Instruction Manual of Integrated Tool for Item Analysis and Response Data Analysis

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VERSION DESCRIPTION		
Version	Date	Description
V1	November 24, 2020	Japanese version was released
V2	November 30, 2020	Japanese version was modified
V3	May 19, 2021	English version was released

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INTRODUCTION

"Integrated Tool for Item Analysis & Response Data Analysis" is designed to analyze multiple-choice test data. After setting examinees' response data and answer key data, and running the software, summary of test scores, results of item analysis and examinee analysis are shown. These information are helpful to understand item characteristics and examinees' performance. The software runs on Windows PC.

DOWNLOAD

To download the software and related files, please access to the ISHII Lab website.

http://www.educa.nagoya-u.ac.jp/~ishii-h/english.html

Click ‘Item Analysis System’ in sidebar and download the following files:

- Software (Excel Macro),
- Instruction Manual (PDF),
- Sample Response Data (Excel),
- Sample Key Data (Excel).

You can batch download these files by clicking “Batch Download” (zip).

FILE PREPARATION

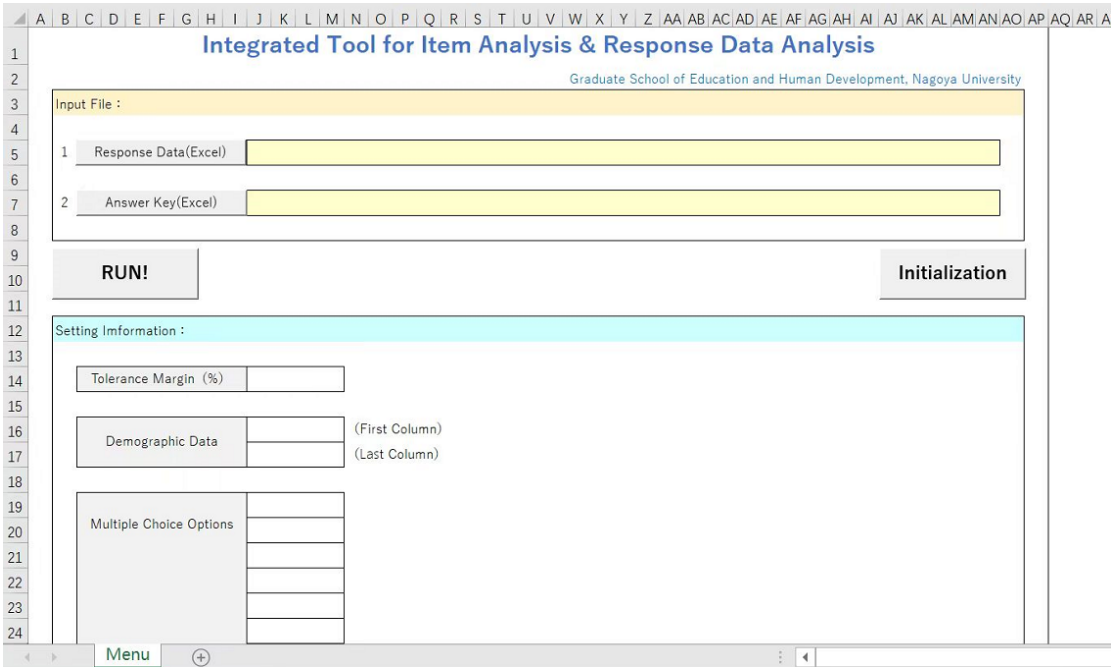
To conduct analysis, 3 files are required, which are: (1) Software (Excel macro file), (2) Response Data (Excel or CSV file), and (3) Key Data (Excel or CSV file),.

Software

As the core part, the software is based on Excel Macro. It can be used to read Response Data and Key Data files, to conduct analysis and save results.

The tabular and fixed contents in the file cannot be changed while some cells will be filled in accordance with your needs. Meanwhile, its ‘.xlsm’ formats cannot be changed.

After analysis completed, the file can be saved as another file name to keep the results.



Response Data File

As shown in sample response data, the file is used to save examinees' response data. The file can be saved in one of '.xlsx', '.xls', '.csv' formats supported by Excel.

When making Response Data file, please follow the **following rules:**

- *Input variable name in the **first row** and input response data from the **second row**. The variable name refers to the input rule allowed by Excel.*
- *Input personal identification of examinees in **column A**, such as candidate number, examinee ID etc.*
- *Input demographic information from **column B**, such as grade, gender etc. There is no limit on the number of columns and you can skip it if there is no demographic data.*
- *Input the examinees' response data from the right side of the last column of demographic data. **Do not** enter anything in the right space of the last column of response data.*
- *Please unify the same symbols for all items .Symbols can be any format allowed by Excel, such as numbers, letters etc. and should be kept consistent in each item.*
- *Please leave it blank if the response is missing.*

NO.	School	Grade	Type	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
1	1	1	1	A	C	B	D	A	D	C	C	B	D
2	1	2	2	A	C	B	A	A	D	C	C		D
3	1	2	3	A	C	B	D	A	D	C	C	B	D

Answer Key File

As shown in sample key data, the file is used to save correct answer information for multiple-choice items. The file can be saved in one of '.xlsx', '.xls', '.csv' formats supported by Excel.

When making the Answer Key file, please follow the **following rules**:

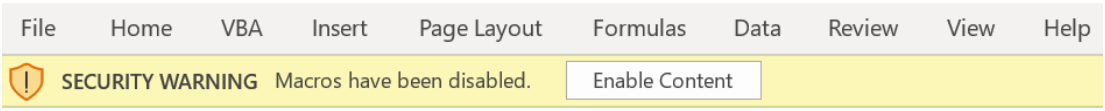
- *Input whatever in the first row, column A. However, the recommendation is 'TEST' or 'Test'.*
- *Input the name of items in the **first row** from **column B**. The name of items should be consistent with the ones in Respond Data file, otherwise there will be errors when the software is run. Therefore, it is recommended to directly copy name of items in Respond Data file and paste them here.*
- *Input the specific test name in the **second row, column A**, such as '2021 Language final exam', 'Sample' etc. Any language is acceptable.*
- *Input the key of items in the **second row** from **column B**. Please make sure that the symbols of items in the Key file are consistent with the ones in Response Data file.*
- ***Do not** input demographic item names in this file.*
- ***Do not** enter anything after the third row and last column when Key data is completed.*

	A	B	C	D	E	F	G	H	I	J	K
1	TEST	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2	Sample	A	C	B	B	A	D	C	C	B	D

HOW TO RUN THE SOFTWARE

Start the Software

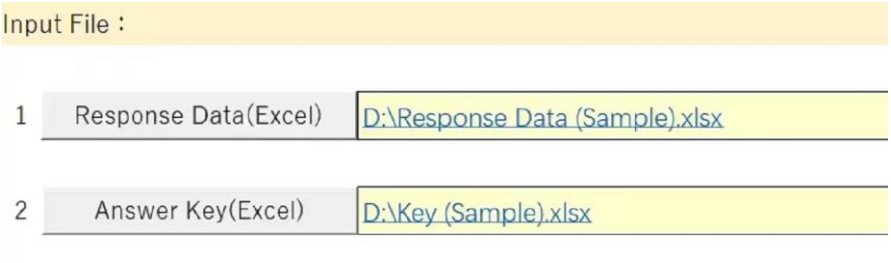
Download the software and double-click to open it. When the following display appears,



Please click '**Enable Content**' to confirm.

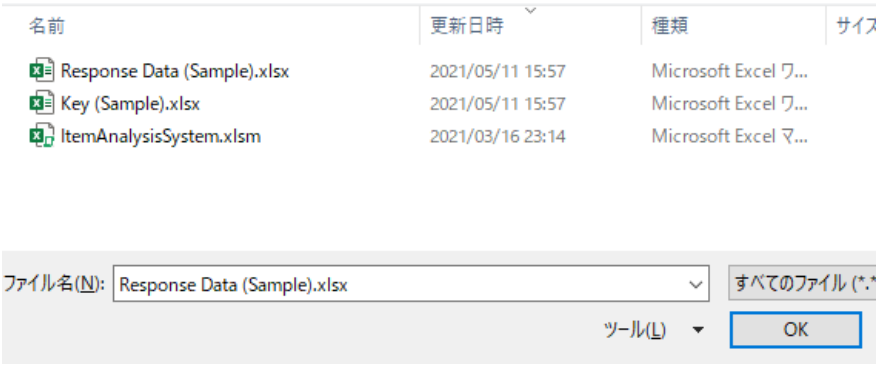
Input File Names

In the 'menu' worksheet, you will see the following display:



Please click the 'Response Data' Button to find the path of Response Data file and press 'OK' to confirm.

Similarly, click the 'Answer Key' button to set for the Key data.



Set Demographic Data Field

Set the first and last columns of Demographic Data in **Capital Letters** according to your own Response data. For example in Response Data (Sample), demographic data start from column B ('school') and end at column D ('types').

Demographic Data	B	(First Column)
	D	(Last Column)

Set Multiple-Choice Options

Regardless of the type of symbols (Numbers, Letters, etc.), please set all symbols that are used in all items. If the numbers of options between items are inconsistent, set the symbol corresponding to the one with most options.

Multiple Choice Options	A
	B
	C
	D

Set Tolerance Margin

There may be abnormal conditions in examinees' respond data. For example, examinees with high total score incorrectly answer easy items (items with high passing rate), or examinees with low total score correctly answer difficult items (items with low passing rate). The software identifies such abnormal responses with different color cells.

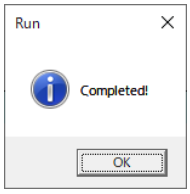
Tolerance Margin can be set as 0-100 for the sensitivity of abnormal conditions. The larger the value is, the higher the tolerance of abnormal conditions is and the fewer color cells are. The default is 50 (%).

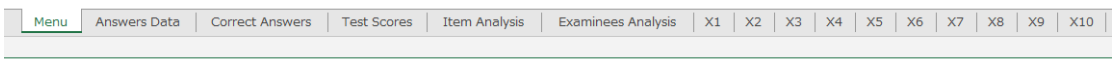
For the setting of coloration, please refer to the section of ‘Examinee Analysis’ in ‘Results Interpretation’.

Tolerance Threshold (%)	50

Run the Software

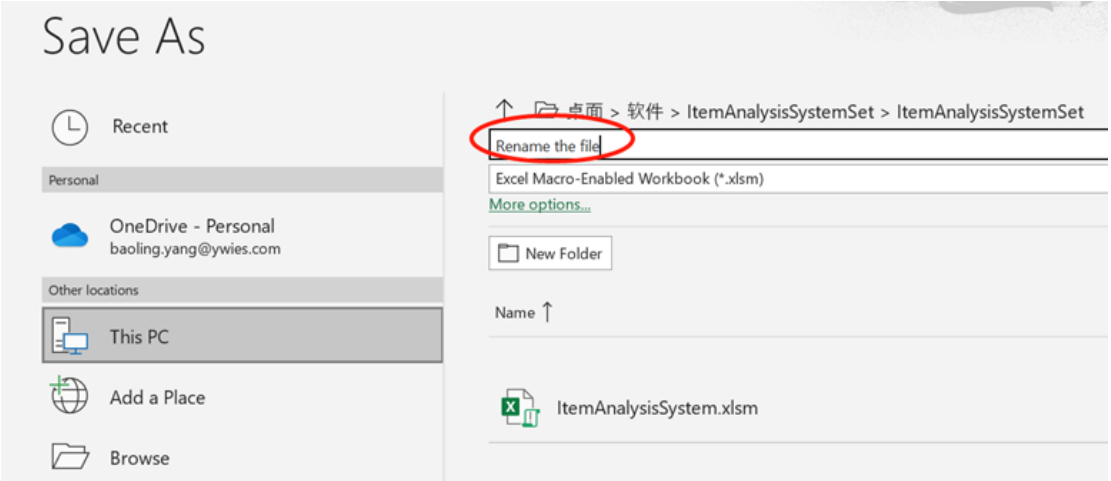
After all the above settings are completed, click the ‘RUN!’ button to conduct analysis. When the software runs successfully, an Info Window of ‘Completed!’ will be displayed. Click ‘OK’, then analysis results will be shown in worksheets. If it runs unsuccessfully, an Info Window of error message will be displayed. For more information, please refer to the section of ‘Error Message’.





Save the Results

To keep analysis results, please click ‘Save As’ and save the file with different name. The renamed file contains the analysis results.



Start a New Round

To start a new analysis of other data, please open the existing software file and click the ‘Initialization’ button. All worksheet except for ‘menu’ will be removed .The previous setting information remains. Of course, you can also reset it for the new round of analysis if needed.

RESULTS

When the software runs successfully, analysis results will form the following worksheets: Response Data, Answer Key, Test Scores, Item Analysis, Examinee Analysis and Item Characteristics. Item characteristics of each item is shown in each worksheet.

Response Data

This is the Response Data you entered earlier.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	NO.	School	Grade	Type	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2	1	1	1	1	A	C	B	D	A	D	C	C	B	D
3	2	1	2	2	A	C	B	A	A	D	C	C		D
4	3	1	2	3	A	C	B	D	A	D	C	C	B	D

Answer Key

This is the Key Data you entered earlier.

	A	B	C	D	E	F	G	H	I	J	K
1	TEST	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2	Sample	A	C	B	B	A	D	C	C	B	D

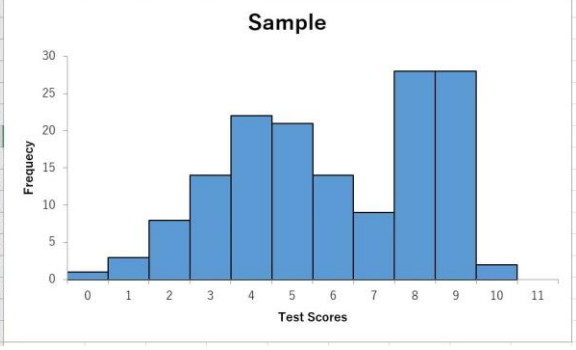
Test Scores

In this part, summary of test scores is presented such as Number of Items, Number of Examinees, Mean, Standard Deviation (SD), Min, Median, Max, Coefficient Alpha, and histogram of test scores.

Coefficient Alpha (α) is an index of test reliability, which stands for smallness of measurement errors, that is, preciseness of test scores. The larger the coefficient Alpha is, the more reliable the test score is. The maximum value of Coefficient Alpha is + 1.

Another way to express test score is so called Proportion. Test scores can be converted into proportions. The calculation formula is: Scores / Number of Items × 100%. The number of items, the number of examinees and Coefficient Alpha are consistent, regardless of the expression of Score or Proportion.

	A	B	C	D	E	F	G	H	I
1	Test Scores	mber of Iteer of Exan		Mean	SD	Min	Median	Max	α
2	Scores	10	150	5.98	2.43	0	6	10	0.70
3	Proportions	10	150	60%	24%	0%	60%	100%	0.70



Item Analysis

Summary of item analysis results is shown in the following table:

A	B	C	D	E	F	G	H	I	J	K	L	M
Item	Number o	P Value	D Value	I - T Cor.	α	Del. α	Key	A	B	C	D	Missing
X1	150	57%	76%	0.47	0.70	0.66	A	57%	12%	21%	9%	1%
X2	150	50%	93%	0.51	0.70	0.65	C	18%	10%	50%	22%	0%
X3	150	70%	61%	0.44	0.70	0.66	B	12%	70%	14%	4%	0%
X4	150	24%	-17%	-0.27	0.70	0.77	B	21%	24%	15%	41%	0%
X5	150	55%	93%	0.54	0.70	0.64	A	55%	20%	15%	9%	1%
X6	150	57%	68%	0.41	0.70	0.67	D	19%	15%	9%	57%	0%
X7	150	73%	59%	0.42	0.70	0.67	C	10%	9%	73%	8%	0%
X8	150	83%	41%	0.43	0.70	0.67	C	7%	3%	83%	7%	0%
X9	150	58%	54%	0.32	0.70	0.68	B	9%	58%	17%	13%	2%
X10	150	69%	56%	0.37	0.70	0.68	D	12%	7%	9%	69%	3%

Item：

Names or serial number of items.

Number of Examinees：

The number of participants in the test, which is consistent through all items.

P Value：

Proportion of correct (passing rate) of each item (%).

D Value：

As an indicator of item discrimination, D Value refers that examinees with higher total score are more likely to answer the item correctly while examinees with lower total score are more likely to answer the item incorrectly.

D value is calculated by subtracting the pass rate of low group (the lower 27%) from the one of high group (the top 27%). The range of D value is -100% ~ +100%. The greater D value is, the greater discrimination is.

When D value is negative, it means that examinees with lower score are more likely to answer correctly. This requires special attention, therefore, it will be indicated with text in red.

I-T Cor.：

As an indicator of item discrimination, I-T Cor. refers to the correlation between item scores ('I') and the total score of other items (Total score minus Score of the Item, 'T'). The range of I-T Cor. value is -1 ~ + 1. The greater the value is, the greater the discrimination is.

When value of I-T Cor. is negative, it means that examinees with lower score are more likely to answer correctly. This requires special attention, therefore, it will be indicated with text in red.

Coefficient Alpha：

Coefficient Alpha is an index of test reliability. There is only one Coefficient Alpha value for a test and all items share the same value.

Del. Alpha：

Del. Alpha refers that Coefficient Alpha is calculated without the item (the item is not included). If Coefficient Alpha ≥ Del. Alpha, it means that the item is acceptable for the test. While if Coefficient Alpha < Del. Alpha, the item is not acceptable.

Key：

Correct answer of each item.

Choice：

The choice rate (%) of the option. The colored cell is the correct option.

Missing：

Missing rate (%) of the item.

Examinee Analysis

The results of Examinee Analysis are as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	NO.	School	Grade	Type	Scores	Proportion	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2	1	1	1	1	9	90%	1	1	1	0	1	1	1	1	1	1
3	2	1	2	2	8	80%	1	1	1	0	1	1	1	1	0	1
4	3	1	2	3	9	90%	1	1	1	0	1	1	1	1	1	1
5	4	1	3	2	9	90%	1	1	1	1	1	1	0	1	1	1
6	5	2	1	1	8	80%	1	0	1	0	1	1	1	1	1	1
7	6	2	2	3	3	30%	0	0	1	1	0	0	0	0	1	0
8	7	2	2	1	8	80%	1	1	1	0	1	1	1	1	1	0

Examinee ID and Demographic Variables：

Those data come from Response Data file.

Scores：

Test score of each examinee which is the number of items the examinee answered correctly.

Proportions：

Proportion (%) of correctly answered items by the examinee. The calculation formula is: Score / Number of Items × 100%.

Item：

Each response is scored with 1 or 0. '1' means the answer is correct, '0' means the answer is incorrect including non-response.

When examinees with high total score incorrectly answer easy items, the cells will be displayed in yellow. When examinees with low total score correctly answer difficult items, the cells will be displayed in light blue. The criteria of judgements are as follows:

Let B denote the cumulative relative frequency of total score X from the highest total score, D denote Tolerance Margin, and P denote P Value of the item. For the examinee with score X:

Abnormal Case A: *When the item score = 0 and P - B > D,*

Examinees fail to pass easy items which they would answer correctly, beyond Tolerance Margin limit.

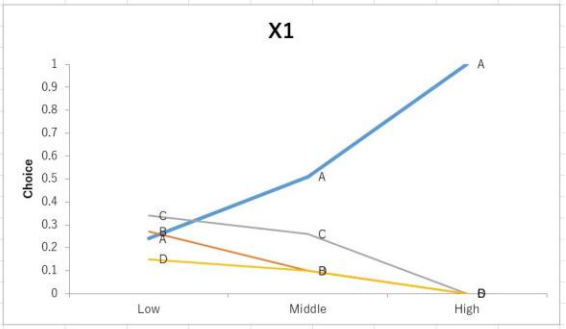
Abnormal Case B: *When the item score =1 and B - P > D,*

Examinees pass difficult items which they would answer incorrectly, beyond Tolerance Margin limit.

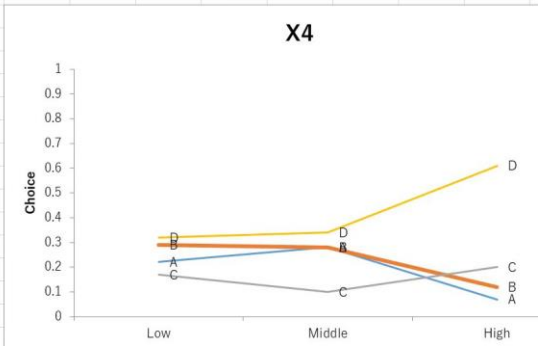
Item Characteristics

The detailed item characteristics are shown as follows:

Item	X1					
Number o	P Value	D Value	I - T Cor.	α		Del. α
150	57%	76%	0.47	0.70		0.66
Key						
A						
Choice	A	B	C	D		Missing
All	57%	12%	21%	9%		1%
High	100%	0%	0%	0%		0%
Middle	51%	10%	26%	10%		1%
Low	24%	27%	34%	15%		0%
Disc.	A	B	C	D		Missing
D Value	76%	-27%	-34%	-15%		0%
I - T Cor.	0.47	-0.29	-0.22	-0.19		0.06



Item	X4					
Number o	P Value	D Value	I - T Cor.	α		Del. α
150	24%	-17%	-0.27	0.70		0.77
Key						
B						
Choice	A	B	C	D		Missing
All	21%	24%	15%	41%		0%
High	7%	12%	20%	61%		0%
Middle	28%	28%	10%	34%		0%
Low	22%	29%	17%	32%		0%
Disc.	A	B	C	D		Missing
D Value	-15%	-17%	2%	29%		0%
I - T Cor.	-0.09	-0.27	0.04	0.29		0.00



In this part, summary of item characteristics is presented, including Number of Examinees, P Value, D Value, I-T Cor., Coefficient Alpha, Del. Alpha, Key, etc.

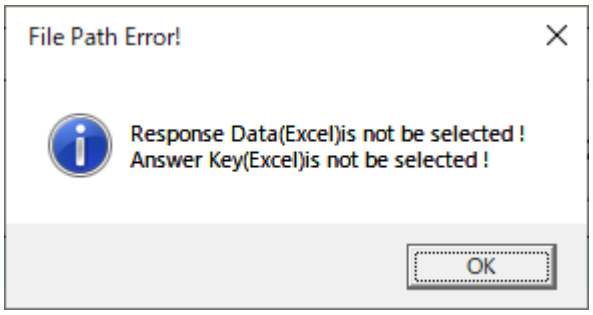
Choice and Missing rate (%) for All group, High group (top 27%), Middle group (middle 46%), and Low group (lower 27%) are also presented.

D-value and I-T Cor., which were used as discrimination indicators, are presented for each choice and missing data, regardless of correct answer or not. For the correct answer option, D value and I-T Cor. are expect to be positive (+), while for distractors, those are expect to be negative (-).

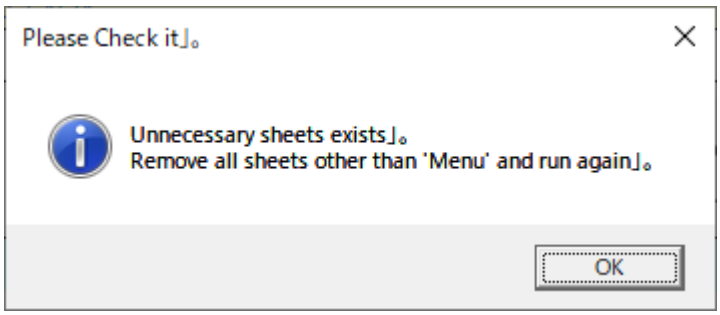
The Trace Line (Choice Ratio Analysis Chart) is a line chart, in which the Y-axis is choice rate of options and the X-axis is presented in three groups: low, middle, and high. The line of correct answer is displayed with bold line. For high quality items, it is expected that the graph of correct answer rises in upper right corner and the ones of distractors fall into the lower right corner.

ERROR MESSAGES

If you run the software without selecting a file --> Please specify the file.

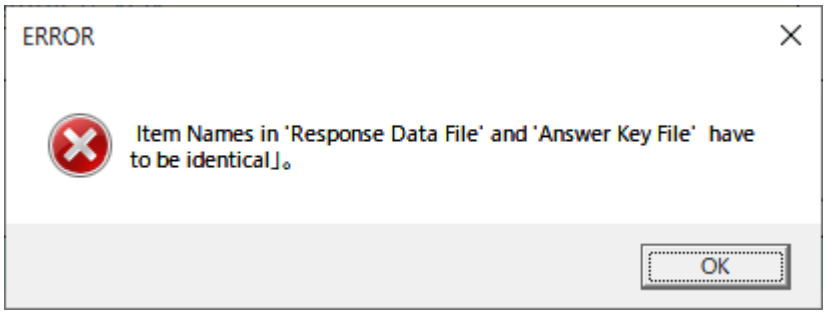


If there are still results of the last analysis (worksheets) --> Please press the 'Initialization' button.

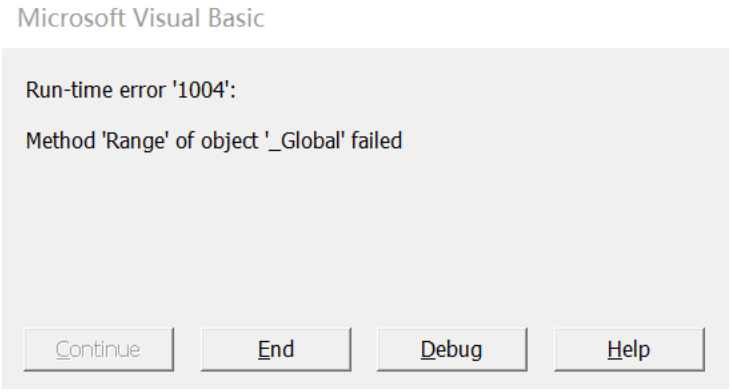


If item names in Response Data are inconsistent with the ones in Answer Key --> Please make item names consistent.

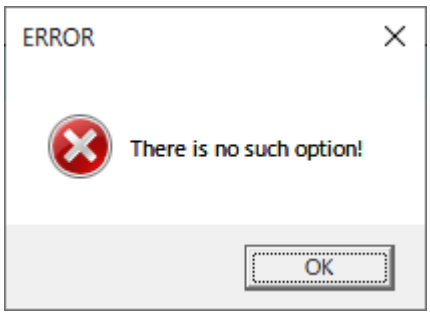
If enter incorrect letter when setting the demographic data --> Please set the last column correctly according to your data carefully.



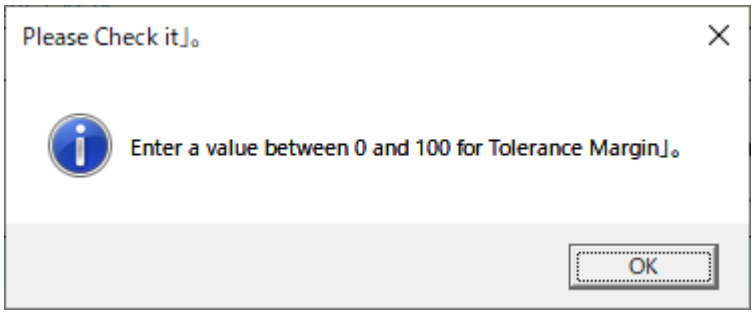
If you run the software without setting the last column of demographic data --> Please enter right value of the last column.



If symbols of options in Response Data are not consistent with the ones in Answer Key --> Please make symbols consistent.



If input a value out of range 0~100 for Tolerance Margin --> Please enter a value between 0 and 100 for Tolerance Margin.



RELATED INFORMATION

Software Environment

The software is based on Excel Macro Language. Please run it under Windows system which supports Excel Macro Language (some windows systems may not be compatible).

Copyright and License

Disclaimers

Please be aware that the copyright owner is not responsible for any results produced by application of the software.

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