ltm()

latent trait models

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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)

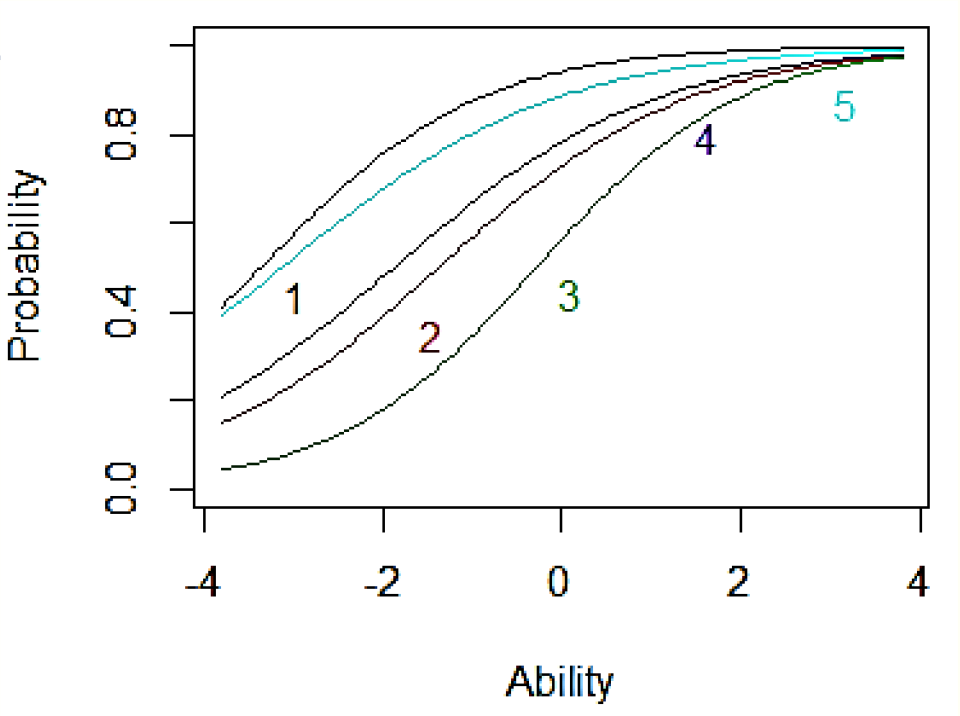
- **IRTmodel <- ltm(LSAT ~ z1, IRT.param = TRUE)**
- **summary(IRTmodel)** nebo **coef(IRTmodel)**

```
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
```

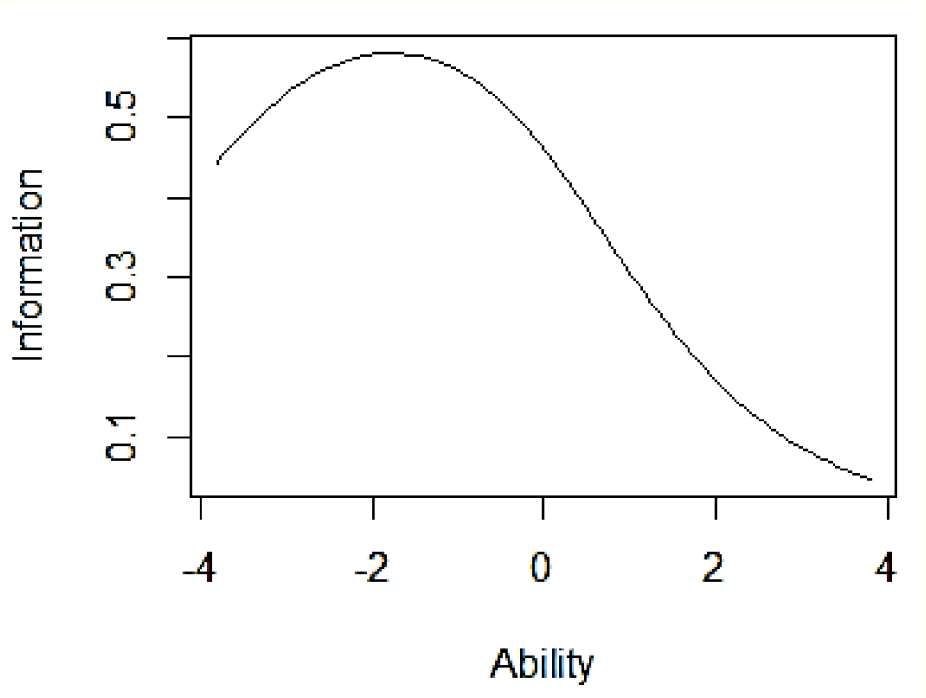
Postup – 2PL (3/5)

- **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

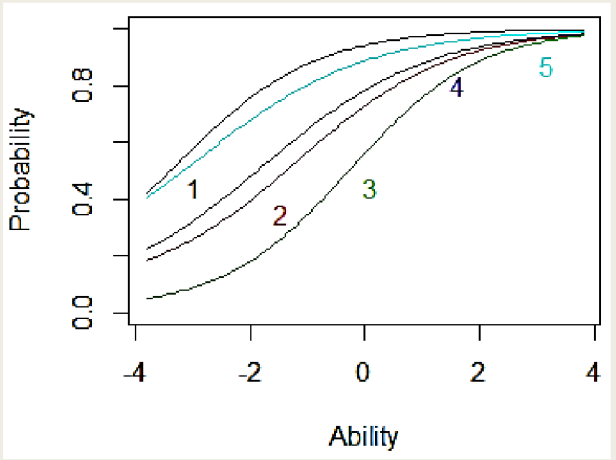
Postup – 3PL

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

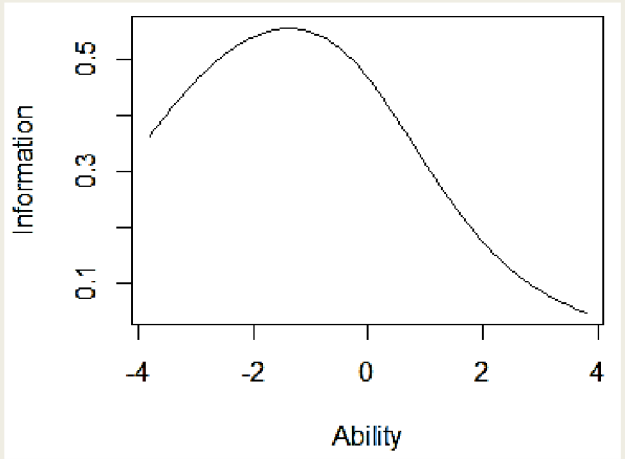
coef(IRTmodel2)

	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
```