Errata and On-line Appendix for Article: "It might not make a big DIF: Improved Differential Test Functioning statistics that account for sampling variability"

R. Philip Chalmers, Alyssa Counsell, and David B. Flora
York University

Abstract

Construction of the estimated parameter covariance matrix, obtained after inverting a suitable parameter information matrix, neglected to include information regarding the latent variable mean and variance parameters. Although these parameter estimates are not directly involved in the computation of the $sDTF$ and $uDTF$ measures, their exclusion from the information matrix caused the imputed sampling variability sets for the $sDTF$ and $uDTF$ measures to be generally distorted, resulting in slightly improper confidence intervals and detection rates. After the software responsible for this distortion was corrected, the simulation results suggested that the $sDTF$ and $uDTF$ measures were generally conservative in smaller sample sizes and approached the nominal α in larger sample sizes. However, the pattern of the detection rates in the simulated power analyses, and the general analysis result in the Empirical Application section, were largely unaffected by this bias. More information regarding the specific amendments can be found in the associated on-line appendix.

		$sDTF$			$uDTF_{\%}(\alpha = .95)$				
N	Test Length	$p < .10$	$p < .05$	$p < .01$	> 2	> 2.5	> 3	> 3.5	> 4
500	30	.031	.013	.001	1.000	1.000	.987	.854	.601
	40	.026	.006	.000	1.000	1.000	.998	.933	.687
	50	.015	.007	.000	1.000	1.000	.999	.978	.873
1000	30	.071	.030	.000	.839	.371	.152	.063	.026
	40	.062	.035	.008	.866	.377	.149	.073	.018
	50	.052	.015	.003	.930	.437	.203	.087	.034
3000	30	.092	.043	.009	.008	.001	.000	.000	.000
	40	.092	.043	.005	.014	.000	.000	.000	.000
	50	.084	.039	.002	.009	.001	.000	.000	.000
5000	30	.091	.042	.013	.000	.000	.000	.000	.000
	40	.090	.045	.007	.000	.000	.000	.000	.000
	50	.075	.031	.004	.000	.000	.000	.000	.000

Table 2

DTF conditions for the 3PLM when no items contained DIF, representing the Type I error rates ($sDTF$) and cut-off values at the 95% percentile ($uDTF$).

		$sDTF$			$uDTF_{\%}(\alpha = .95)$				
N	Test Length	$p < .10$	$p < .05$	$p < .01$	> 2	> 2.5	> 3	> 3.5	> 4
500	20	.024	.008	.000	1.000	.981	.808	.506	.288
	25	.013	.005	.000	1.000	1.000	.952	.732	.462
	30	.003	.001	.000	1.000	1.000	.994	.930	.723
1000	20	.046	.016	.001	.518	.175	.047	.006	.001
	25	.053	.025	.004	.613	.208	.061	.022	.004
	30	.047	.013	.000	.725	.284	.091	.024	.002
3000	20	.088	.046	.004	.005	.000	.000	.000	.000
	25	.071	.032	.006	.003	.000	.000	.000	.000
	30	.079	.033	.004	.003	.000	.000	.000	.000
5000	20	.083	.042	.004	.000	.000	.000	.000	.000
	25	.075	.036	.005	.000	.000	.000	.000	.000
	30	.102	.053	.009	.000	.000	.000	.000	.000

Table 3

DTF conditions for the GRM when no items contained DIF, representing the Type I error rates ($sDTF$) and cut-off values at the 95% percentile ($uDTF$).

Specific corrections

- p. 127, the sentence "However, larger sample sizes generally lead to more liberal Type I error rates for the $s\widehat{DTF}$ statistic." should read "However, larger sample sizes generally lead to Type I error rates closer to the nominal detection rate for the $s\widehat{DTF}$ statistic."
- p. 132, the sentence "Overall, the DTF statistics for the GRM demonstrated nominal to slightly liberal Type I error rates, and generally provided smaller $uDTF_{\%}$ values than the previous 3PLM simulation." should read "Overall, the DTF statistics for the GRM demonstrated nominal

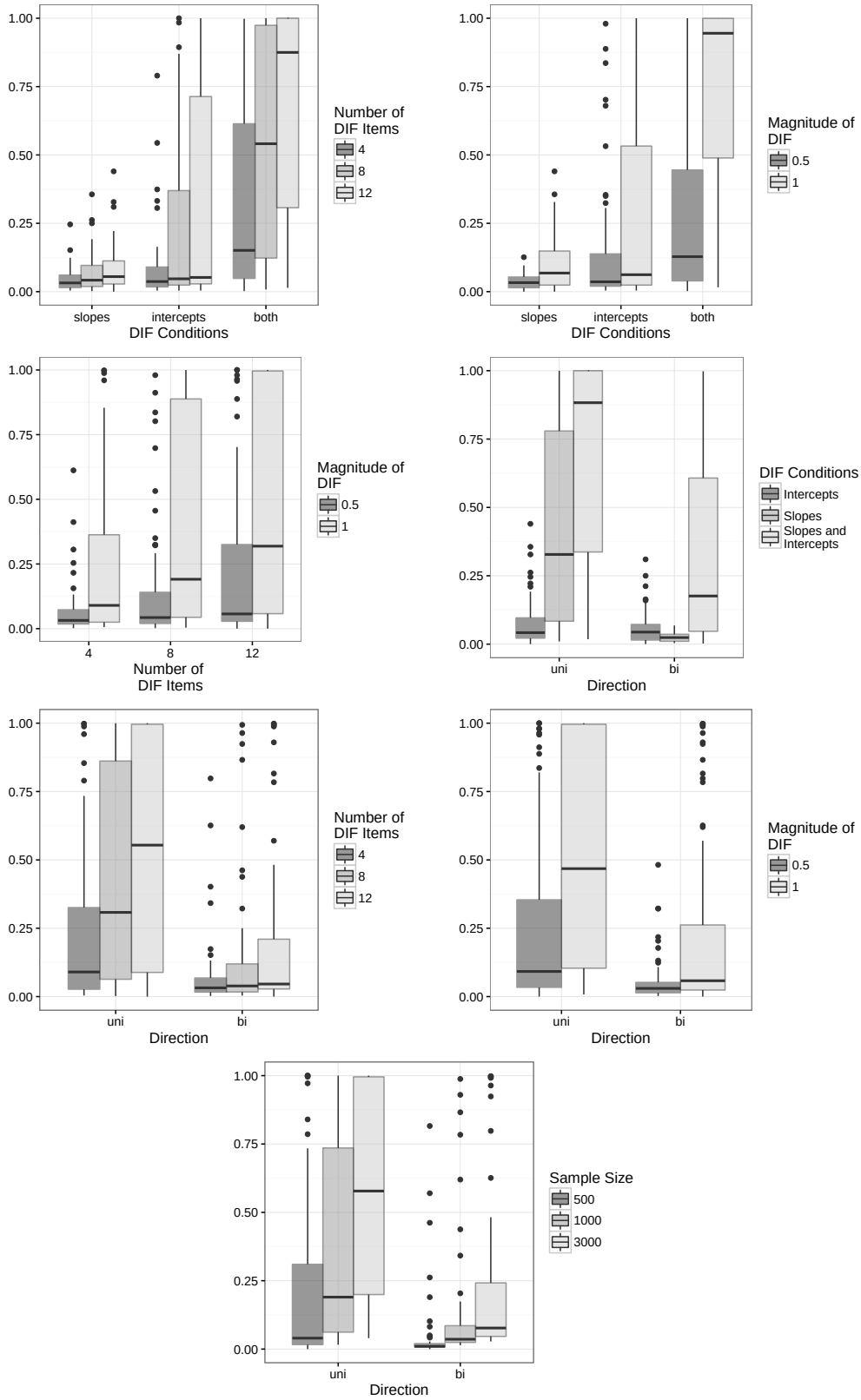

Figure 1. $sDTF$ empirical p-value interaction plots at $\alpha = .05$ for 3PLM simulation.

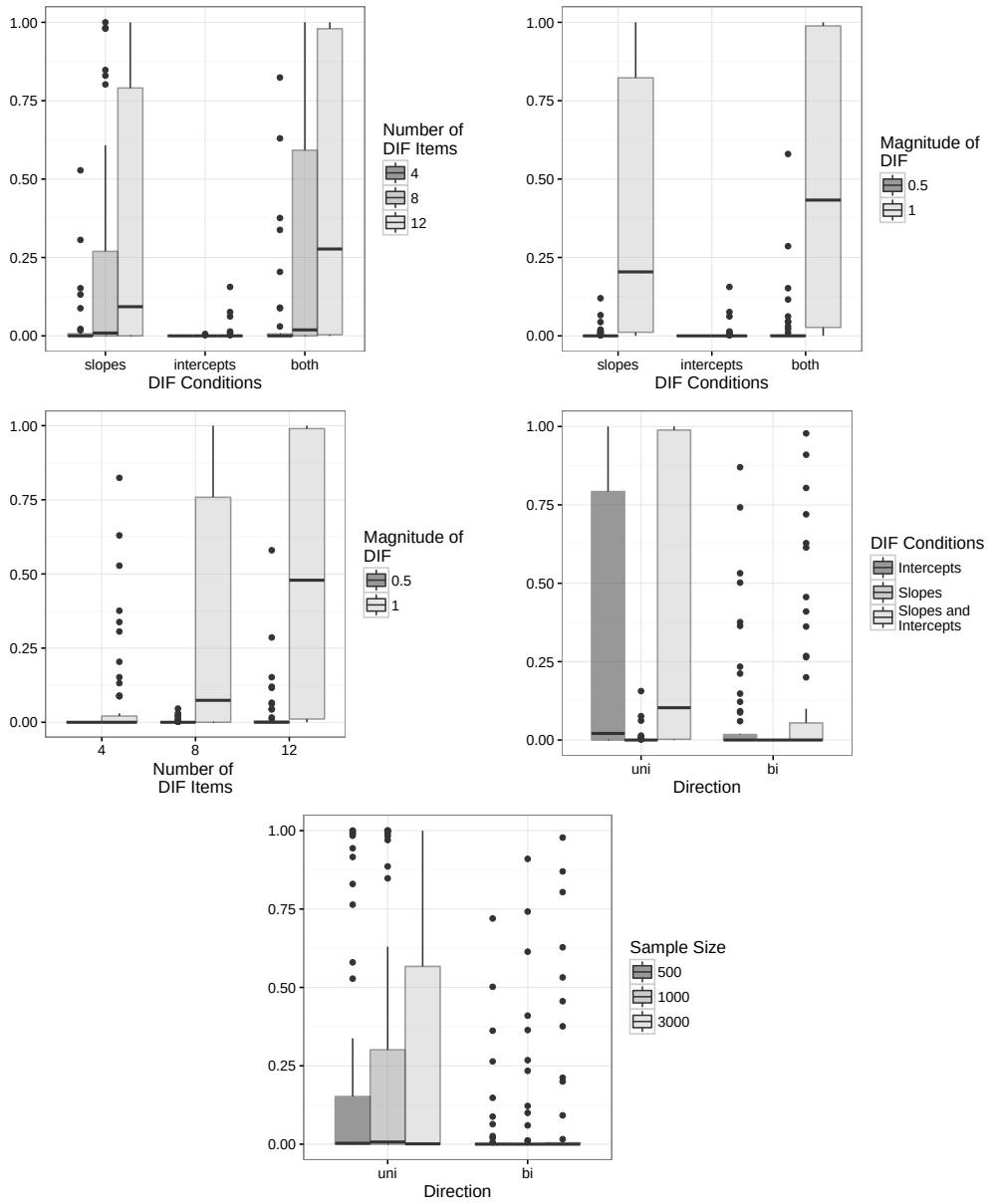

Figure 2. $uDTF_{\%}$ interaction plots with cutoff value greater than $uDTF_{\%}(\alpha = .05)$ for 3PLM simulation.

Group	Item	a	d_1	d_2	d_3
	1	2.08 (0.28)	6.00 (0.83)	3.47 (0.43)	-1.58 (0.24)
	2	1.87 (0.23)	4.80 (0.53)	1.66 (0.23)	-2.77 (0.31)
	3	1.75 (0.17)	5.18 (0.50)	2.06 (0.20)	-2.14 (0.22)
	4	3.64 (0.48)	7.55 (1.06)	2.69 (0.41)	-3.16 (0.44)
Canada	5	3.25 (0.40)	7.55 (1.35)	2.21 (0.34)	-3.17 (0.41)
	6	2.38 (0.26)	7.03 (0.73)	3.88 (0.34)	-1.23 (0.22)
	7	2.61 (0.24)	5.18 (0.44)	1.82 (0.23)	-2.59 (0.29)
	8	2.82 (0.28)	6.31 (0.56)	2.71 (0.30)	-2.89 (0.31)
	9	3.02 (0.43)	8.06 (1.14)	3.56 (0.44)	-2.35 (0.39)
	10	3.26 (0.38)	7.59 (0.89)	3.30 (0.41)	-2.89 (0.41)
	1	1.55 (0.26)	5.56 (0.79)	4.72 (0.59)	-0.05 (0.21)
	2	2.08 (0.34)	5.96 (0.98)	3.67 (0.42)	-0.60 (0.26)
	3	1.75 (0.17)	5.18 (0.50)	2.06 (0.20)	-2.14 (0.22)
	4	2.38 (0.33)	4.82 (0.52)	1.49 (0.30)	-3.41 (0.42)
Germany	5	2.88 (0.50)	6.34 (0.76)	3.43 (0.58)	-2.00 (0.35)
	6	2.38 (0.26)	7.03 (0.73)	3.88 (0.34)	-1.23 (0.22)
	7	2.61 (0.24)	5.18 (0.44)	1.82 (0.23)	-2.59 (0.29)
	8	2.82 (0.28)	6.31 (0.56)	2.71 (0.30)	-2.89 (0.31)
	9	1.79 (0.30)	4.88 (0.55)	2.61 (0.34)	-1.20 (0.26)
	10	1.69 (0.28)	4.89 (0.70)	3.28 (0.38)	-0.57 (0.23)

Table 4

Parameter estimates with standard errors for Canada and German samples for final anchored model. Standard errors were estimated using the cross-product approximation. Dashed lines indicate parameters that were constrained to be equal across groups.

to slightly conservative Type I error rates, and generally provided larger $uDTF_{\%}$ values than the previous 3PLM simulation."

• p. 133, the sentence "Using the Canadian group as the reference group (with latent mean fixed to 0 and variance fixed to 1), the German group had latent mean and variance estimates of -0.115 and 0.953, respectively." should contain the standard error information and read "Using the Canadian group as the reference group (with latent mean fixed to 0 and variance fixed to 1), the German group had latent mean and variance estimates of -0.115 ($SE = 0.11$) and 0.953 ($SE = 0.16$), respectively."

• p. 134, the sentence "Specifically, $\widehat{sDTF} = -0.629$ (95% CI: -0.969 to -0.351) and $\widehat{uDTF} = 0.663$ (95% CI: 0.363 to 1.001), which overall represent a bias in the total scores of approximately 0.629 raw score points (or 1.57%) in favor of the German population." should read "Specifically, $\widehat{sDTF} = -0.629$ (95% CI: -1.089 to -0.281) and $\widehat{uDTF} = 0.663$ (95% CI: 0.318 to 1.146), which overall represent a bias in the total scores of approximately 0.629 raw score points (or 1.57%) in favor of the German population."

• p. 136, the sentence "In the simulation studies of the 3PLM and GRM, when no DIF existed in the population the two statistics behaved appropriately, retaining nominal to slightly liberal Type I errors rates, depending on the IRT model used, and provided evidence of equal test scoring functions as the sample sizes increased." should read "In the simulation studies of the 3PLM and

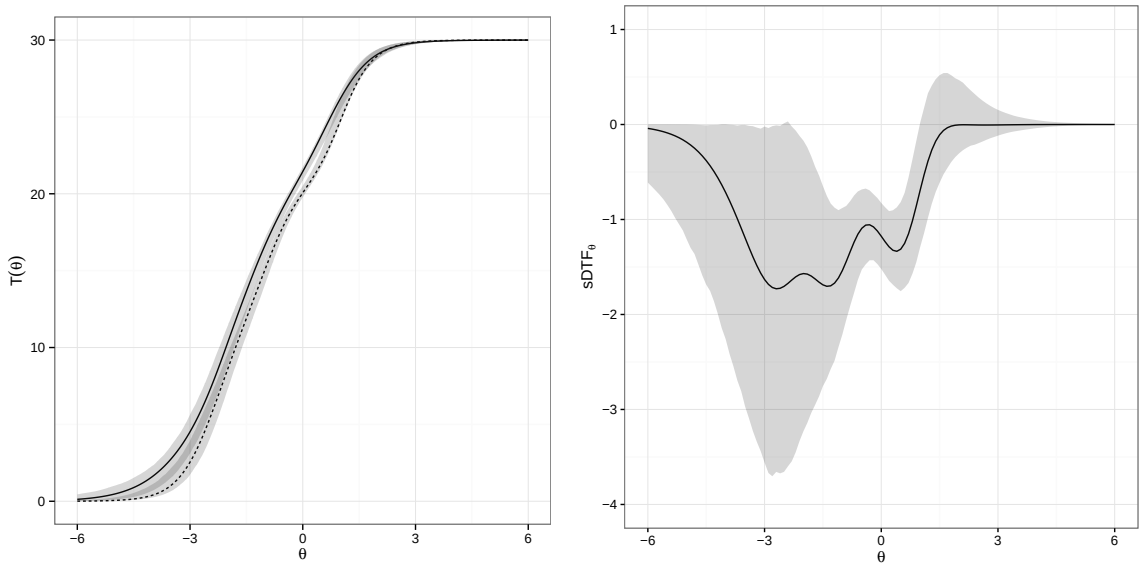

Figure 3. Empirical test-scoring functions with imputed 95% confidence intervals (left) for the German (solid) and Canadian (dashed) groups, and $s\widehat{DTF}$ statistics evaluated at different locations along θ (right) with 95% confidence intervals.

GRM, when no DIF existed in the population the two statistics behaved appropriately, demonstrating nominal to slightly conservative Type I errors rates, and provided evidence of equal test scoring functions as the sample sizes increased."

Online Appendix for Article: It Might Not Make a Big DIF: Improved Differential Test Functioning Statistics That Account for Sampling Variability

Chalmers, Counsell, and Flora

February 25, 2016

On-line appendix to accompany *It might not make a big DIF: Improved Differential Test Functioning statistics that account for sampling variability.* The tables contain simulation results pertaining to detection rates ($sDTF$) and cut-off values greater than the 05% percentile ($uDTF$) when varying sample size (500, 1000, 3000), DIF size (0.5 and 1.0), test size (30, 40, and 50), parameters containing DIF (d, a, d and a), and number of items containing DIF (4, 8, and 12 in the 3PLM design, and 4, 6, and 8 in the GRM design).

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
1	slopes	30.00	4.00	0.50	0.02	0.00	0.00	0.00
3	intercepts	30.00	4.00	0.50	0.03	0.00	0.00	0.00
5	both	30.00	4.00	0.50	0.07	0.00	0.00	0.00
7	slopes	40.00	4.00	0.50	0.01	0.00	0.00	0.00
9	intercepts	40.00	4.00	0.50	0.01	0.00	0.00	0.00
11	both	40.00	4.00	0.50	0.02	0.00	0.00	0.00
13	slopes	50.00	4.00	0.50	0.00	0.00	0.00	0.00
15	intercepts	50.00	4.00	0.50	0.01	0.00	0.00	0.00
17	both	50.00	4.00	0.50	0.02	0.00	0.00	0.00
19	slopes	30.00	8.00	0.50	0.02	0.01	0.00	0.00
21	intercepts	30.00	8.00	0.50	0.07	0.00	0.00	0.00
23	both	30.00	8.00	0.50	0.32	0.02	0.00	0.00
25	slopes	40.00	8.00	0.50	0.00	0.00	0.00	0.00
27	intercepts	40.00	8.00	0.50	0.03	0.00	0.00	0.00
29	both	40.00	8.00	0.50	0.12	0.00	0.00	0.00
31	slopes	50.00	8.00	0.50	0.00	0.00	0.00	0.00
33	intercepts	50.00	8.00	0.50	0.01	0.00	0.00	0.00
35	both	50.00	8.00	0.50	0.04	0.00	0.00	0.00
37	slopes	30.00	12.00	0.50	0.03	0.04	0.00	0.00
39	intercepts	30.00	12.00	0.50	0.27	0.00	0.00	0.00
41	both	30.00	12.00	0.50	0.67	0.15	0.01	0.00
43	slopes	40.00	12.00	0.50	0.01	0.00	0.00	0.00
45	intercepts	40.00	12.00	0.50	0.08	0.00	0.00	0.00
47	both	40.00	12.00	0.50	0.33	0.04	0.00	0.00
49	slopes	50.00	12.00	0.50	0.00	0.00	0.00	0.00
51	intercepts	50.00	12.00	0.50	0.02	0.00	0.00	0.00
53	both	50.00	12.00	0.50	0.15	0.00	0.00	0.00
55	slopes	30.00	4.00	1.00	0.02	0.15	0.02	0.00
57	intercepts	30.00	4.00	1.00	0.09	0.00	0.00	0.00
59	both	30.00	4.00	1.00	0.73	0.34	0.05	0.01
61	slopes	40.00	4.00	1.00	0.01	0.02	0.00	0.00
63	intercepts	40.00	4.00	1.00	0.04	0.00	0.00	0.00
65	both	40.00	4.00	1.00	0.37	0.09	0.00	0.00
67	slopes	50.00	4.00	1.00	0.01	0.01	0.00	0.00
69	intercepts	50.00	4.00	1.00	0.02	0.00	0.00	0.00
71	both	50.00	4.00	1.00	0.17	0.01	0.00	0.00
73	slopes	30.00	8.00	1.00	0.03	0.83	0.59	0.27
75	intercepts	30.00	8.00	1.00	0.47	0.01	0.00	0.00
77	both	30.00	8.00	1.00	1.00	0.99	0.91	0.61
79	slopes	40.00	8.00	1.00	0.02	0.53	0.17	0.02
81	intercepts	40.00	8.00	1.00	0.18	0.00	0.00	0.00
83	both	40.00	8.00	1.00	0.97	0.92	0.44	0.11
85	slopes	50.00	8.00	1.00	0.01	0.20	0.02	0.00
87	intercepts	50.00	8.00	1.00	0.08	0.00	0.00	0.00
89	both	50.00	8.00	1.00	0.79	0.58	0.09	0.01
91	slopes	30.00	12.00	1.00	0.06	0.99	0.96	0.87
93	intercepts	30.00	12.00	1.00	0.84	0.06	0.00	0.00
95	both	30.00	12.00	1.00	1.00	1.00	1.00	1.00
97	slopes	40.00	12.00	1.00	0.04	0.94	0.74	0.44
99	intercepts	40.00	12.00	1.00	0.50	0.01	0.00	0.00
101	both	40.00	12.00	1.00	1.00	1.00	0.99	0.85
103	slopes	50.00	12.00	1.00	0.02	0.76	0.36	0.10
105	intercepts	50.00	12.00	1.00	0.23	0.00	0.00	0.00
107	both	50.00	12.00	1.00	1.00	0.98	0.83	0.37

Table 1: Unidirectional power simulation for 3PLM items with sample size 500

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
2	slopes	30.00	4.00	0.50	0.01	0.00	0.00	0.00
4	intercepts	30.00	4.00	0.50	0.01	0.00	0.00	0.00
6	both	30.00	4.00	0.50	0.02	0.00	0.00	0.00
8	slopes	40.00	4.00	0.50	0.01	0.00	0.00	0.00
10	intercepts	40.00	4.00	0.50	0.01	0.00	0.00	0.00
12	both	40.00	4.00	0.50	0.01	0.00	0.00	0.00
14	slopes	50.00	4.00	0.50	0.01	0.00	0.00	0.00
16	intercepts	50.00	4.00	0.50	0.00	0.00	0.00	0.00
18	both	50.00	4.00	0.50	0.00	0.00	0.00	0.00
20	slopes	30.00	8.00	0.50	0.02	0.00	0.00	0.00
22	intercepts	30.00	8.00	0.50	0.02	0.00	0.00	0.00
24	both	30.00	8.00	0.50	0.02	0.00	0.00	0.00
26	slopes	40.00	8.00	0.50	0.01	0.00	0.00	0.00
28	intercepts	40.00	8.00	0.50	0.01	0.00	0.00	0.00
30	both	40.00	8.00	0.50	0.01	0.00	0.00	0.00
32	slopes	50.00	8.00	0.50	0.00	0.00	0.00	0.00
34	intercepts	50.00	8.00	0.50	0.01	0.00	0.00	0.00
36	both	50.00	8.00	0.50	0.01	0.00	0.00	0.00
38	slopes	30.00	12.00	0.50	0.03	0.00	0.00	0.00
40	intercepts	30.00	12.00	0.50	0.01	0.00	0.00	0.00
42	both	30.00	12.00	0.50	0.05	0.00	0.00	0.00
44	slopes	40.00	12.00	0.50	0.01	0.00	0.00	0.00
46	intercepts	40.00	12.00	0.50	0.01	0.00	0.00	0.00
48	both	40.00	12.00	0.50	0.03	0.00	0.00	0.00
50	slopes	50.00	12.00	0.50	0.01	0.00	0.00	0.00
52	intercepts	50.00	12.00	0.50	0.00	0.00	0.00	0.00
54	both	50.00	12.00	0.50	0.01	0.00	0.00	0.00
56	slopes	30.00	4.00	1.00	0.01	0.00	0.00	0.00
58	intercepts	30.00	4.00	1.00	0.01	0.00	0.00	0.00
60	both	30.00	4.00	1.00	0.10	0.00	0.00	0.00
62	slopes	40.00	4.00	1.00	0.02	0.00	0.00	0.00
64	intercepts	40.00	4.00	1.00	0.01	0.00	0.00	0.00
66	both	40.00	4.00	1.00	0.05	0.00	0.00	0.00
68	slopes	50.00	4.00	1.00	0.01	0.00	0.00	0.00
70	intercepts	50.00	4.00	1.00	0.01	0.00	0.00	0.00
72	both	50.00	4.00	1.00	0.02	0.00	0.00	0.00
74	slopes	30.00	8.00	1.00	0.02	0.09	0.02	0.00
76	intercepts	30.00	8.00	1.00	0.01	0.00	0.00	0.00
78	both	30.00	8.00	1.00	0.46	0.26	0.03	0.00
80	slopes	40.00	8.00	1.00	0.01	0.01	0.00	0.00
82	intercepts	40.00	8.00	1.00	0.00	0.00	0.00	0.00
84	both	40.00	8.00	1.00	0.19	0.03	0.00	0.00
86	slopes	50.00	8.00	1.00	0.01	0.00	0.00	0.00
88	intercepts	50.00	8.00	1.00	0.01	0.00	0.00	0.00
90	both	50.00	8.00	1.00	0.08	0.00	0.00	0.00
92	slopes	30.00	12.00	1.00	0.04	0.50	0.12	0.02
94	intercepts	30.00	12.00	1.00	0.02	0.00	0.00	0.00
96	both	30.00	12.00	1.00	0.82	0.72	0.28	0.04
98	slopes	40.00	12.00	1.00	0.01	0.15	0.01	0.00
100	intercepts	40.00	12.00	1.00	0.01	0.00	0.00	0.00
102	both	40.00	12.00	1.00	0.57	0.36	0.03	0.00
104	slopes	50.00	12.00	1.00	0.00	0.02	0.00	0.00
106	intercepts	50.00	12.00	1.00	0.00	0.00	0.00	0.00
108	both	50.00	12.00	1.00	0.26	0.06	0.00	0.00

Table 2: Bidirectional power simulation for 3PLM items with sample size 500

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
109	slopes	30.00	4.00	0.50	0.02	0.00	0.00	0.00
111	intercepts	30.00	4.00	0.50	0.08	0.00	0.00	0.00
113	both	30.00	4.00	0.50	0.22	0.00	0.00	0.00
115	slopes	40.00	4.00	0.50	0.03	0.00	0.00	0.00
117	intercepts	40.00	4.00	0.50	0.06	0.00	0.00	0.00
119	both	40.00	4.00	0.50	0.10	0.00	0.00	0.00
121	slopes	50.00	4.00	0.50	0.02	0.00	0.00	0.00
123	intercepts	50.00	4.00	0.50	0.04	0.00	0.00	0.00
125	both	50.00	4.00	0.50	0.09	0.00	0.00	0.00
127	slopes	30.00	8.00	0.50	0.05	0.02	0.00	0.00
129	intercepts	30.00	8.00	0.50	0.32	0.00	0.00	0.00
131	both	30.00	8.00	0.50	0.70	0.03	0.00	0.00
133	slopes	40.00	8.00	0.50	0.04	0.00	0.00	0.00
135	intercepts	40.00	8.00	0.50	0.15	0.00	0.00	0.00
137	both	40.00	8.00	0.50	0.46	0.00	0.00	0.00
139	slopes	50.00	8.00	0.50	0.02	0.00	0.00	0.00
141	intercepts	50.00	8.00	0.50	0.08	0.00	0.00	0.00
143	both	50.00	8.00	0.50	0.29	0.00	0.00	0.00
145	slopes	30.00	12.00	0.50	0.04	0.07	0.00	0.00
147	intercepts	30.00	12.00	0.50	0.68	0.00	0.00	0.00
149	both	30.00	12.00	0.50	0.96	0.29	0.02	0.00
151	slopes	40.00	12.00	0.50	0.03	0.01	0.00	0.00
153	intercepts	40.00	12.00	0.50	0.35	0.00	0.00	0.00
155	both	40.00	12.00	0.50	0.82	0.06	0.00	0.00
157	slopes	50.00	12.00	0.50	0.02	0.00	0.00	0.00
159	intercepts	50.00	12.00	0.50	0.17	0.00	0.00	0.00
161	both	50.00	12.00	0.50	0.61	0.01	0.00	0.00
163	slopes	30.00	4.00	1.00	0.07	0.31	0.06	0.00
165	intercepts	30.00	4.00	1.00	0.33	0.00	0.00	0.00
167	both	30.00	4.00	1.00	0.96	0.63	0.12	0.00
169	slopes	40.00	4.00	1.00	0.04	0.09	0.00	0.00
171	intercepts	40.00	4.00	1.00	0.16	0.00	0.00	0.00
173	both	40.00	4.00	1.00	0.85	0.20	0.00	0.00
175	slopes	50.00	4.00	1.00	0.04	0.02	0.00	0.00
177	intercepts	50.00	4.00	1.00	0.09	0.00	0.00	0.00
179	both	50.00	4.00	1.00	0.62	0.03	0.00	0.00
181	slopes	30.00	8.00	1.00	0.14	0.98	0.87	0.52
183	intercepts	30.00	8.00	1.00	0.87	0.00	0.00	0.00
185	both	30.00	8.00	1.00	1.00	1.00	0.99	0.86
187	slopes	40.00	8.00	1.00	0.09	0.85	0.43	0.11
189	intercepts	40.00	8.00	1.00	0.61	0.00	0.00	0.00
191	both	40.00	8.00	1.00	1.00	0.99	0.79	0.29
193	slopes	50.00	8.00	1.00	0.06	0.61	0.12	0.01
195	intercepts	50.00	8.00	1.00	0.43	0.00	0.00	0.00
197	both	50.00	8.00	1.00	0.99	0.89	0.34	0.02
199	slopes	30.00	12.00	1.00	0.21	1.00	1.00	0.98
201	intercepts	30.00	12.00	1.00	1.00	0.08	0.00	0.00
203	both	30.00	12.00	1.00	1.00	1.00	1.00	1.00
205	slopes	40.00	12.00	1.00	0.11	1.00	0.98	0.81
207	intercepts	40.00	12.00	1.00	0.94	0.01	0.00	0.00
209	both	40.00	12.00	1.00	1.00	1.00	1.00	0.98
211	slopes	50.00	12.00	1.00	0.08	0.97	0.70	0.31
213	intercepts	50.00	12.00	1.00	0.75	0.00	0.00	0.00
215	both	50.00	12.00	1.00	1.00	1.00	0.98	0.69

Table 3: Unidirectional power simulation for 3PLM items with sample size 1000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
110	slopes	30.00	4.00	0.50	0.03	0.00	0.00	0.00
112	intercepts	30.00	4.00	0.50	0.02	0.00	0.00	0.00
114	both	30.00	4.00	0.50	0.04	0.00	0.00	0.00
116	slopes	40.00	4.00	0.50	0.03	0.00	0.00	0.00
118	intercepts	40.00	4.00	0.50	0.03	0.00	0.00	0.00
120	both	40.00	4.00	0.50	0.04	0.00	0.00	0.00
122	slopes	50.00	4.00	0.50	0.02	0.00	0.00	0.00
124	intercepts	50.00	4.00	0.50	0.02	0.00	0.00	0.00
126	both	50.00	4.00	0.50	0.02	0.00	0.00	0.00
128	slopes	30.00	8.00	0.50	0.05	0.00	0.00	0.00
130	intercepts	30.00	8.00	0.50	0.02	0.00	0.00	0.00
132	both	30.00	8.00	0.50	0.11	0.00	0.00	0.00
134	slopes	40.00	8.00	0.50	0.03	0.00	0.00	0.00
136	intercepts	40.00	8.00	0.50	0.02	0.00	0.00	0.00
138	both	40.00	8.00	0.50	0.05	0.00	0.00	0.00
140	slopes	50.00	8.00	0.50	0.01	0.00	0.00	0.00
142	intercepts	50.00	8.00	0.50	0.03	0.00	0.00	0.00
144	both	50.00	8.00	0.50	0.03	0.00	0.00	0.00
146	slopes	30.00	12.00	0.50	0.05	0.00	0.00	0.00
148	intercepts	30.00	12.00	0.50	0.02	0.00	0.00	0.00
150	both	30.00	12.00	0.50	0.20	0.00	0.00	0.00
152	slopes	40.00	12.00	0.50	0.04	0.00	0.00	0.00
154	intercepts	40.00	12.00	0.50	0.03	0.00	0.00	0.00
156	both	40.00	12.00	0.50	0.09	0.00	0.00	0.00
158	slopes	50.00	12.00	0.50	0.03	0.00	0.00	0.00
160	intercepts	50.00	12.00	0.50	0.03	0.00	0.00	0.00
162	both	50.00	12.00	0.50	0.07	0.00	0.00	0.00
164	slopes	30.00	4.00	1.00	0.07	0.00	0.00	0.00
166	intercepts	30.00	4.00	1.00	0.03	0.00	0.00	0.00
168	both	30.00	4.00	1.00	0.34	0.00	0.00	0.00
170	slopes	40.00	4.00	1.00	0.02	0.00	0.00	0.00
172	intercepts	40.00	4.00	1.00	0.02	0.00	0.00	0.00
174	both	40.00	4.00	1.00	0.17	0.00	0.00	0.00
176	slopes	50.00	4.00	1.00	0.05	0.00	0.00	0.00
178	intercepts	50.00	4.00	1.00	0.02	0.00	0.00	0.00
180	both	50.00	4.00	1.00	0.11	0.00	0.00	0.00
182	slopes	30.00	8.00	1.00	0.11	0.23	0.02	0.00
184	intercepts	30.00	8.00	1.00	0.03	0.00	0.00	0.00
186	both	30.00	8.00	1.00	0.87	0.41	0.03	0.00
188	slopes	40.00	8.00	1.00	0.04	0.06	0.00	0.00
190	intercepts	40.00	8.00	1.00	0.02	0.00	0.00	0.00
192	both	40.00	8.00	1.00	0.62	0.10	0.00	0.00
194	slopes	50.00	8.00	1.00	0.04	0.01	0.00	0.00
196	intercepts	50.00	8.00	1.00	0.02	0.00	0.00	0.00
198	both	50.00	8.00	1.00	0.44	0.01	0.00	0.00
200	slopes	30.00	12.00	1.00	0.11	0.74	0.27	0.04
202	intercepts	30.00	12.00	1.00	0.03	0.00	0.00	0.00
204	both	30.00	12.00	1.00	0.99	0.91	0.49	0.09
206	slopes	40.00	12.00	1.00	0.07	0.36	0.03	0.00
208	intercepts	40.00	12.00	1.00	0.03	0.00	0.00	0.00
210	both	40.00	12.00	1.00	0.93	0.61	0.11	0.01
212	slopes	50.00	12.00	1.00	0.06	0.12	0.00	0.00
214	intercepts	50.00	12.00	1.00	0.02	0.00	0.00	0.00
216	both	50.00	12.00	1.00	0.78	0.27	0.01	0.00

Table 4: Bidirectional power simulations for 3PLM items with sample size 1000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
217	slopes	30.00	4.00	0.50	0.05	0.00	0.00	0.00
219	intercepts	30.00	4.00	0.50	0.31	0.00	0.00	0.00
221	both	30.00	4.00	0.50	0.61	0.00	0.00	0.00
223	slopes	40.00	4.00	0.50	0.04	0.00	0.00	0.00
225	intercepts	40.00	4.00	0.50	0.16	0.00	0.00	0.00
227	both	40.00	4.00	0.50	0.41	0.00	0.00	0.00
229	slopes	50.00	4.00	0.50	0.07	0.00	0.00	0.00
231	intercepts	50.00	4.00	0.50	0.11	0.00	0.00	0.00
233	both	50.00	4.00	0.50	0.25	0.00	0.00	0.00
235	slopes	30.00	8.00	0.50	0.10	0.01	0.00	0.00
237	intercepts	30.00	8.00	0.50	0.84	0.00	0.00	0.00
239	both	30.00	8.00	0.50	0.98	0.05	0.00	0.00
241	slopes	40.00	8.00	0.50	0.10	0.00	0.00	0.00
243	intercepts	40.00	8.00	0.50	0.53	0.00	0.00	0.00
245	both	40.00	8.00	0.50	0.91	0.00	0.00	0.00
247	slopes	50.00	8.00	0.50	0.04	0.00	0.00	0.00
249	intercepts	50.00	8.00	0.50	0.35	0.00	0.00	0.00
251	both	50.00	8.00	0.50	0.80	0.00	0.00	0.00
253	slopes	30.00	12.00	0.50	0.13	0.12	0.00	0.00
255	intercepts	30.00	12.00	0.50	0.98	0.00	0.00	0.00
257	both	30.00	12.00	0.50	1.00	0.58	0.03	0.00
259	slopes	40.00	12.00	0.50	0.08	0.02	0.00	0.00
261	intercepts	40.00	12.00	0.50	0.89	0.00	0.00	0.00
263	both	40.00	12.00	0.50	1.00	0.12	0.00	0.00
265	slopes	50.00	12.00	0.50	0.06	0.00	0.00	0.00
267	intercepts	50.00	12.00	0.50	0.70	0.00	0.00	0.00
269	both	50.00	12.00	0.50	0.96	0.00	0.00	0.00
271	slopes	30.00	4.00	1.00	0.25	0.53	0.08	0.00
273	intercepts	30.00	4.00	1.00	0.79	0.00	0.00	0.00
275	both	30.00	4.00	1.00	1.00	0.82	0.23	0.01
277	slopes	40.00	4.00	1.00	0.12	0.13	0.00	0.00
279	intercepts	40.00	4.00	1.00	0.54	0.00	0.00	0.00
281	both	40.00	4.00	1.00	1.00	0.38	0.01	0.00
283	slopes	50.00	4.00	1.00	0.10	0.02	0.00	0.00
285	intercepts	50.00	4.00	1.00	0.37	0.00	0.00	0.00
287	both	50.00	4.00	1.00	0.99	0.09	0.00	0.00
289	slopes	30.00	8.00	1.00	0.36	1.00	0.96	0.75
291	intercepts	30.00	8.00	1.00	1.00	0.00	0.00	0.00
293	both	30.00	8.00	1.00	1.00	1.00	1.00	0.98
295	slopes	40.00	8.00	1.00	0.26	0.98	0.72	0.22
297	intercepts	40.00	8.00	1.00	0.98	0.00	0.00	0.00
299	both	40.00	8.00	1.00	1.00	1.00	0.94	0.50
301	slopes	50.00	8.00	1.00	0.19	0.80	0.22	0.02
303	intercepts	50.00	8.00	1.00	0.89	0.00	0.00	0.00
305	both	50.00	8.00	1.00	1.00	0.99	0.61	0.05
307	slopes	30.00	12.00	1.00	0.44	1.00	1.00	1.00
309	intercepts	30.00	12.00	1.00	1.00	0.16	0.00	0.00
311	both	30.00	12.00	1.00	1.00	1.00	1.00	1.00
313	slopes	40.00	12.00	1.00	0.33	1.00	1.00	0.95
315	intercepts	40.00	12.00	1.00	1.00	0.00	0.00	0.00
317	both	40.00	12.00	1.00	1.00	1.00	1.00	1.00
319	slopes	50.00	12.00	1.00	0.22	1.00	0.96	0.60
321	intercepts	50.00	12.00	1.00	1.00	0.00	0.00	0.00
323	both	50.00	12.00	1.00	1.00	1.00	1.00	0.95

Table 5: Unidirectional power simulation for 3PLM items with sample size 3000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
218	slopes	30.00	4.00	0.50	0.06	0.00	0.00	0.00
220	intercepts	30.00	4.00	0.50	0.04	0.00	0.00	0.00
222	both	30.00	4.00	0.50	0.13	0.00	0.00	0.00
224	slopes	40.00	4.00	0.50	0.05	0.00	0.00	0.00
226	intercepts	40.00	4.00	0.50	0.05	0.00	0.00	0.00
228	both	40.00	4.00	0.50	0.09	0.00	0.00	0.00
230	slopes	50.00	4.00	0.50	0.05	0.00	0.00	0.00
232	intercepts	50.00	4.00	0.50	0.03	0.00	0.00	0.00
234	both	50.00	4.00	0.50	0.08	0.00	0.00	0.00
236	slopes	30.00	8.00	0.50	0.08	0.00	0.00	0.00
238	intercepts	30.00	8.00	0.50	0.05	0.00	0.00	0.00
240	both	30.00	8.00	0.50	0.32	0.00	0.00	0.00
242	slopes	40.00	8.00	0.50	0.08	0.00	0.00	0.00
244	intercepts	40.00	8.00	0.50	0.03	0.00	0.00	0.00
246	both	40.00	8.00	0.50	0.18	0.00	0.00	0.00
248	slopes	50.00	8.00	0.50	0.04	0.00	0.00	0.00
250	intercepts	50.00	8.00	0.50	0.04	0.00	0.00	0.00
252	both	50.00	8.00	0.50	0.12	0.00	0.00	0.00
254	slopes	30.00	12.00	0.50	0.08	0.00	0.00	0.00
256	intercepts	30.00	12.00	0.50	0.04	0.00	0.00	0.00
258	both	30.00	12.00	0.50	0.48	0.00	0.00	0.00
260	slopes	40.00	12.00	0.50	0.06	0.00	0.00	0.00
262	intercepts	40.00	12.00	0.50	0.04	0.00	0.00	0.00
264	both	40.00	12.00	0.50	0.32	0.00	0.00	0.00
266	slopes	50.00	12.00	0.50	0.05	0.00	0.00	0.00
268	intercepts	50.00	12.00	0.50	0.04	0.00	0.00	0.00
270	both	50.00	12.00	0.50	0.22	0.00	0.00	0.00
272	slopes	30.00	4.00	1.00	0.15	0.01	0.00	0.00
274	intercepts	30.00	4.00	1.00	0.07	0.00	0.00	0.00
276	both	30.00	4.00	1.00	0.80	0.01	0.00	0.00
278	slopes	40.00	4.00	1.00	0.09	0.00	0.00	0.00
280	intercepts	40.00	4.00	1.00	0.04	0.00	0.00	0.00
282	both	40.00	4.00	1.00	0.63	0.00	0.00	0.00
284	slopes	50.00	4.00	1.00	0.07	0.00	0.00	0.00
286	intercepts	50.00	4.00	1.00	0.04	0.00	0.00	0.00
288	both	50.00	4.00	1.00	0.40	0.00	0.00	0.00
290	slopes	30.00	8.00	1.00	0.25	0.38	0.04	0.00
292	intercepts	30.00	8.00	1.00	0.07	0.00	0.00	0.00
294	both	30.00	8.00	1.00	0.99	0.63	0.09	0.00
296	slopes	40.00	8.00	1.00	0.16	0.09	0.00	0.00
298	intercepts	40.00	8.00	1.00	0.05	0.00	0.00	0.00
300	both	40.00	8.00	1.00	0.96	0.20	0.00	0.00
302	slopes	50.00	8.00	1.00	0.12	0.01	0.00	0.00
304	intercepts	50.00	8.00	1.00	0.04	0.00	0.00	0.00
306	both	50.00	8.00	1.00	0.92	0.02	0.00	0.00
308	slopes	30.00	12.00	1.00	0.31	0.87	0.41	0.08
310	intercepts	30.00	12.00	1.00	0.06	0.00	0.00	0.00
312	both	30.00	12.00	1.00	1.00	0.98	0.73	0.17
314	slopes	40.00	12.00	1.00	0.21	0.53	0.06	0.00
316	intercepts	40.00	12.00	1.00	0.04	0.00	0.00	0.00
318	both	40.00	12.00	1.00	1.00	0.80	0.15	0.00
320	slopes	50.00	12.00	1.00	0.16	0.21	0.01	0.00
322	intercepts	50.00	12.00	1.00	0.05	0.00	0.00	0.00
324	both	50.00	12.00	1.00	0.99	0.46	0.01	0.00

Table 6: Bidirectional power simulation for 3PLM items with sample size 3000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
1	slopes	20.00	4.00	0.50	0.04	0.01	0.00	0.00
3	intercepts	20.00	4.00	0.50	0.06	0.00	0.00	0.00
5	both	20.00	4.00	0.50	0.27	0.04	0.00	0.00
7	slopes	25.00	4.00	0.50	0.01	0.00	0.00	0.00
9	intercepts	25.00	4.00	0.50	0.02	0.00	0.00	0.00
11	both	25.00	4.00	0.50	0.12	0.01	0.00	0.00
13	slopes	30.00	4.00	0.50	0.00	0.00	0.00	0.00
15	intercepts	30.00	4.00	0.50	0.00	0.00	0.00	0.00
17	both	30.00	4.00	0.50	0.03	0.00	0.00	0.00
19	slopes	20.00	6.00	0.50	0.06	0.07	0.01	0.00
21	intercepts	20.00	6.00	0.50	0.25	0.00	0.00	0.00
23	both	20.00	6.00	0.50	0.60	0.23	0.02	0.00
25	slopes	25.00	6.00	0.50	0.02	0.02	0.00	0.00
27	intercepts	25.00	6.00	0.50	0.10	0.00	0.00	0.00
29	both	25.00	6.00	0.50	0.30	0.07	0.00	0.00
31	slopes	30.00	6.00	0.50	0.01	0.00	0.00	0.00
33	intercepts	30.00	6.00	0.50	0.03	0.00	0.00	0.00
35	both	30.00	6.00	0.50	0.14	0.01	0.00	0.00
37	slopes	20.00	8.00	0.50	0.06	0.25	0.04	0.00
39	intercepts	20.00	8.00	0.50	0.49	0.00	0.00	0.00
41	both	20.00	8.00	0.50	0.80	0.62	0.18	0.03
43	slopes	25.00	8.00	0.50	0.04	0.09	0.01	0.00
45	intercepts	25.00	8.00	0.50	0.19	0.00	0.00	0.00
47	both	25.00	8.00	0.50	0.56	0.28	0.03	0.00
49	slopes	30.00	8.00	0.50	0.01	0.02	0.00	0.00
51	intercepts	30.00	8.00	0.50	0.06	0.00	0.00	0.00
53	both	30.00	8.00	0.50	0.28	0.08	0.00	0.00
55	slopes	20.00	4.00	1.00	0.18	0.81	0.49	0.20
57	intercepts	20.00	4.00	1.00	0.43	0.00	0.00	0.00
59	both	20.00	4.00	1.00	0.94	0.98	0.84	0.48
61	slopes	25.00	4.00	1.00	0.07	0.60	0.21	0.04
63	intercepts	25.00	4.00	1.00	0.20	0.00	0.00	0.00
65	both	25.00	4.00	1.00	0.84	0.87	0.45	0.10
67	slopes	30.00	4.00	1.00	0.02	0.29	0.05	0.00
69	intercepts	30.00	4.00	1.00	0.05	0.00	0.00	0.00
71	both	30.00	4.00	1.00	0.60	0.61	0.12	0.00
73	slopes	20.00	6.00	1.00	0.23	0.99	0.93	0.77
75	intercepts	20.00	6.00	1.00	0.87	0.02	0.00	0.00
77	both	20.00	6.00	1.00	1.00	1.00	1.00	0.98
79	slopes	25.00	6.00	1.00	0.13	0.95	0.76	0.46
81	intercepts	25.00	6.00	1.00	0.56	0.00	0.00	0.00
83	both	25.00	6.00	1.00	0.98	1.00	0.97	0.80
85	slopes	30.00	6.00	1.00	0.05	0.82	0.42	0.11
87	intercepts	30.00	6.00	1.00	0.24	0.00	0.00	0.00
89	both	30.00	6.00	1.00	0.92	0.98	0.82	0.40
91	slopes	20.00	8.00	1.00	0.25	1.00	1.00	0.98
93	intercepts	20.00	8.00	1.00	0.99	0.33	0.01	0.00
95	both	20.00	8.00	1.00	1.00	1.00	1.00	1.00
97	slopes	25.00	8.00	1.00	0.16	1.00	0.98	0.91
99	intercepts	25.00	8.00	1.00	0.87	0.04	0.00	0.00
101	both	25.00	8.00	1.00	1.00	1.00	1.00	0.99
103	slopes	30.00	8.00	1.00	0.07	0.98	0.87	0.59
105	intercepts	30.00	8.00	1.00	0.56	0.01	0.00	0.00
107	both	30.00	8.00	1.00	0.99	1.00	0.99	0.91

Table 7: Unidirectional power simulation for GRM items with sample size 500

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
2	slopes	20.00	4.00	0.50	0.03	0.00	0.00	0.00
4	intercepts	20.00	4.00	0.50	0.01	0.00	0.00	0.00
6	both	20.00	4.00	0.50	0.03	0.00	0.00	0.00
8	slopes	25.00	4.00	0.50	0.01	0.00	0.00	0.00
10	intercepts	25.00	4.00	0.50	0.01	0.00	0.00	0.00
12	both	25.00	4.00	0.50	0.01	0.00	0.00	0.00
14	slopes	30.00	4.00	0.50	0.00	0.00	0.00	0.00
16	intercepts	30.00	4.00	0.50	0.00	0.00	0.00	0.00
18	both	30.00	4.00	0.50	0.01	0.00	0.00	0.00
20	slopes	20.00	6.00	0.50	0.04	0.00	0.00	0.00
22	intercepts	20.00	6.00	0.50	0.01	0.00	0.00	0.00
24	both	20.00	6.00	0.50	0.06	0.00	0.00	0.00
26	slopes	25.00	6.00	0.50	0.01	0.00	0.00	0.00
28	intercepts	25.00	6.00	0.50	0.01	0.00	0.00	0.00
30	both	25.00	6.00	0.50	0.03	0.00	0.00	0.00
32	slopes	30.00	6.00	0.50	0.00	0.00	0.00	0.00
34	intercepts	30.00	6.00	0.50	0.00	0.00	0.00	0.00
36	both	30.00	6.00	0.50	0.01	0.00	0.00	0.00
38	slopes	20.00	8.00	0.50	0.05	0.00	0.00	0.00
40	intercepts	20.00	8.00	0.50	0.01	0.00	0.00	0.00
42	both	20.00	8.00	0.50	0.10	0.00	0.00	0.00
44	slopes	25.00	8.00	0.50	0.02	0.00	0.00	0.00
46	intercepts	25.00	8.00	0.50	0.01	0.00	0.00	0.00
48	both	25.00	8.00	0.50	0.03	0.00	0.00	0.00
50	slopes	30.00	8.00	0.50	0.00	0.00	0.00	0.00
52	intercepts	30.00	8.00	0.50	0.00	0.00	0.00	0.00
54	both	30.00	8.00	0.50	0.01	0.00	0.00	0.00
56	slopes	20.00	4.00	1.00	0.12	0.10	0.00	0.00
58	intercepts	20.00	4.00	1.00	0.01	0.00	0.00	0.00
60	both	20.00	4.00	1.00	0.37	0.19	0.01	0.00
62	slopes	25.00	4.00	1.00	0.04	0.03	0.00	0.00
64	intercepts	25.00	4.00	1.00	0.01	0.00	0.00	0.00
66	both	25.00	4.00	1.00	0.16	0.04	0.00	0.00
68	slopes	30.00	4.00	1.00	0.01	0.00	0.00	0.00
70	intercepts	30.00	4.00	1.00	0.00	0.00	0.00	0.00
72	both	30.00	4.00	1.00	0.04	0.01	0.00	0.00
74	slopes	20.00	6.00	1.00	0.15	0.37	0.08	0.01
76	intercepts	20.00	6.00	1.00	0.01	0.00	0.00	0.00
78	both	20.00	6.00	1.00	0.60	0.62	0.16	0.01
80	slopes	25.00	6.00	1.00	0.06	0.15	0.01	0.00
82	intercepts	25.00	6.00	1.00	0.00	0.00	0.00	0.00
84	both	25.00	6.00	1.00	0.36	0.34	0.02	0.00
86	slopes	30.00	6.00	1.00	0.03	0.05	0.00	0.00
88	intercepts	30.00	6.00	1.00	0.00	0.00	0.00	0.00
90	both	30.00	6.00	1.00	0.15	0.11	0.00	0.00
92	slopes	20.00	8.00	1.00	0.20	0.74	0.31	0.06
94	intercepts	20.00	8.00	1.00	0.02	0.00	0.00	0.00
96	both	20.00	8.00	1.00	0.75	0.90	0.55	0.18
98	slopes	25.00	8.00	1.00	0.09	0.47	0.07	0.01
100	intercepts	25.00	8.00	1.00	0.01	0.00	0.00	0.00
102	both	25.00	8.00	1.00	0.61	0.70	0.20	0.02
104	slopes	30.00	8.00	1.00	0.03	0.22	0.02	0.00
106	intercepts	30.00	8.00	1.00	0.00	0.00	0.00	0.00
108	both	30.00	8.00	1.00	0.33	0.45	0.05	0.00

Table 8: Bidirectional power simulation for GRM items with sample size 500

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
109	slopes	20.00	4.00	0.50	0.11	0.01	0.00	0.00
111	intercepts	20.00	4.00	0.50	0.29	0.00	0.00	0.00
113	both	20.00	4.00	0.50	0.61	0.06	0.00	0.00
115	slopes	25.00	4.00	0.50	0.07	0.00	0.00	0.00
117	intercepts	25.00	4.00	0.50	0.20	0.00	0.00	0.00
119	both	25.00	4.00	0.50	0.50	0.01	0.00	0.00
121	slopes	30.00	4.00	0.50	0.05	0.00	0.00	0.00
123	intercepts	30.00	4.00	0.50	0.10	0.00	0.00	0.00
125	both	30.00	4.00	0.50	0.31	0.00	0.00	0.00
127	slopes	20.00	6.00	0.50	0.17	0.13	0.01	0.00
129	intercepts	20.00	6.00	0.50	0.64	0.00	0.00	0.00
131	both	20.00	6.00	0.50	0.87	0.38	0.04	0.00
133	slopes	25.00	6.00	0.50	0.11	0.05	0.00	0.00
135	intercepts	25.00	6.00	0.50	0.46	0.00	0.00	0.00
137	both	25.00	6.00	0.50	0.72	0.13	0.00	0.00
139	slopes	30.00	6.00	0.50	0.07	0.02	0.00	0.00
141	intercepts	30.00	6.00	0.50	0.22	0.00	0.00	0.00
143	both	30.00	6.00	0.50	0.63	0.03	0.00	0.00
145	slopes	20.00	8.00	0.50	0.16	0.42	0.10	0.01
147	intercepts	20.00	8.00	0.50	0.91	0.00	0.00	0.00
149	both	20.00	8.00	0.50	0.94	0.84	0.32	0.04
151	slopes	25.00	8.00	0.50	0.14	0.21	0.02	0.00
153	intercepts	25.00	8.00	0.50	0.69	0.00	0.00	0.00
155	both	25.00	8.00	0.50	0.90	0.51	0.08	0.00
157	slopes	30.00	8.00	0.50	0.08	0.05	0.00	0.00
159	intercepts	30.00	8.00	0.50	0.49	0.00	0.00	0.00
161	both	30.00	8.00	0.50	0.84	0.22	0.01	0.00
163	slopes	20.00	4.00	1.00	0.34	0.95	0.77	0.41
165	intercepts	20.00	4.00	1.00	0.88	0.00	0.00	0.00
167	both	20.00	4.00	1.00	0.99	0.99	0.94	0.71
169	slopes	25.00	4.00	1.00	0.26	0.82	0.40	0.07
171	intercepts	25.00	4.00	1.00	0.72	0.00	0.00	0.00
173	both	25.00	4.00	1.00	0.98	0.98	0.74	0.21
175	slopes	30.00	4.00	1.00	0.20	0.59	0.14	0.02
177	intercepts	30.00	4.00	1.00	0.51	0.00	0.00	0.00
179	both	30.00	4.00	1.00	0.94	0.87	0.36	0.04
181	slopes	20.00	6.00	1.00	0.47	1.00	1.00	0.95
183	intercepts	20.00	6.00	1.00	1.00	0.04	0.00	0.00
185	both	20.00	6.00	1.00	1.00	1.00	1.00	0.99
187	slopes	25.00	6.00	1.00	0.35	1.00	0.96	0.79
189	intercepts	25.00	6.00	1.00	0.96	0.01	0.00	0.00
191	both	25.00	6.00	1.00	1.00	1.00	1.00	0.96
193	slopes	30.00	6.00	1.00	0.28	0.98	0.77	0.40
195	intercepts	30.00	6.00	1.00	0.87	0.00	0.00	0.00
197	both	30.00	6.00	1.00	0.99	1.00	0.96	0.73
199	slopes	20.00	8.00	1.00	0.50	1.00	1.00	1.00
201	intercepts	20.00	8.00	1.00	1.00	0.50	0.00	0.00
203	both	20.00	8.00	1.00	1.00	1.00	1.00	1.00
205	slopes	25.00	8.00	1.00	0.42	1.00	1.00	0.98
207	intercepts	25.00	8.00	1.00	1.00	0.07	0.00	0.00
209	both	25.00	8.00	1.00	1.00	1.00	1.00	1.00
211	slopes	30.00	8.00	1.00	0.29	1.00	0.99	0.90
213	intercepts	30.00	8.00	1.00	0.99	0.00	0.00	0.00
215	both	30.00	8.00	1.00	1.00	1.00	1.00	0.99

Table 9: Unidirectional power simulation for GRM items with sample size 1000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
110	slopes	20.00	4.00	0.50	0.09	0.00	0.00	0.00
112	intercepts	20.00	4.00	0.50	0.02	0.00	0.00	0.00
114	both	20.00	4.00	0.50	0.14	0.00	0.00	0.00
116	slopes	25.00	4.00	0.50	0.07	0.00	0.00	0.00
118	intercepts	25.00	4.00	0.50	0.02	0.00	0.00	0.00
120	both	25.00	4.00	0.50	0.09	0.00	0.00	0.00
122	slopes	30.00	4.00	0.50	0.03	0.00	0.00	0.00
124	intercepts	30.00	4.00	0.50	0.02	0.00	0.00	0.00
126	both	30.00	4.00	0.50	0.05	0.00	0.00	0.00
128	slopes	20.00	6.00	0.50	0.09	0.00	0.00	0.00
130	intercepts	20.00	6.00	0.50	0.03	0.00	0.00	0.00
132	both	20.00	6.00	0.50	0.21	0.00	0.00	0.00
134	slopes	25.00	6.00	0.50	0.08	0.00	0.00	0.00
136	intercepts	25.00	6.00	0.50	0.01	0.00	0.00	0.00
138	both	25.00	6.00	0.50	0.17	0.00	0.00	0.00
140	slopes	30.00	6.00	0.50	0.05	0.00	0.00	0.00
142	intercepts	30.00	6.00	0.50	0.01	0.00	0.00	0.00
144	both	30.00	6.00	0.50	0.08	0.00	0.00	0.00
146	slopes	20.00	8.00	0.50	0.12	0.00	0.00	0.00
148	intercepts	20.00	8.00	0.50	0.04	0.00	0.00	0.00
150	both	20.00	8.00	0.50	0.32	0.01	0.00	0.00
152	slopes	25.00	8.00	0.50	0.10	0.00	0.00	0.00
154	intercepts	25.00	8.00	0.50	0.01	0.00	0.00	0.00
156	both	25.00	8.00	0.50	0.22	0.00	0.00	0.00
158	slopes	30.00	8.00	0.50	0.05	0.00	0.00	0.00
160	intercepts	30.00	8.00	0.50	0.01	0.00	0.00	0.00
162	both	30.00	8.00	0.50	0.13	0.00	0.00	0.00
164	slopes	20.00	4.00	1.00	0.26	0.20	0.01	0.00
166	intercepts	20.00	4.00	1.00	0.04	0.00	0.00	0.00
168	both	20.00	4.00	1.00	0.66	0.27	0.02	0.00
170	slopes	25.00	4.00	1.00	0.18	0.03	0.00	0.00
172	intercepts	25.00	4.00	1.00	0.02	0.00	0.00	0.00
174	both	25.00	4.00	1.00	0.51	0.06	0.00	0.00
176	slopes	30.00	4.00	1.00	0.14	0.01	0.00	0.00
178	intercepts	30.00	4.00	1.00	0.03	0.00	0.00	0.00
180	both	30.00	4.00	1.00	0.33	0.01	0.00	0.00
182	slopes	20.00	6.00	1.00	0.31	0.58	0.15	0.01
184	intercepts	20.00	6.00	1.00	0.06	0.00	0.00	0.00
186	both	20.00	6.00	1.00	0.82	0.73	0.27	0.03
188	slopes	25.00	6.00	1.00	0.25	0.31	0.01	0.00
190	intercepts	25.00	6.00	1.00	0.03	0.00	0.00	0.00
192	both	25.00	6.00	1.00	0.73	0.52	0.04	0.00
194	slopes	30.00	6.00	1.00	0.19	0.15	0.01	0.00
196	intercepts	30.00	6.00	1.00	0.02	0.00	0.00	0.00
198	both	30.00	6.00	1.00	0.63	0.24	0.00	0.00
200	slopes	20.00	8.00	1.00	0.38	0.88	0.51	0.14
202	intercepts	20.00	8.00	1.00	0.05	0.00	0.00	0.00
204	both	20.00	8.00	1.00	0.93	0.96	0.72	0.27
206	slopes	25.00	8.00	1.00	0.31	0.71	0.21	0.04
208	intercepts	25.00	8.00	1.00	0.04	0.00	0.00	0.00
210	both	25.00	8.00	1.00	0.86	0.86	0.33	0.03
212	slopes	30.00	8.00	1.00	0.23	0.45	0.06	0.00
214	intercepts	30.00	8.00	1.00	0.03	0.00	0.00	0.00
216	both	30.00	8.00	1.00	0.79	0.68	0.09	0.00

Table 10: Bidirectional power simulation for GRM items with sample size 1000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
217	slopes	20.00	4.00	0.50	0.33	0.01	0.00	0.00
219	intercepts	20.00	4.00	0.50	0.85	0.00	0.00	0.00
221	both	20.00	4.00	0.50	0.88	0.05	0.00	0.00
223	slopes	25.00	4.00	0.50	0.24	0.00	0.00	0.00
225	intercepts	25.00	4.00	0.50	0.67	0.00	0.00	0.00
227	both	25.00	4.00	0.50	0.86	0.01	0.00	0.00
229	slopes	30.00	4.00	0.50	0.16	0.00	0.00	0.00
231	intercepts	30.00	4.00	0.50	0.45	0.00	0.00	0.00
233	both	30.00	4.00	0.50	0.78	0.00	0.00	0.00
235	slopes	20.00	6.00	0.50	0.37	0.28	0.02	0.00
237	intercepts	20.00	6.00	0.50	0.99	0.00	0.00	0.00
239	both	20.00	6.00	0.50	0.98	0.67	0.07	0.00
241	slopes	25.00	6.00	0.50	0.31	0.08	0.00	0.00
243	intercepts	25.00	6.00	0.50	0.96	0.00	0.00	0.00
245	both	25.00	6.00	0.50	0.95	0.28	0.00	0.00
247	slopes	30.00	6.00	0.50	0.24	0.02	0.00	0.00
249	intercepts	30.00	6.00	0.50	0.85	0.00	0.00	0.00
251	both	30.00	6.00	0.50	0.93	0.05	0.00	0.00
253	slopes	20.00	8.00	0.50	0.44	0.83	0.23	0.02
255	intercepts	20.00	8.00	0.50	1.00	0.00	0.00	0.00
257	both	20.00	8.00	0.50	1.00	0.97	0.53	0.05
259	slopes	25.00	8.00	0.50	0.38	0.41	0.03	0.00
261	intercepts	25.00	8.00	0.50	1.00	0.00	0.00	0.00
263	both	25.00	8.00	0.50	0.98	0.81	0.12	0.00
265	slopes	30.00	8.00	0.50	0.32	0.15	0.00	0.00
267	intercepts	30.00	8.00	0.50	0.98	0.00	0.00	0.00
269	both	30.00	8.00	0.50	0.97	0.43	0.01	0.00
271	slopes	20.00	4.00	1.00	0.60	1.00	0.92	0.64
273	intercepts	20.00	4.00	1.00	1.00	0.00	0.00	0.00
275	both	20.00	4.00	1.00	1.00	1.00	0.99	0.87
277	slopes	25.00	4.00	1.00	0.56	0.98	0.70	0.22
279	intercepts	25.00	4.00	1.00	0.99	0.00	0.00	0.00
281	both	25.00	4.00	1.00	1.00	0.99	0.91	0.43
283	slopes	30.00	4.00	1.00	0.49	0.86	0.35	0.01
285	intercepts	30.00	4.00	1.00	0.96	0.00	0.00	0.00
287	both	30.00	4.00	1.00	1.00	0.97	0.61	0.08
289	slopes	20.00	6.00	1.00	0.72	1.00	1.00	1.00
291	intercepts	20.00	6.00	1.00	1.00	0.09	0.00	0.00
293	both	20.00	6.00	1.00	1.00	1.00	1.00	1.00
295	slopes	25.00	6.00	1.00	0.64	1.00	1.00	0.96
297	intercepts	25.00	6.00	1.00	1.00	0.00	0.00	0.00
299	both	25.00	6.00	1.00	1.00	1.00	1.00	0.99
301	slopes	30.00	6.00	1.00	0.58	1.00	0.95	0.73
303	intercepts	30.00	6.00	1.00	1.00	0.00	0.00	0.00
305	both	30.00	6.00	1.00	1.00	1.00	1.00	0.90
307	slopes	20.00	8.00	1.00	0.72	1.00	1.00	1.00
309	intercepts	20.00	8.00	1.00	1.00	0.87	0.00	0.00
311	both	20.00	8.00	1.00	1.00	1.00	1.00	1.00
313	slopes	25.00	8.00	1.00	0.66	1.00	1.00	1.00
315	intercepts	25.00	8.00	1.00	1.00	0.18	0.00	0.00
317	both	25.00	8.00	1.00	1.00	1.00	1.00	1.00
319	slopes	30.00	8.00	1.00	0.65	1.00	1.00	0.99
321	intercepts	30.00	8.00	1.00	1.00	0.01	0.00	0.00
323	both	30.00	8.00	1.00	1.00	1.00	1.00	1.00

Table 11: Unidirectional power simulation for GRM items with sample size 3000

	condition	test_size	DIF_items	DIF_size	sDTF_0.05	uDTF_2	uDTF_3	uDTF_4
218	slopes	20.00	4.00	0.50	0.28	0.00	0.00	0.00
220	intercepts	20.00	4.00	0.50	0.04	0.00	0.00	0.00
222	both	20.00	4.00	0.50	0.36	0.00	0.00	0.00
224	slopes	25.00	4.00	0.50	0.20	0.00	0.00	0.00
226	intercepts	25.00	4.00	0.50	0.04	0.00	0.00	0.00
228	both	25.00	4.00	0.50	0.29	0.00	0.00	0.00
230	slopes	30.00	4.00	0.50	0.12	0.00	0.00	0.00
232	intercepts	30.00	4.00	0.50	0.03	0.00	0.00	0.00
234	both	30.00	4.00	0.50	0.17	0.00	0.00	0.00
236	slopes	20.00	6.00	0.50	0.31	0.00	0.00	0.00
238	intercepts	20.00	6.00	0.50	0.06	0.00	0.00	0.00
240	both	20.00	6.00	0.50	0.49	0.00	0.00	0.00
242	slopes	25.00	6.00	0.50	0.19	0.00	0.00	0.00
244	intercepts	25.00	6.00	0.50	0.04	0.00	0.00	0.00
246	both	25.00	6.00	0.50	0.40	0.00	0.00	0.00
248	slopes	30.00	6.00	0.50	0.17	0.00	0.00	0.00
250	intercepts	30.00	6.00	0.50	0.05	0.00	0.00	0.00
252	both	30.00	6.00	0.50	0.31	0.00	0.00	0.00
254	slopes	20.00	8.00	0.50	0.35	0.00	0.00	0.00
256	intercepts	20.00	8.00	0.50	0.06	0.00	0.00	0.00
258	both	20.00	8.00	0.50	0.62	0.00	0.00	0.00
260	slopes	25.00	8.00	0.50	0.28	0.00	0.00	0.00
262	intercepts	25.00	8.00	0.50	0.04	0.00	0.00	0.00
264	both	25.00	8.00	0.50	0.50	0.00	0.00	0.00
266	slopes	30.00	8.00	0.50	0.21	0.00	0.00	0.00
268	intercepts	30.00	8.00	0.50	0.03	0.00	0.00	0.00
270	both	30.00	8.00	0.50	0.41	0.00	0.00	0.00
272	slopes	20.00	4.00	1.00	0.52	0.21	0.01	0.00
274	intercepts	20.00	4.00	1.00	0.07	0.00	0.00	0.00
276	both	20.00	4.00	1.00	0.89	0.37	0.01	0.00
278	slopes	25.00	4.00	1.00	0.45	0.08	0.00	0.00
280	intercepts	25.00	4.00	1.00	0.05	0.00	0.00	0.00
282	both	25.00	4.00	1.00	0.80	0.12	0.00	0.00
284	slopes	30.00	4.00	1.00	0.34	0.01	0.00	0.00
286	intercepts	30.00	4.00	1.00	0.04	0.00	0.00	0.00
288	both	30.00	4.00	1.00	0.73	0.02	0.00	0.00
290	slopes	20.00	6.00	1.00	0.61	0.74	0.24	0.02
292	intercepts	20.00	6.00	1.00	0.09	0.00	0.00	0.00
294	both	20.00	6.00	1.00	0.94	0.86	0.37	0.04
296	slopes	25.00	6.00	1.00	0.50	0.49	0.05	0.00
298	intercepts	25.00	6.00	1.00	0.07	0.00	0.00	0.00
300	both	25.00	6.00	1.00	0.92	0.62	0.09	0.00
302	slopes	30.00	6.00	1.00	0.45	0.18	0.00	0.00
304	intercepts	30.00	6.00	1.00	0.06	0.00	0.00	0.00
306	both	30.00	6.00	1.00	0.90	0.38	0.01	0.00
308	slopes	20.00	8.00	1.00	0.65	0.94	0.64	0.24
310	intercepts	20.00	8.00	1.00	0.10	0.00	0.00	0.00
312	both	20.00	8.00	1.00	0.98	0.99	0.85	0.37
314	slopes	25.00	8.00	1.00	0.59	0.85	0.34	0.04
316	intercepts	25.00	8.00	1.00	0.06	0.00	0.00	0.00
318	both	25.00	8.00	1.00	0.96	0.92	0.50	0.07
320	slopes	30.00	8.00	1.00	0.48	0.63	0.10	0.00
322	intercepts	30.00	8.00	1.00	0.07	0.00	0.00	0.00
324	both	30.00	8.00	1.00	0.95	0.79	0.17	0.01

Table 12: Bidirectional power simulation for GRM items with sample size 3000