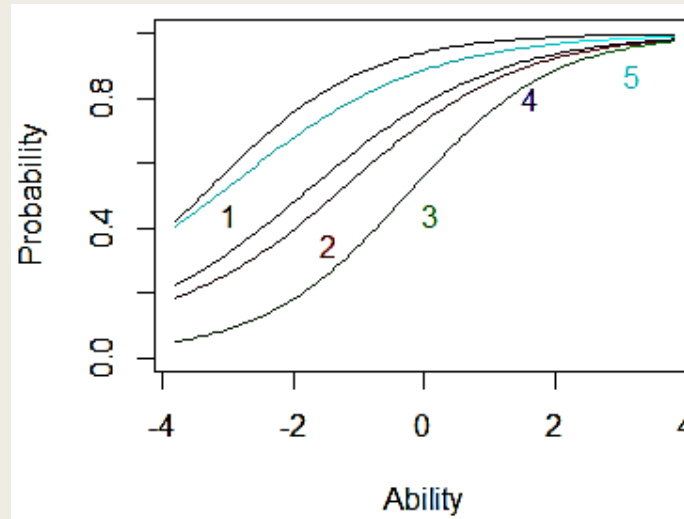
Porovnání modelů

- pokud chceme zjistit, jestli má zahrnutí parametru c smysl

- **anova(IRTmodel, IRTmodel2)**

```
Likelihood Ratio Table
              AIC      BIC  log.Lik    LRT df p.value
IRTmodel  4953.31 5002.38 -2466.65
IRTmodel2 4963.32 5036.94 -2466.66 -0.01  5       1
```