

```
(*-----*)
(*      Shojima, K. (30/04/2022)                                *)
(*      Item response theory on Mathematica.                    *)
(*      http://shojima.starfree.jp/tde/                        *)
(*-----*)
```

#### (\*DATA SPECIFICATION\*)

(\*Specify the file name of your data.\*)

```
datafile = "J15S500.csv";
```

(\*Put the data file in the same folder  
where this Mathematica program is placed.\*)

(\*Do not delete the folder named as "mod."\*)

(\*Specify the row number in which the item labels are input. The  
program considers the reponse data start from the next row.\*)

```
itemlabelrow = 1;
```

(\*Specify the column number in which the student IDs are input. The  
program considers the reponse data start from the next column.\*)

```
studentIDcolumn = 1;
```

(\*The missing indicator must be a numerical value.\*)

```
mi = -99;
```

```
(*-----*)
```

#### (\*ANALYSIS SETTING\*)

(\*Select 2-, 3-, or 4-parameter logistic model.\*)

```
model = 3;
```

(\*Position the cursor anywhere in the program commands and hit [shift+enter],  
and the program runs.\*)

```
(*-----*)
```

```
dir = NotebookDirectory[];
```

```
NotebookEvaluate[dir <> "/mod/Module_IRT.nb"];
```

```
irt[data];
```

```
(*-----*)
```

The 3PL model was selected.

## Test Statistics

N of Items	15
Sample Size	500
Mean	9.664
SE of Mean	0.119074
SD	2.66257
Skewness	-0.411622
Kurtosis	2.55284
Min	2
Max	15

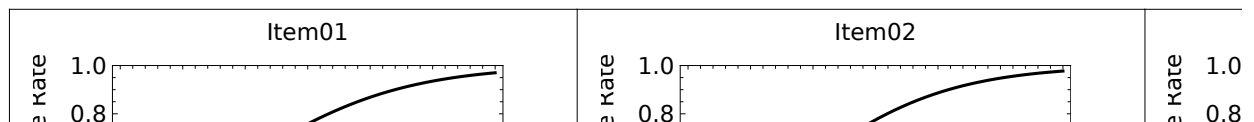
## Item Statistics

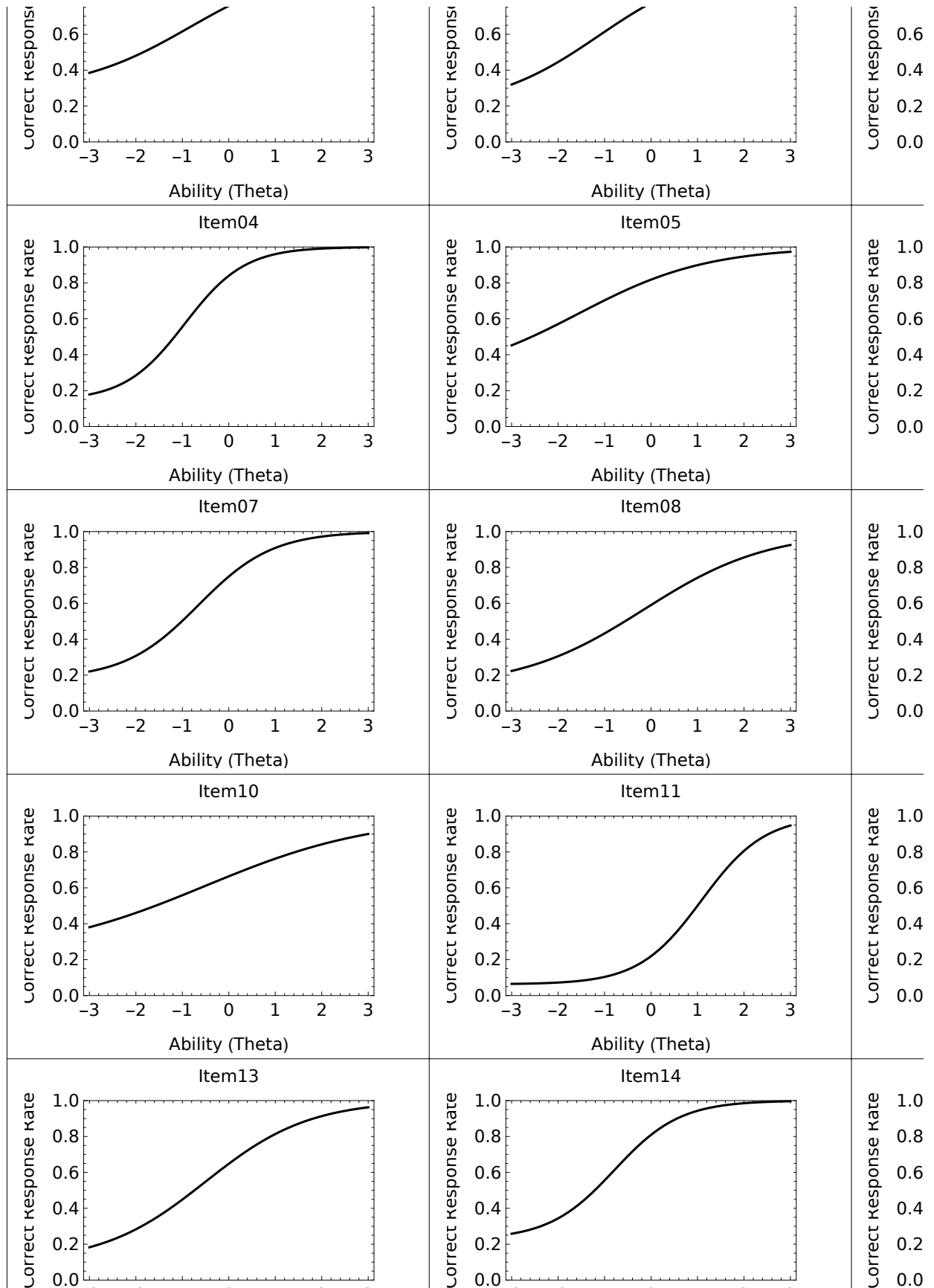
Item	Number of Respondents	Correct Response Rate	Item Threshold	Item-Total Correlation
Item01	500	0.746	-0.661955	0.374648
Item02	500	0.754	-0.687131	0.393205
Item03	500	0.726	-0.60076	0.3213
Item04	500	0.776	-0.758754	0.502824
Item05	500	0.804	-0.855996	0.329054
Item06	500	0.864	-1.09847	0.37686
Item07	500	0.716	-0.570999	0.483067
Item08	500	0.588	-0.222403	0.405215
Item09	500	0.364	0.347787	0.22482
Item10	500	0.662	-0.417928	0.314446
Item11	500	0.286	0.565108	0.455081
Item12	500	0.274	0.60076	0.467784
Item13	500	0.634	-0.342466	0.47125
Item14	500	0.764	-0.719229	0.484841
Item15	500	0.706	-0.541737	0.412775

Section 4.5 Item Parameter Estimation: The computation may take some time when there are many items.

Item	Slope	Location	Lower Asymptote	PSD(Slope)	PSD(Loc)	PSD(LA)
Item01	0.817585	-0.833699	0.280362	0.181931	0.62788	0.170187
Item02	0.859864	-1.11942	0.185206	0.156605	0.471175	0.148788
Item03	0.657401	-0.698975	0.304841	0.161984	0.797501	0.172825
Item04	1.55014	-0.948784	0.144197	0.227304	0.215632	0.104374
Item05	0.721491	-1.55837	0.258387	0.147605	0.699878	0.186009
Item06	1.02165	-1.87593	0.182696	0.17138	0.422984	0.157669
Item07	1.25518	-0.655375	0.179313	0.214443	0.289333	0.116538
Item08	0.748492	-0.154612	0.130774	0.147744	0.394311	0.107746
Item09	1.17749	2.28703	0.292968	0.492754	0.422869	0.0440459
Item10	0.546446	-0.505194	0.222122	0.131173	0.778513	0.156163
Item11	1.47599	1.08971	0.062748	0.263346	0.120313	0.0320583
Item12	1.47844	1.08493	0.0462087	0.245315	0.115012	0.0276025
Item13	0.897851	-0.501889	0.0959918	0.142236	0.271516	0.0857765
Item14	1.41806	-0.787882	0.225956	0.247707	0.291208	0.125219
Item15	0.907561	-0.812479	0.153152	0.158805	0.383328	0.125407

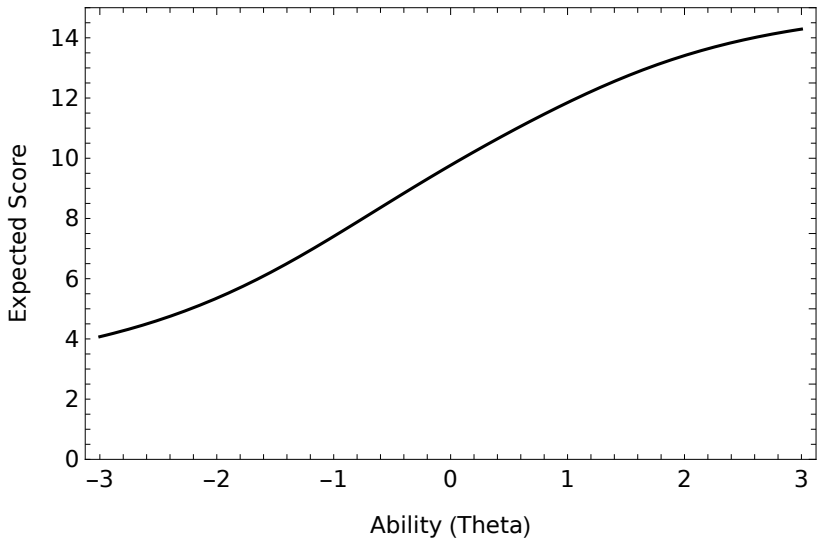
## Section 4.2 Item Response Function



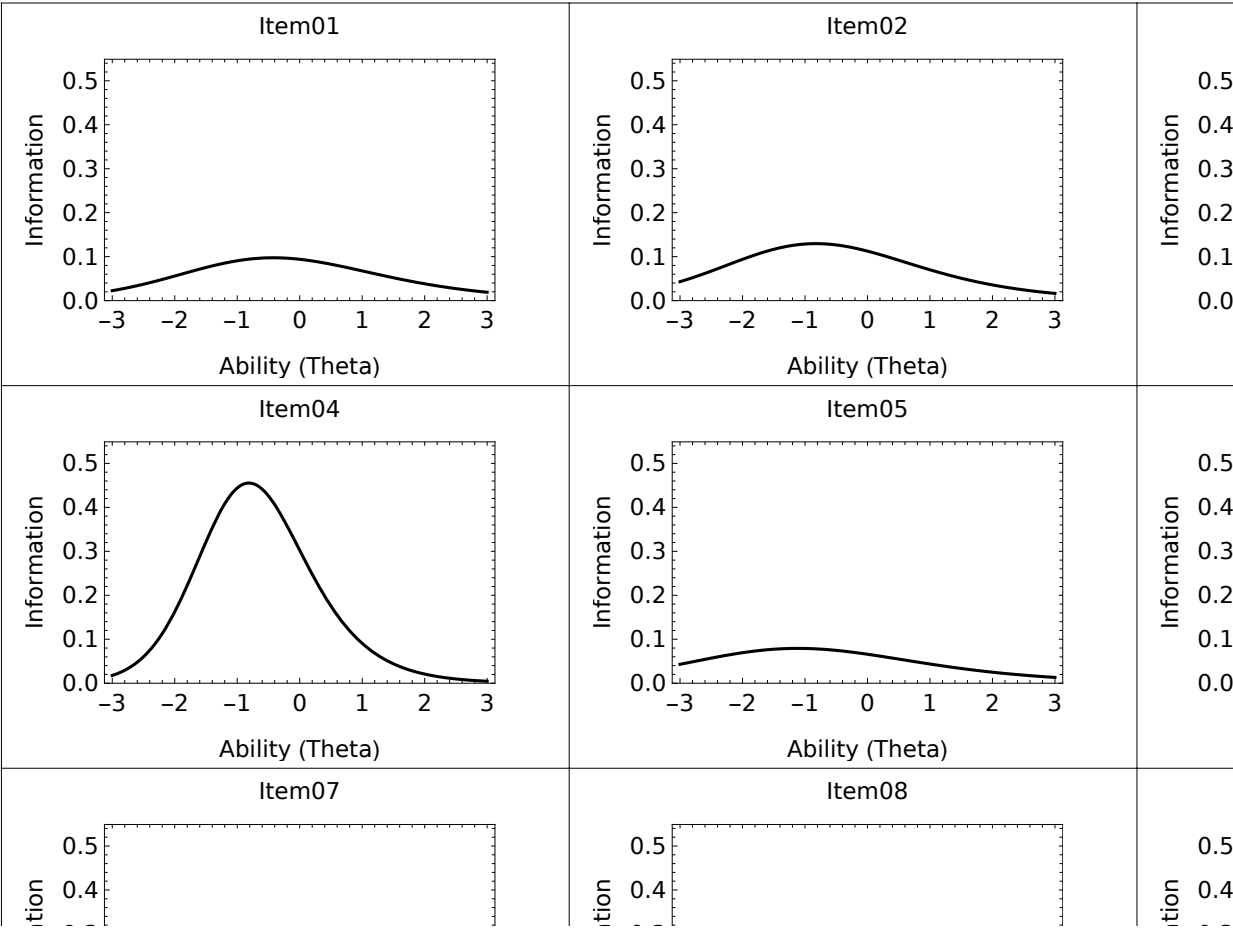


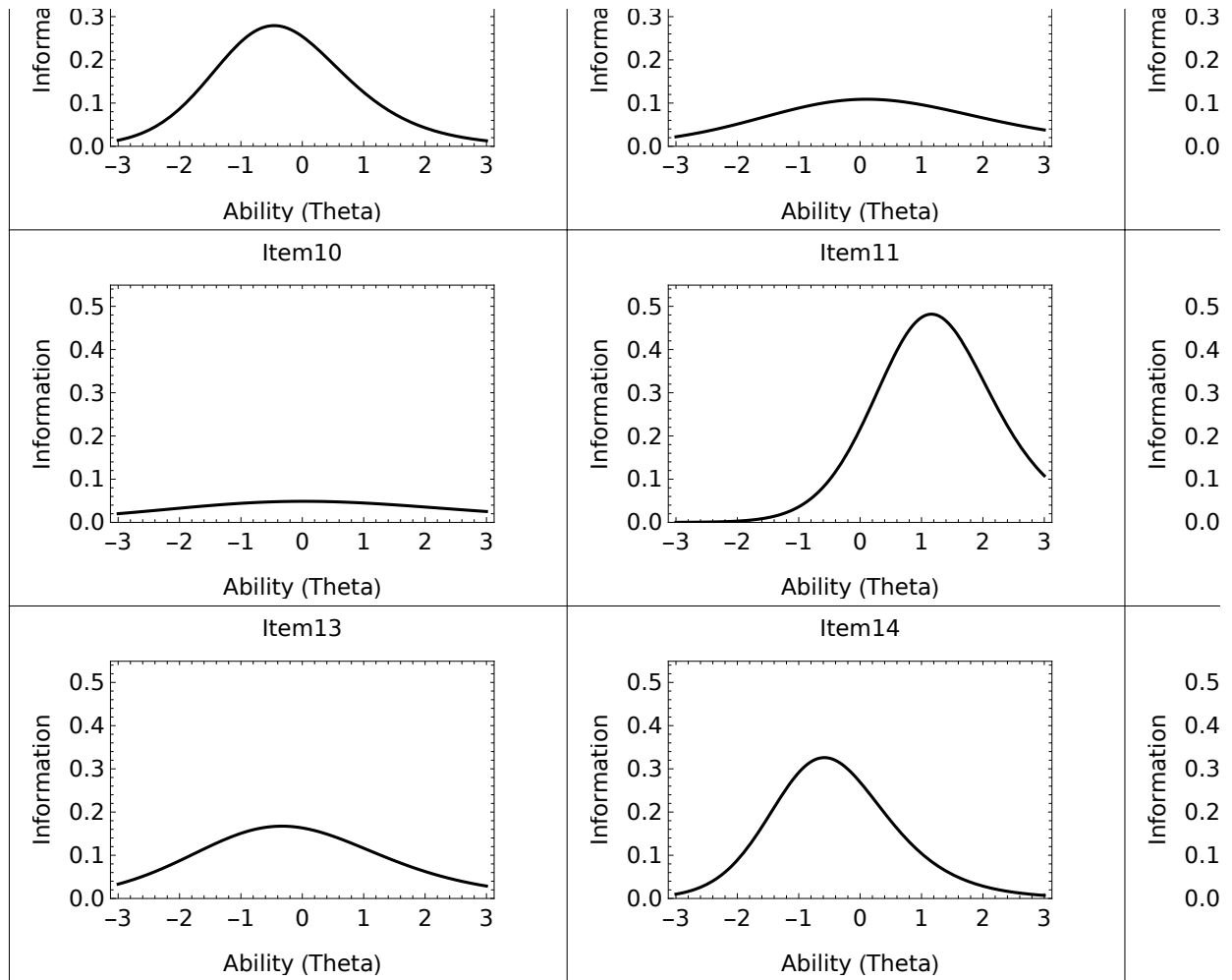


Section 4.2.5 Test Response Function

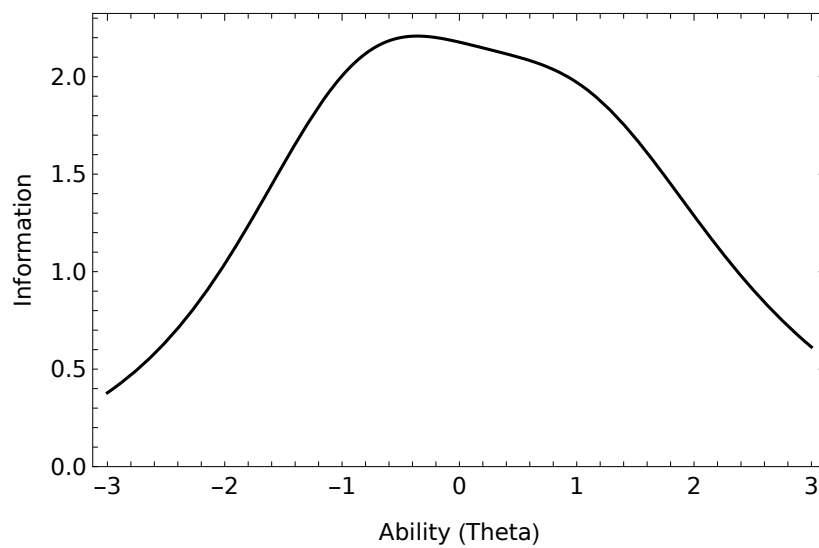


Section 4.4 Item Information Function





## Section 4.4.1 Test Information Function



## Section 4.3 Ability Parameter Estimation:

The results are recorded in the Excel output file.

## Section 4.6 Model Fit

Model		Item Response Theory 3PL Model	
N of EM Cycles		12	
Log-Likelihood(Benchmark Model)		-3560.01	
Log-Likelihood(Null Model)		-4350.22	
Chi-square(Null Model)		1580.42	
DF(Null Model)		195	
Log-Likelihood(Analysis Model)		-3880.79	
Chi-square(Analysis Model)		641.578	
DF(Analysis Model)		165	
NFI		0.594047	
RFI		0.520237	
IFI		0.663296	
TLI		0.593461	
CFI		0.656005	
RMSEA		0.0760808	
AIC		311.578	
CAIC		-384.162	
BIC		-383.832	

	Log-Likelihood(Benchmark Model)	Log-Likelihood(Null Model)	Chi-square(Null Model)	DF()
Item01	-240.19	-283.343	86.3072	
Item02	-235.436	-278.949	87.0245	
Item03	-260.906	-293.598	65.3834	
Item04	-192.072	-265.962	147.78	
Item05	-206.537	-247.403	81.732	
Item06	-153.94	-198.817	89.7553	
Item07	-228.379	-298.345	139.933	
Item08	-293.225	-338.789	91.1272	
Item09	-300.492	-327.842	54.6997	
Item10	-288.198	-319.85	63.3026	
Item11	-224.085	-299.265	150.36	
Item12	-214.797	-293.598	157.603	
Item13	-262.031	-328.396	132.73	
Item14	-204.953	-273.212	136.519	
Item15	-254.764	-302.847	96.1665	