In[ ]:=
```
(*-------------------------------------------------*)
(*        Shojima, K. (30/04/2022)                 *)
(*           Classical test theory on Mathematica.     *)
(*           http://shojima.starfree.jp/tde/          *)
(*-------------------------------------------------*)

(*DATA SPECIFICATION*)

(*Specify the file name of your data.*)
datafile = "J20S400.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;

(*Position the cursor anywhere in the program commands and hit [shift+enter],
and the program runs.*)
(*-------------------------------------------------*)
dir = NotebookDirectory[];
NotebookEvaluate[dir <> "mod\\Module_CTT.nb"];
ctt[data];
(*-------------------------------------------------*)
```

Section 2.3 Student Analysis: The results are recoreded in the
  Excel output file. See the folder, and you can find the Excel file.

Section 2.4 Single-Item Analysis

Item	Number of Respondents	Correct Response Rate	Item Odds	Item Threshold	Item Entropy
Item01	394	0.654822	1.89706	-0.398373	0.929687
Item02	394	0.756345	3.10417	-0.694594	0.801065
Item03	397	0.748111	2.97	-0.668557	0.814259
Item04	393	0.445293	0.802752	0.137564	0.991347
Item05	397	0.574307	1.34911	-0.187351	0.984009
Item06	399	0.533835	1.14516	-0.0849127	0.996694
Item07	396	0.689394	2.21951	-0.494133	0.893872
Item08	396	0.462121	0.859155	0.0950912	0.995856
Item09	396	0.906566	9.7027	-1.3199	0.44783
Item10	394	0.949239	18.7	-1.63752	0.289623
Item11	393	0.885496	7.73333	-1.20292	0.513353
Item12	397	0.375315	0.600806	0.317809	0.954666
Item13	395	0.653165	1.88321	-0.393878	0.93121
Item14	399	0.546366	1.20442	-0.116485	0.993788
Item15	398	0.786432	3.68235	-0.794103	0.748247
Item16	396	0.787879	3.71429	-0.799083	0.745518
Item17	395	0.777215	3.48864	-0.762822	0.76522
Item18	393	0.852417	5.77586	-1.04686	0.603758
Item19	395	0.539241	1.17033	-0.0985205	0.995552
Item20	397	0.745592	2.93069	-0.660682	0.81819

Section 2.5 Interitem Correct Response Rate

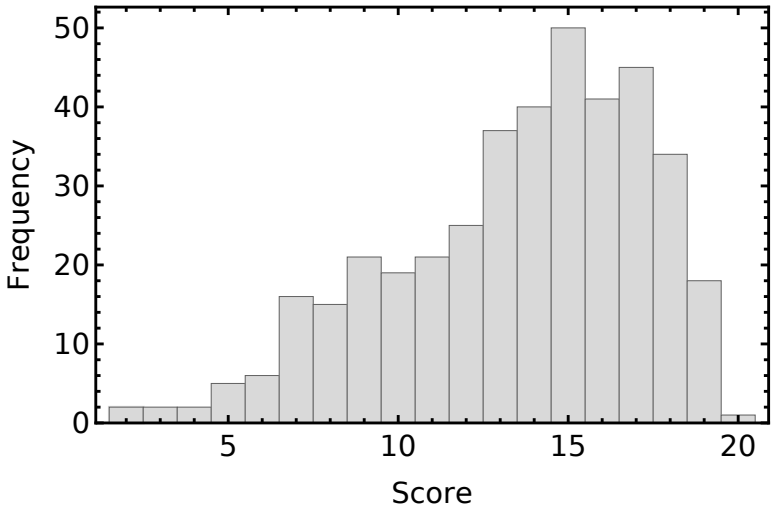
Analysis: The results are recoreded in the Excel output file.

Section 2.6 Interitem Correlation Analysis: This calculation includes the estimation of the tetrachoric and biserial correlations and may thus take some time if there are many items or the computing power is not sufficient. The phi and tetrachoric matrices are recorded in the Excel output file.

Item	Item-Total Correlation	Item-Total Bisereal Correlation
Item01	0.456342	0.557067
Item02	0.50095	0.620518
Item03	0.441382	0.545155
Item04	0.446765	0.55583
Item05	0.537483	0.645316
Item06	0.519104	0.634576
Item07	0.608336	0.710199
Item08	0.00788363	0.0098463
Item09	0.456612	0.638556
Item10	0.334454	0.58201
Item11	0.459438	0.624248
Item12	-0.137312	-0.172496
Item13	0.553876	0.651287
Item14	0.503172	0.607576
Item15	0.492269	0.610399
Item16	0.563847	0.687857
Item17	0.511825	0.621501
Item18	0.38275	0.506111
Item19	0.542034	0.655263
Item20	0.526904	0.628651

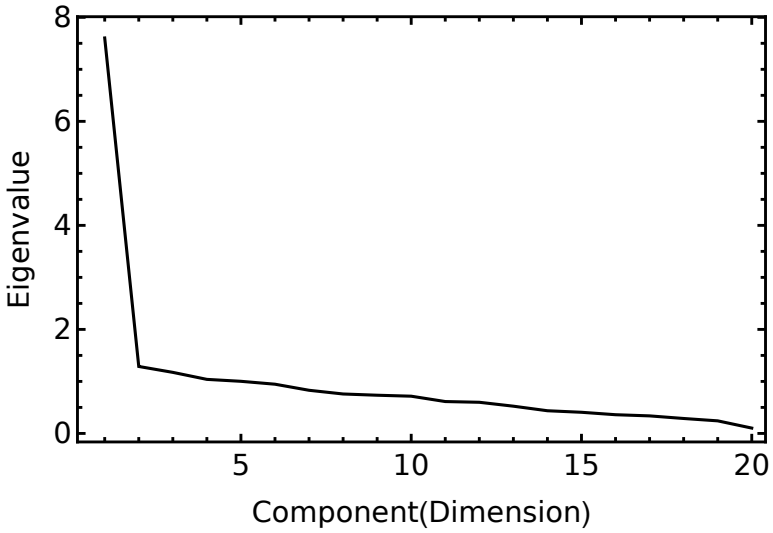
Section 2.7 Test Analysis

Total Score	Statistics
Test Length	20
Sample Size	400
Mean	13.5175
SE of Mean	0.186544
Variance	13.9195
SD	3.73088
Skewness	-0.671122
Kurtosis	2.81576
Min	2
Max	20
Range	18
Q1(25%)	11
Median(50%)	14
Q3(75%)	16
Interquartile Range	5
Q2(Stainine)	6
Q3(Stainine)	8
Q4(Stainine)	11
Q5(Stainine)	13
Q6(Stainine)	15
Q7(Stainine)	17
Q8(Stainine)	18
Q9(Stainine)	19



Section 2.8 Dimensionality Analysis

Component (Dimension)	Eigenvalue	% of Variance	Cumulative %
1	7.60309	0.380154	0.380154
2	1.28752	0.0643762	0.44453
3	1.17424	0.0587122	0.503243
4	1.03942	0.0519712	0.555214
5	1.0021	0.0501049	0.605319
6	0.946521	0.0473261	0.652645
7	0.829738	0.0414869	0.694132
8	0.758404	0.0379202	0.732052
9	0.73457	0.0367285	0.76878
10	0.715992	0.0357996	0.80458
11	0.613027	0.0306513	0.835231
12	0.598931	0.0299466	0.865178
13	0.524004	0.0262002	0.891378
14	0.436241	0.0218121	0.91319
15	0.406697	0.0203349	0.933525
16	0.359892	0.0179946	0.95152
17	0.337448	0.0168724	0.968392
18	0.287347	0.0143674	0.982759
19	0.241861	0.0120931	0.994852
20	0.102952	0.00514758	1.



Sections 3.4 and 3.5 Alpha and Omega Coefficients

Total Score	Statistics
Alpha(Covariance)	0.765883
Alpha(Phi)	0.778068
Alpha(Tetrachoric)	0.881002
Omega(Covariance)	0.781223
Omega(Phi)	0.790372
Omega(Tetrachoric)	0.894028

Item	Alpha If Item Deleted(Covariance)	Alpha If Item Deleted(Phi)	Alpha If Item Deleted(T
Item01	0.755155	0.768996	0.876172
Item02	0.750876	0.764356	0.872707
Item03	0.755519	0.769072	0.875795
Item04	0.756298	0.770241	0.877039
Item05	0.748211	0.76286	0.872184
Item06	0.749705	0.764133	0.872879
Item07	0.741544	0.756162	0.868004
Item08	0.790944	0.798011	0.895748
Item09	0.754806	0.765095	0.86987
Item10	0.761075	0.772786	0.873019
Item11	0.754351	0.765633	0.870993
Item12	0.799109	0.80548	0.900489
Item13	0.746419	0.761071	0.871294
Item14	0.751285	0.765336	0.873667
Item15	0.751404	0.76407	0.872313
Item16	0.745936	0.758962	0.868946
Item17	0.750078	0.76259	0.871356
Item18	0.758679	0.771738	0.876648
Item19	0.747431	0.762197	0.871724
Item20	0.748632	0.762163	0.871493