Practice DCM

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January 17, 2019

DINA

```
## -------------------------------------------------------------------------------
## DINA MODEL
## ** 2019-01-17 14:45:38
## -------------------------------------------------------------------------------
## Iter.  1  :  14:45:38 ,   loglike= -5129.088  / max. param. ch. :  0.195669  / relative deviance char
## Iter.  2  :  14:45:38 ,   loglike= -4821.365  / max. param. ch. :  0.079596  / relative deviance char
## Iter.  3  :  14:45:38 ,   loglike= -4752.967  / max. param. ch. :  0.032349  / relative deviance char
## Iter.  4  :  14:45:38 ,   loglike= -4732.218  / max. param. ch. :  0.0156  / relative deviance change
## Iter.  5  :  14:45:38 ,   loglike= -4725.35  / max. param. ch. :  0.008164  / relative deviance chang
## Iter.  6  :  14:45:38 ,   loglike= -4722.858  / max. param. ch. :  0.004511  / relative deviance char
## Iter.  7  :  14:45:38 ,   loglike= -4721.82  / max. param. ch. :  0.002593  / relative deviance chang
## Iter.  8  :  14:45:38 ,   loglike= -4721.327  / max. param. ch. :  0.00155  / relative deviance chang
## Iter.  9  :  14:45:38 ,   loglike= -4721.069  / max. param. ch. :  0.000969  / relative deviance char
## Iter.  10  :  14:45:38 ,   loglike= -4720.925  / max. param. ch. :  0.000634  / relative deviance cha
## Iter.  11  :  14:45:38 ,   loglike= -4720.839  / max. param. ch. :  0.000432  / relative deviance cha
## Iter.  12  :  14:45:38 ,   loglike= -4720.787  / max. param. ch. :  0.000305  / relative deviance cha
## Iter.  13  :  14:45:38 ,   loglike= -4720.753  / max. param. ch. :  0.000221  / relative deviance cha
## -------------------------------------------------------------------------------
## Time difference of 0.3459899 secs
```

Print DINA

```
## Estimation of Mixed DINA/DINO Model
##
## CDM 7.1-20 (2018-12-13 11:54:50)
##
## Call:
## din(data = data, q.matrix = qmatrix, maxit = 500, guess.equal = 0.2,
##     slip.equal = 0.1, rule = "DINA")
##
## Number of cases=536
## Number of items=20
## Number of skill dimensions=8
## Number of skill classes=256
## Number of parameters=257
##   # item parameters=2
##   # skill distribution parameters=255
##
## Log-Likelihood=-4720.75
## AIC=9956
## BIC=11057
```

DINA Summary

```
## CDM 7.1-20 (Built 2018-12-13 11:54:50)
## Call:
##  din(data = data, q.matrix = qmatrix, maxit = 500, guess.equal = 0.2,      slip.equal = 0.1, rule = 
##
## Date of Analysis: 2019-01-17 14:45:38
## Time difference of 0.3459899 secs
## Computation Time: 0.3459899
##
##
## Deviance = 9441.506  |   Log-Likelihood= -4720.753
##
## Number of iterations: 14
##
## Number of item parameters: 2
## Number of skill class parameters: 255
##
## Information criteria:
##   AIC = 9955.506
##   BIC = 11056.53
##
## Mean of RMSEA item fit: 0.138
##
## Item parameters
##      item guess  slip   IDI rmsea
## 1   Item1 0.079 0.135 0.786 0.064
## 2   Item2 0.079 0.135 0.786 0.117
## 3   Item3 0.079 0.135 0.786 0.088
## 4   Item4 0.079 0.135 0.786 0.213
## 5   Item5 0.079 0.135 0.786 0.233
## 6   Item6 0.079 0.135 0.786 0.166
## 7   Item7 0.079 0.135 0.786 0.104
## 8   Item8 0.079 0.135 0.786 0.247
## 9   Item9 0.079 0.135 0.786 0.234
## 10 Item10 0.079 0.135 0.786 0.130
## 11 Item11 0.079 0.135 0.786 0.090
## 12 Item12 0.079 0.135 0.786 0.106
## 13 Item13 0.079 0.135 0.786 0.200
## 14 Item14 0.079 0.135 0.786 0.110
## 15 Item15 0.079 0.135 0.786 0.096
## 16 Item16 0.079 0.135 0.786 0.114
## 17 Item17 0.079 0.135 0.786 0.109
## 18 Item18 0.079 0.135 0.786 0.149
## 19 Item19 0.079 0.135 0.786 0.101
## 20 Item20 0.079 0.135 0.786 0.090
##
## Marginal skill probabilities:
##        skill.prob
## alpha1     0.5245
## alpha2     0.8254
## alpha3     0.7190
## alpha4     0.6623
```

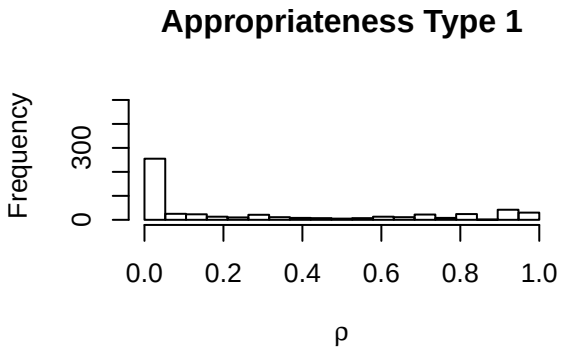
```
## alpha5     0.5868
## alpha6     0.7955
## alpha7     0.8495
## alpha8     0.8360
##
## Tetrachoric correlations among skill dimensions
##         alpha1 alpha2 alpha3 alpha4 alpha5 alpha6  alpha7 alpha8
## alpha1 1.00000 0.4105 0.4666 0.7300 0.6470 0.5356 0.03961 0.4101
## alpha2 0.41053 1.0000 0.3942 0.4821 0.1488 0.4852 0.74688 0.7278
## alpha3 0.46658 0.3942 1.0000 0.3957 0.6266 0.3886 0.37411 0.3929
## alpha4 0.73004 0.4821 0.3957 1.0000 0.5443 0.6683 0.27004 0.4107
## alpha5 0.64697 0.1488 0.6266 0.5443 1.0000 0.4999 0.14122 0.2323
## alpha6 0.53563 0.4852 0.3886 0.6683 0.4999 1.0000 0.53411 0.4301
## alpha7 0.03961 0.7469 0.3741 0.2700 0.1412 0.5341 1.00000 0.6344
## alpha8 0.41006 0.7278 0.3929 0.4107 0.2323 0.4301 0.63437 1.0000
##
## Skill Pattern Probabilities
##
## 00000000 10000000 01000000 00100000 00010000 00001000 00000100 00000010
##  0.00144  0.00144  0.00091  0.00144  0.00144  0.00144  0.00144  0.00459
## 00000001 11000000 10100000 10010000 10001000 10000100 10000010 10000001
##  0.00144  0.00091  0.00144  0.00144  0.00144  0.00144  0.00000  0.00144
## 01100000 01010000 01001000 01000100 01000010 01000001 00110000 00101000
##  0.00091  0.00091  0.00091  0.00091  0.00487  0.00091  0.00144  0.00144
## 00100100 00100010 00100001 00011000 00010100 00010010 00010001 00001100
##  0.00144  0.00459  0.00144  0.00144  0.00144  0.00022  0.00144  0.00144
## 00001010 00001001 00000110 00000101 00000011 11100000 11010000 11001000
##  0.00459  0.00144  0.00459  0.00144  0.00326  0.00091  0.00091  0.00091
## 11000100 11000010 11000001 10110000 10101000 10100100 10100010 10100001
##  0.00091  0.00000  0.00091  0.00144  0.00144  0.00144  0.00000  0.00144
## 10011000 10010100 10010010 10010001 10001100 10001010 10001001 10000110
##  0.00144  0.00144  0.00000  0.00144  0.00144  0.00000  0.00144  0.00000
## 10000101 10000011 01110000 01101000 01100100 01100010 01100001 01011000
##  0.00144  0.00005  0.00091  0.00091  0.00091  0.00487  0.00091  0.00091
## 01010100 01010010 01010001 01001100 01001010 01001001 01000110 01000101
##  0.00091  0.00043  0.00091  0.00091  0.00000  0.00091  0.00487  0.00091
## 01000011 00111000 00110100 00110010 00110001 00101100 00101010 00101001
##  0.03256  0.00144  0.00144  0.00022  0.00144  0.00144  0.00459  0.00144
## 00100110 00100101 00100011 00011100 00011010 00011001 00010110 00010101
##  0.00459  0.00144  0.00326  0.00144  0.00022  0.00144  0.00279  0.00144
## 00010011 00001110 00001101 00001011 00000111 11110000 11101000 11100100
##  0.00000  0.00459  0.00144  0.00326  0.00326  0.00091  0.00091  0.00091
## 11100010 11100001 11011000 11010100 11010010 11010001 11001100 11001010
##  0.00000  0.00091  0.00091  0.00091  0.00096  0.00091  0.00091  0.00000
## 11001001 11000110 11000101 11000011 10111000 10110100 10110010 10110001
##  0.00091  0.00000  0.00091  0.00098  0.00144  0.00144  0.00000  0.00144
## 10101100 10101010 10101001 10100110 10100101 10100011 10011100 10011010
##  0.00144  0.00000  0.00144  0.00000  0.00144  0.00005  0.00144  0.00000
## 10011001 10010110 10010101 10010011 10001110 10001101 10001011 10000111
##  0.00144  0.00000  0.00144  0.00000  0.00000  0.00144  0.00005  0.00005
## 01111000 01110100 01110010 01110001 01101100 01101010 01101001 01100110
##  0.00091  0.00091  0.00043  0.00091  0.00091  0.00000  0.00091  0.00487
## 01100101 01100011 01011100 01011010 01011001 01010110 01010101 01010011
##  0.00091  0.03256  0.00091  0.00000  0.00091  0.00242  0.00091  0.00492
```

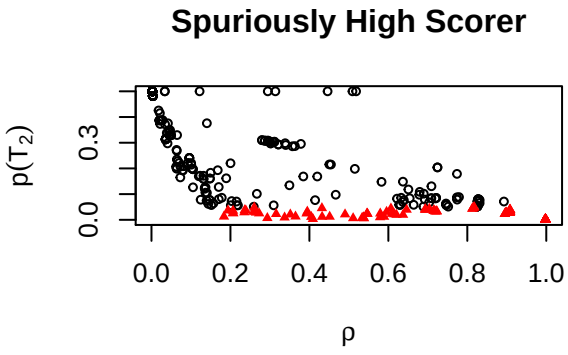
```
## 01001110 01001101 01001011 01000111 00111100 00111010 00111001 00110110
##  0.00001  0.00091  0.00000  0.03256  0.00144  0.00022  0.00144  0.00279
## 00110101 00110011 00101110 00101101 00101011 00100111 00011110 00011101
##  0.00144  0.00000  0.00459  0.00144  0.00326  0.00326  0.00279  0.00144
## 00011011 00010111 00001111 11111000 11110100 11110010 11110001 11101100
##  0.00000  0.00120  0.00326  0.00091  0.00091  0.00096  0.00091  0.00091
## 11101010 11101001 11100110 11100101 11100011 11011100 11011010 11011001
##  0.00000  0.00091  0.00000  0.00091  0.00098  0.00091  0.00000  0.00091
## 11010110 11010101 11010011 11001110 11001101 11001011 11000111 10111100
##  0.00082  0.00091  0.00000  0.00001  0.00091  0.00000  0.00098  0.00144
## 10111010 10111001 10110110 10110101 10110011 10101110 10101101 10101011
##  0.00000  0.00144  0.00000  0.00144  0.00000  0.00000  0.00144  0.00005
## 10100111 10011110 10011101 10011011 10010111 10001111 01111100 01111010
##  0.00005  0.00000  0.00144  0.00000  0.00060  0.00005  0.00091  0.00000
## 01111001 01110110 01110101 01110011 01101110 01101101 01101011 01100111
##  0.00091  0.00242  0.00091  0.00492  0.00000  0.00091  0.00408  0.03256
## 01011110 01011101 01011011 01010111 01001111 00111110 00111101 00111011
##  0.00620  0.00091  0.00000  0.03149  0.00067  0.00279  0.00144  0.00000
## 00110111 00101111 00011111 11111100 11111010 11111001 11110110 11110101
##  0.00120  0.00326  0.00120  0.00091  0.00003  0.00091  0.00082  0.00091
## 11110011 11101110 11101101 11101011 11100111 11011110 11011101 11011011
##  0.00000  0.00209  0.00091  0.00000  0.00098  0.00022  0.00091  0.00001
## 11010111 11001111 10111110 10111101 10111011 10110111 10101111 10011111
##  0.03053  0.00028  0.00000  0.00144  0.00000  0.00060  0.00005  0.00060
## 01111110 01111101 01111011 01110111 01101111 01011111 00111111 11111110
##  0.00116  0.00091  0.00000  0.03149  0.02327  0.00004  0.00120  0.00158
## 11111101 11111011 11110111 11101111 11011111 10111111 01111111 11111111
##  0.00091  0.00324  0.03053  0.01523  0.00875  0.00060  0.05694  0.34650
```

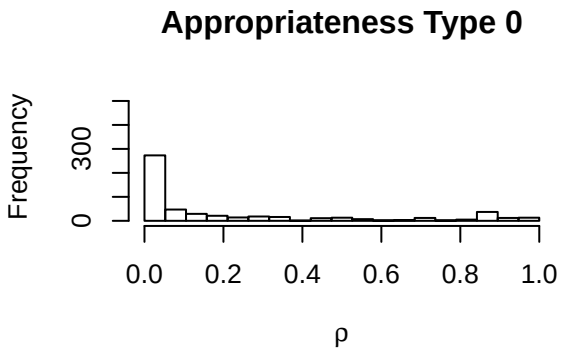
DINA Person-Fit

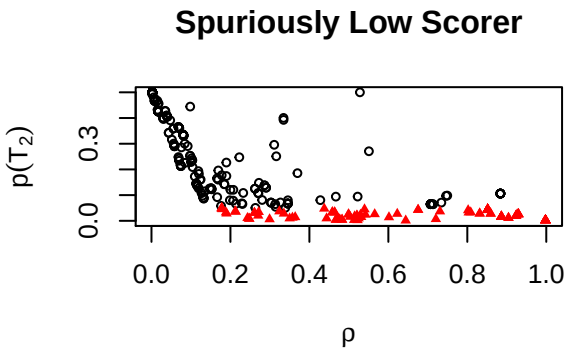
```
## ***************************************
## Appropriateness Type  1
## Iteration 1 | Max. rho parameter change= 0.1
## Iteration 2 | Max. rho parameter change= 0.1111111
## Iteration 3 | Max. rho parameter change= 0.1111111
## Iteration 4 | Max. rho parameter change= 0.1
## Iteration 5 | Max. rho parameter change= 0.081
## Iteration 6 | Max. rho parameter change= 0.059049
## Iteration 7 | Max. rho parameter change= 0.03874205
## Iteration 8 | Max. rho parameter change= 0.02287679
## ***************************************
## Appropriateness Type  0
## Iteration 1 | Max. rho parameter change= 0.1
## Iteration 2 | Max. rho parameter change= 0.1111111
## Iteration 3 | Max. rho parameter change= 0.1111111
## Iteration 4 | Max. rho parameter change= 0.1
## Iteration 5 | Max. rho parameter change= 0.081
## Iteration 6 | Max. rho parameter change= 0.059049
## Iteration 7 | Max. rho parameter change= 0.03874205
## Iteration 8 | Max. rho parameter change= 0.02287679
```

```
##                          appr.type M.rho SD.rho median.SE.rho prop.sign.T2
## Spuriously High Scorers          1 0.298  0.361         0.158        0.246
## Spuriously Low Scorers           0 0.217  0.312         0.144        0.209
```









DINO

```
## ----------------------------------------------------------------------------
## DINO MODEL
## ** 2019-01-17 14:45:45
## ----------------------------------------------------------------------------
## Iter.  1  :  14:45:45 ,   loglike= -5924.387  / max. param. ch. :  0.240237  / relative deviance char
## Iter.  2  :  14:45:45 ,   loglike= -5860.201  / max. param. ch. :  0.118158  / relative deviance char
## Iter.  3  :  14:45:45 ,   loglike= -5818.205  / max. param. ch. :  0.053075  / relative deviance char
## Iter.  4  :  14:45:45 ,   loglike= -5803.271  / max. param. ch. :  0.027305  / relative deviance char
## Iter.  5  :  14:45:45 ,   loglike= -5797.036  / max. param. ch. :  0.015208  / relative deviance char
## Iter.  6  :  14:45:45 ,   loglike= -5794.039  / max. param. ch. :  0.008766  / relative deviance char
## Iter.  7  :  14:45:45 ,   loglike= -5792.459  / max. param. ch. :  0.005158  / relative deviance char
## Iter.  8  :  14:45:45 ,   loglike= -5791.564  / max. param. ch. :  0.003103  / relative deviance char
## Iter.  9  :  14:45:45 ,   loglike= -5791.024  / max. param. ch. :  0.001917  / relative deviance char
## Iter.  10  :  14:45:45 ,   loglike= -5790.679  / max. param. ch. :  0.001218  / relative deviance cha
## Iter.  11  :  14:45:45 ,   loglike= -5790.449  / max. param. ch. :  0.000797  / relative deviance cha
## Iter.  12  :  14:45:45 ,   loglike= -5790.289  / max. param. ch. :  0.000537  / relative deviance cha
## Iter.  13  :  14:45:45 ,   loglike= -5790.176  / max. param. ch. :  0.000371  / relative deviance cha
## Iter.  14  :  14:45:45 ,   loglike= -5790.094  / max. param. ch. :  0.000262  / relative deviance cha
## Iter.  15  :  14:45:45 ,   loglike= -5790.033  / max. param. ch. :  0.000214  / relative deviance cha
## Iter.  16  :  14:45:45 ,   loglike= -5789.987  / max. param. ch. :  0.000189  / relative deviance cha
## ----------------------------------------------------------------------------
## Time difference of 0.3499899 secs
```

Print DINO

```
## Estimation of Mixed DINA/DINO Model
##
## CDM 7.1-20 (2018-12-13 11:54:50)
##
## Call:
## din(data = data, q.matrix = qmatrix, maxit = 500, guess.equal = 0.2,
##     slip.equal = 0.1, rule = "DINO")
##
## Number of cases=536
## Number of items=20
## Number of skill dimensions=8
## Number of skill classes=256
## Number of parameters=257
##   # item parameters=2
##   # skill distribution parameters=255
##
## Log-Likelihood=-5789.99
## AIC=12094
## BIC=13195
```

DINO Summary

```
## CDM 7.1-20 (Built 2018-12-13 11:54:50)
## Call:
##  din(data = data, q.matrix = qmatrix, maxit = 500, guess.equal = 0.2,      slip.equal = 0.1, rule = 
##
## Date of Analysis: 2019-01-17 14:45:45
## Time difference of 0.3499899 secs
## Computation Time: 0.3499899
##
##
## Deviance = 11579.97  |   Log-Likelihood= -5789.987
##
## Number of iterations: 17
##
## Number of item parameters: 2
## Number of skill class parameters: 255
##
## Information criteria:
##   AIC = 12093.98
##   BIC = 13195
##
## Mean of RMSEA item fit: 0.215
##
## Item parameters
##      item guess  slip   IDI rmsea
## 1   Item1 0.245 0.161 0.593 0.094
## 2   Item2 0.245 0.161 0.593 0.125
## 3   Item3 0.245 0.161 0.593 0.114
## 4   Item4 0.245 0.161 0.593 0.030
## 5   Item5 0.245 0.161 0.593 0.088
## 6   Item6 0.245 0.161 0.593 0.430
## 7   Item7 0.245 0.161 0.593 0.207
## 8   Item8 0.245 0.161 0.593 0.349
## 9   Item9 0.245 0.161 0.593 0.252
## 10 Item10 0.245 0.161 0.593 0.230
## 11 Item11 0.245 0.161 0.593 0.141
## 12 Item12 0.245 0.161 0.593 0.304
## 13 Item13 0.245 0.161 0.593 0.395
## 14 Item14 0.245 0.161 0.593 0.309
## 15 Item15 0.245 0.161 0.593 0.162
## 16 Item16 0.245 0.161 0.593 0.269
## 17 Item17 0.245 0.161 0.593 0.165
## 18 Item18 0.245 0.161 0.593 0.123
## 19 Item19 0.245 0.161 0.593 0.309
## 20 Item20 0.245 0.161 0.593 0.210
##
## Marginal skill probabilities:
##        skill.prob
## alpha1     0.2372
## alpha2     0.4536
## alpha3     0.2372
## alpha4     0.2821
```

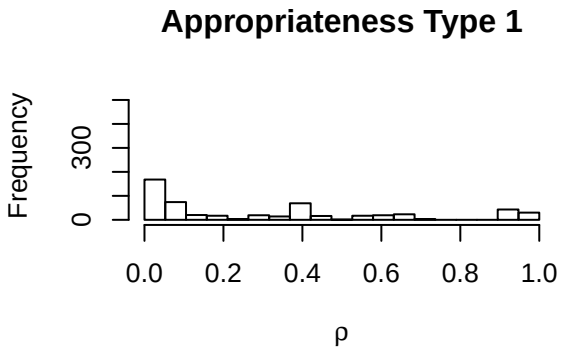
```
## alpha5     0.2372
## alpha6     0.2451
## alpha7     0.4744
## alpha8     0.2486
##
## Tetrachoric correlations among skill dimensions
##        alpha1 alpha2 alpha3 alpha4 alpha5 alpha6 alpha7 alpha8
## alpha1 1.0000 0.8755 0.5532 0.4447 0.5532 0.5333 0.9773 0.5248
## alpha2 0.8755 1.0000 0.8755 0.6776 0.8755 0.8334 0.9998 0.8167
## alpha3 0.5532 0.8755 1.0000 0.4446 0.5533 0.5333 0.9809 0.5247
## alpha4 0.4447 0.6776 0.4446 1.0000 0.4446 0.4805 0.7097 0.4934
## alpha5 0.5532 0.8755 0.5533 0.4446 1.0000 0.5333 0.9797 0.5247
## alpha6 0.5333 0.8334 0.5333 0.4805 0.5333 1.0000 0.8870 0.5047
## alpha7 0.9773 0.9998 0.9809 0.7097 0.9797 0.8870 1.0000 0.8657
## alpha8 0.5248 0.8167 0.5247 0.4934 0.5247 0.5047 0.8657 1.0000
##
## Skill Pattern Probabilities
##
## 00000000 10000000 01000000 00100000 00010000 00001000 00000100 00000010
##  0.48035  0.00000  0.00000  0.00000  0.02608  0.00000  0.00000  0.00033
## 00000001 11000000 10100000 10010000 10001000 10000100 10000010 10000001
##  0.00032  0.00000  0.00000  0.00000  0.00000  0.00000  0.00033  0.00000
## 01100000 01010000 01001000 01000100 01000010 01000001 00110000 00101000
##  0.00000  0.00000  0.00000  0.00000  0.00709  0.00000  0.00000  0.00000
## 00100100 00100010 00100001 00011000 00010100 00010010 00010001 00001100
##  0.00000  0.00033  0.00000  0.00000  0.00779  0.00033  0.01092  0.00000
## 00001010 00001001 00000110 00000101 00000011 11100000 11010000 11001000
##  0.00033  0.00000  0.00033  0.00001  0.00033  0.00000  0.00000  0.00000
## 11000100 11000010 11000001 10110000 10101000 10100100 10100010 10100001
##  0.00000  0.00709  0.00000  0.00000  0.00000  0.00000  0.00033  0.00000
## 10011000 10010100 10010010 10010001 10001100 10001010 10001001 10000110
##  0.00000  0.00001  0.00033  0.00001  0.00000  0.00033  0.00000  0.00033
## 10000101 10000011 01110000 01101000 01100100 01100010 01100001 01011000
##  0.00000  0.00033  0.00000  0.00000  0.00000  0.00709  0.00000  0.00000
## 01010100 01010010 01010001 01001100 01001010 01001001 01000110 01000101
##  0.00000  0.00709  0.00000  0.00000  0.00709  0.00000  0.00709  0.00000
## 01000011 00111000 00110100 00110010 00110001 00101100 00101010 00101001
##  0.00709  0.00000  0.00000  0.00033  0.00000  0.00000  0.00033  0.00000
## 00100110 00100101 00100011 00011100 00011010 00011001 00010110 00010101
##  0.00033  0.00000  0.00033  0.00000  0.00033  0.00000  0.00033  0.00010
## 00010011 00001110 00001101 00001011 00000111 11110000 11101000 11100100
##  0.00033  0.00033  0.00000  0.00033  0.00033  0.00000  0.00000  0.00000
## 11100010 11100001 11011000 11010100 11010010 11010001 11001100 11001010
##  0.00709  0.00000  0.00000  0.00000  0.00709  0.00000  0.00000  0.00709
## 11001001 11000110 11000101 11000011 10111000 10110100 10110010 10110001
##  0.00000  0.00709  0.00000  0.00709  0.00000  0.00000  0.00033  0.00000
## 10101100 10101010 10101001 10100110 10100101 10100011 10011100 10011010
##  0.00000  0.00033  0.00000  0.00033  0.00000  0.00033  0.00000  0.00033
## 10011001 10010110 10010101 10010011 10001110 10001101 10001011 10000111
##  0.00000  0.00033  0.00000  0.00033  0.00033  0.00000  0.00033  0.00033
## 01111000 01110100 01110010 01110001 01101100 01101010 01101001 01100110
##  0.00000  0.00000  0.00709  0.00000  0.00000  0.00709  0.00000  0.00709
## 01100101 01100011 01011100 01011010 01011001 01010110 01010101 01010011
##  0.00000  0.00709  0.00000  0.00709  0.00000  0.00709  0.00000  0.00709
```

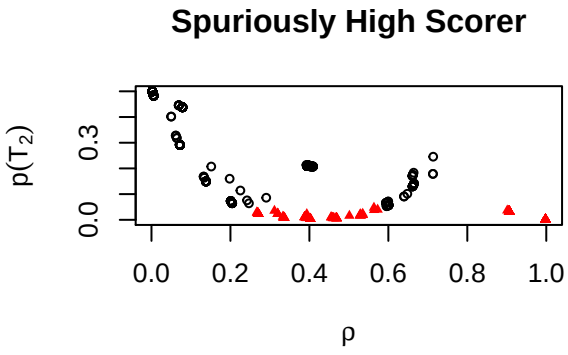
```
## 01001110 01001101 01001011 01000111 00111100 00111010 00111001 00110110
##  0.00709  0.00000  0.00709  0.00709  0.00000  0.00033  0.00000  0.00033
## 00110101 00110011 00101110 00101101 00101011 00100111 00011110 00011101
##  0.00000  0.00033  0.00033  0.00000  0.00033  0.00033  0.00033  0.00000
## 00011011 00010111 00001111 11111000 11110100 11110010 11110001 11101100
##  0.00033  0.00033  0.00033  0.00000  0.00000  0.00709  0.00000  0.00000
## 11101010 11101001 11100110 11100101 11100011 11011100 11011010 11011001
##  0.00709  0.00000  0.00709  0.00000  0.00709  0.00000  0.00709  0.00000
## 11010110 11010101 11010011 11001110 11001101 11001011 11000111 10111100
##  0.00709  0.00000  0.00709  0.00709  0.00000  0.00709  0.00709  0.00000
## 10111010 10111001 10110110 10110101 10110011 10101110 10101101 10101011
##  0.00033  0.00000  0.00033  0.00000  0.00033  0.00033  0.00000  0.00033
## 10100111 10011110 10011101 10011011 10010111 10001111 01111100 01111010
##  0.00033  0.00033  0.00000  0.00033  0.00033  0.00033  0.00000  0.00709
## 01111001 01110110 01110101 01110011 01101110 01101101 01101011 01100111
##  0.00000  0.00709  0.00000  0.00709  0.00709  0.00000  0.00709  0.00709
## 01011110 01011101 01011011 01010111 01001111 00111110 00111101 00111011
##  0.00709  0.00000  0.00709  0.00709  0.00709  0.00033  0.00000  0.00033
## 00110111 00101111 00011111 11111100 11111010 11111001 11110110 11110101
##  0.00033  0.00033  0.00033  0.00000  0.00709  0.00000  0.00709  0.00000
## 11110011 11101110 11101101 11101011 11100111 11011110 11011101 11011011
##  0.00709  0.00709  0.00000  0.00709  0.00709  0.00709  0.00000  0.00709
## 11010111 11001111 10111110 10111101 10111011 10110111 10101111 10011111
##  0.00709  0.00709  0.00033  0.00000  0.00033  0.00033  0.00033  0.00033
## 01111110 01111101 01111011 01110111 01101111 01011111 00111111 11111110
##  0.00709  0.00000  0.00709  0.00709  0.00709  0.00709  0.00033  0.00709
## 11111101 11111011 11110111 11101111 11011111 10111111 01111111 11111111
##  0.00000  0.00709  0.00709  0.00709  0.00709  0.00033  0.00709  0.00709
```

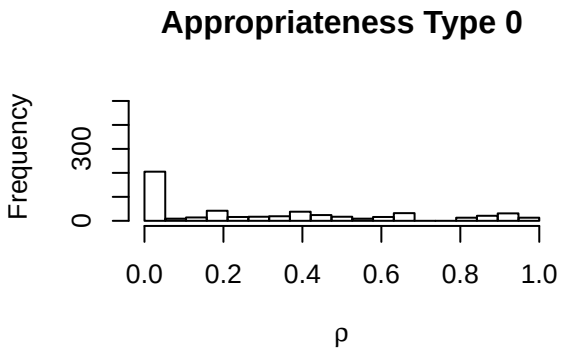
DINO Person-Fit

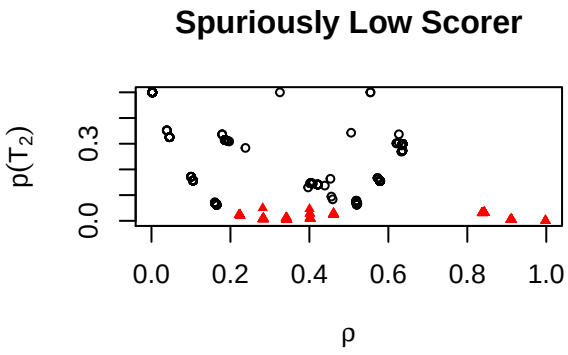
```
## ***************************************
## Appropriateness Type  1
## Iteration 1 | Max. rho parameter change= 0.1
## Iteration 2 | Max. rho parameter change= 0.1111111
## Iteration 3 | Max. rho parameter change= 0.1111111
## Iteration 4 | Max. rho parameter change= 0.1
## Iteration 5 | Max. rho parameter change= 0.081
## Iteration 6 | Max. rho parameter change= 0.059049
## Iteration 7 | Max. rho parameter change= 0.03874205
## Iteration 8 | Max. rho parameter change= 0.02273596
## ***************************************
## Appropriateness Type  0
## Iteration 1 | Max. rho parameter change= 0.1
## Iteration 2 | Max. rho parameter change= 0.1111111
## Iteration 3 | Max. rho parameter change= 0.1111111
## Iteration 4 | Max. rho parameter change= 0.1
## Iteration 5 | Max. rho parameter change= 0.081
## Iteration 6 | Max. rho parameter change= 0.059049
## Iteration 7 | Max. rho parameter change= 0.03874205
## Iteration 8 | Max. rho parameter change= 0.01986352
```

```
##                          appr.type M.rho SD.rho median.SE.rho prop.sign.T2
## Spuriously High Scorers          1 0.308  0.326         0.149        0.295
## Spuriously Low Scorers           0 0.309  0.320         0.133        0.299
```









GDINA

Print GDINA

```
## Estimation of GDINA Model
##
## CDM 7.1-20 (2018-12-13 11:54:50)
##
## Call:
## gdina(data = data, q.matrix = qmatrix, maxit = 500, rule = "GDINA",
##     guess.equal = 0.2, slip.equal = 0.1)
##
## Number of cases=536
## Number of groups=1
## Number of items=20
## Number of skill dimensions=8
## Number of skill classes=256
## Number of parameters=227
##   # item parameters=190
##   # skill distribution parameters=37
##
## Log-Likelihood=-4235.23
## AIC=8924
## BIC=9897
```

GDINA Person-Fit

```
## ***************************************
## Appropriateness Type  1
## Iteration 1 | Max. rho parameter change= 0.1
## Iteration 2 | Max. rho parameter change= 0.1111111
## Iteration 3 | Max. rho parameter change= 0.1111111
## Iteration 4 | Max. rho parameter change= 0.1
## Iteration 5 | Max. rho parameter change= 0.081
## Iteration 6 | Max. rho parameter change= 0.059049
## Iteration 7 | Max. rho parameter change= 0.03874205
## Iteration 8 | Max. rho parameter change= 0.02287679
## ***************************************
## Appropriateness Type  0
## Iteration 1 | Max. rho parameter change= 0.1
## Iteration 2 | Max. rho parameter change= 0.1111111
## Iteration 3 | Max. rho parameter change= 0.1111111
## Iteration 4 | Max. rho parameter change= 0.1
## Iteration 5 | Max. rho parameter change= 0.081
## Iteration 6 | Max. rho parameter change= 0.059049
## Iteration 7 | Max. rho parameter change= 0.03874205
## Iteration 8 | Max. rho parameter change= 0.02287679
```

```
##                         appr.type M.rho SD.rho median.SE.rho prop.sign.T2
## Spuriously High Scorers         1 0.263  0.365         0.211        0.132
## Spuriously Low Scorers          0 0.149  0.271         0.215        0.088
```