UNIBALANCE Users Manual

Marcin Macutkiewicz and Roger M. Cooke

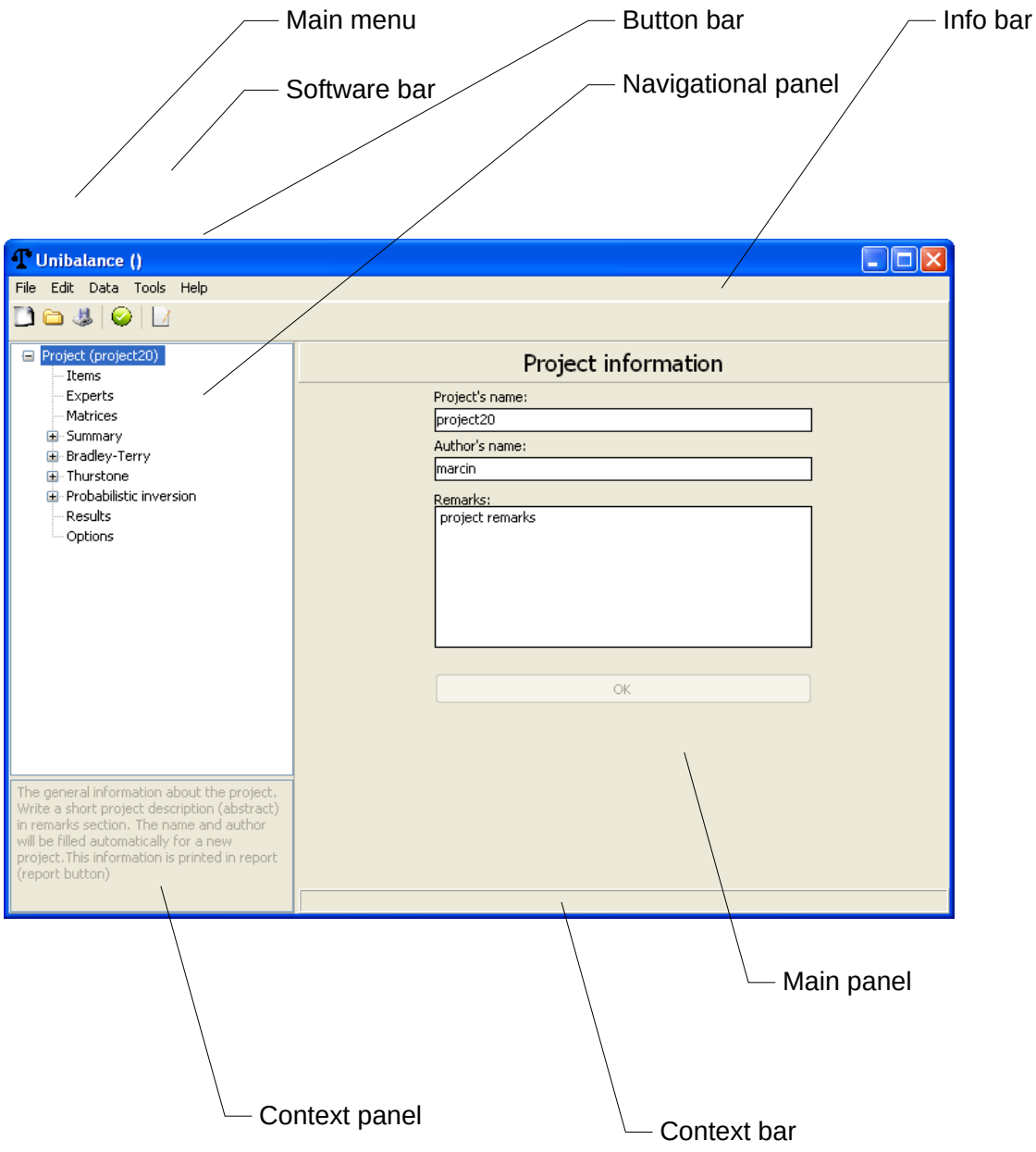
Deflt 2006

1. Installation

The application is delivered in the form of executable installation file.
In order to install it you have to run a **setup.exe** file and follow the instructions on a screen.

After the installation you can find several sample files in the **AppFolder\Samples folder**. You can open them (see section *Opening file*) to get a general impression of the software. You can also easily uninstall the software by clicking
Start -> Programs -> UNIBALANCE -> Uninstall UNIBALANCE.

2. Software overview



We will refer to the presented names of different parts of working space of the software in the further text. The purpose of different areas is the following:

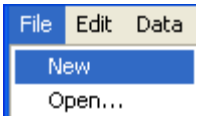
- **Software bar**: provides the information with a package name. If the file is opened or saved it contains the whole path of the project file
- **Button bar**: contains a few buttons in order to access certain features of the software with a one simple click.
- **Info bar**: contains the name of currently activated panel. This name changes if we change a different node in the navigational panel
- **Context bar**: provides the information related to various actions performed in the software. It is used for displaying error messages or recommendations for the user of performing a desirable action
- **Main menu**: it is an access point to all the function included in the software package
- **Navigational panel**: allows switching between different modules of the software. For simplicity we will not make a distinction between a module or a panel if referred to a name
- **Main panel**: displays the panel selected in Navigational panel. It is the main working space of the software
- **Context panel**: provides a context description of functionality and features present in the currently displayed panel

> *If you decide to change the size of the main window the location of elements in the main panel should adjust to the new size. We can also try changing the size of panel in order to achieve ergonomics that suits you the best.*

3. Creating new project

In order to create a new project you should choose

✓ *File -> New*



or

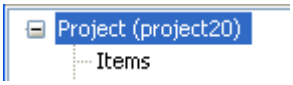
✓ Press **New project** button  on the button bar

> *If you start the software a new project is automatically created. Then you can work with it but you should take care about saving the changes by yourself.*

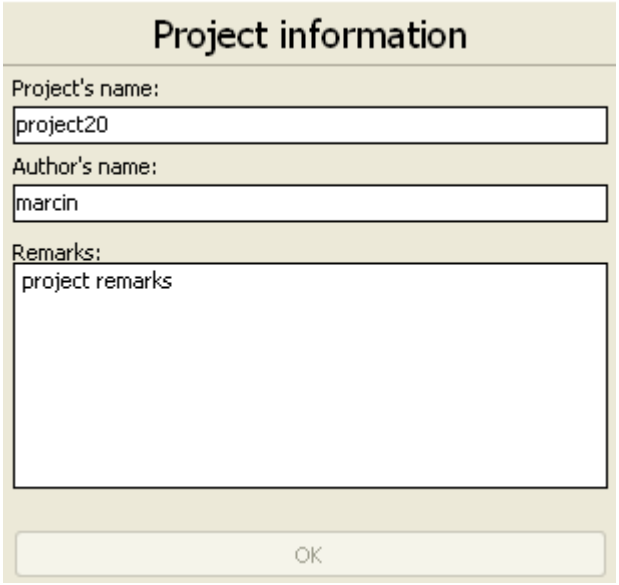
3.1. Project properties

Before you started typing the data it is recommended to provide a brief description of the project.

✓ Click **Project** node in the *navigation panel*. There is a default name of the project present in brackets.



✓ Go to the main panel and fill all the information about the project.



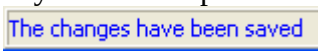
✓ Specify:

- **Project's name**: the name of the project
- **Author's name**: the name of an author of the project

If you create a new project this name will be filled automatically with currently logged windows user name

- **Remarks**: in the remarks section is it recommended to provide a brief description of analyzed dataset, with a link to the research paper the dataset is related to

If you finished press **OK**. You should notice the message in context bar:

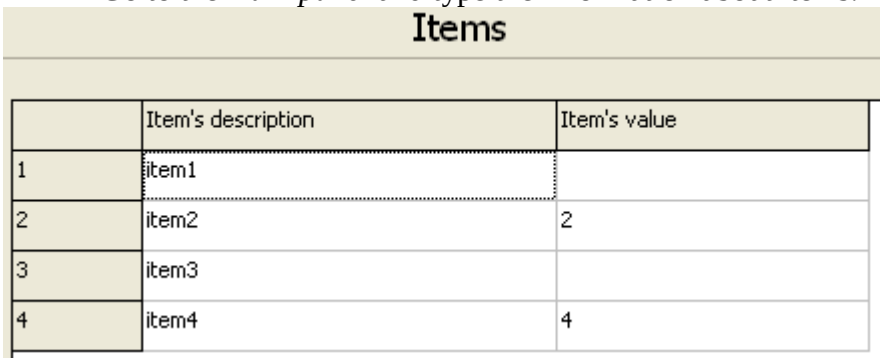


3.2. Items

You have to specify the names of the items experts are supposed to compare. You will type in an item's name and a realization if you have in mind a value of the item.

✓ Click **Items** node in the navigation panel. There is a default number of items printed in brackets.

✓ Go to the *main panel* and type the information about items.



✓ Specify:

- **Items' description**: a meaningful name of the item. Take care about unique names of the items, it helps experts in making comparisons
- **Item's value**: a real number with items realization. If you know this value then you can rescale obtained results to the specified realization

> *In order to prevent ambiguous names every time you add a new item the new name will be suggested with an increased numerical suffix. It helps a lot typing the items if the names are not meaningful (they function just as etiquettes of items)*

To **add** an item:

✓ Press ENTER if you finished writing the name of the item.

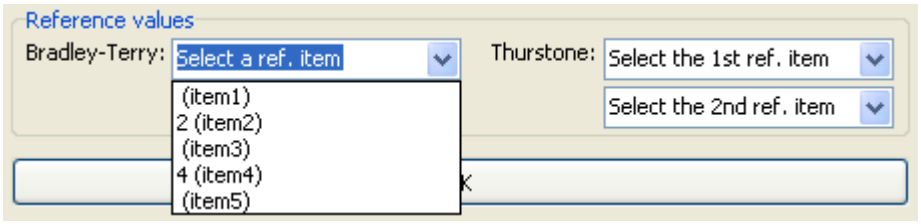
✓ Press ↓ to create a new item row.

To **delete** an item:

✓ Select the item you want to delete

✓ Press CTRL+DEL

If you specified realization(s) of items you can indicate which of them will be used as reference values:



Bradley-Terry reference value

Having the scores of items from Bradley-Terry models $s_1,...,s_T$ new scores $\overline{s_1},...,\overline{s_T}$ will be computed together with a reference value of item i_i, v_i, in the following way:

$$\overline{s_j} = \frac{v_i}{s_i} \cdot s_j$$

Thurstone reference values

In order to compute transformed values for Thurstone model you have to provide two reference values. Then the transformed scores are computed according to the following formula:

$$\overline{s_j} = a \cdot s_j + b$$

$$a = \frac{v_i - v_j}{s_i - s_j}$$

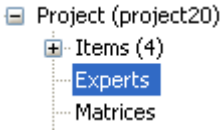
$$b = v_i - a s_i$$

If you finished press **OK**. You should notice the message in the *context bar*:

3.3. Experts

You have to specify the names of the items that experts are supposed to compare. You will type in an item's name and a realization if you have in mind a value of the item.

✓ Click **Items** node in the navigation panel. There is a default number of items printed in brackets.



✓ Go to the main panel and type the information about items.

Experts

	Expert's nickname	p-value	Expert's description
1	e1		Company specialist
2	e2		Market advisor
3	e3		Manager
4	e4		Student

✓ Specify:

- **Expert's nickname**: a meaningful name of an expert. Take care about unique names, it helps not to confuse experts
- **Experts's description**: a short information about an expert (e.g. qualifications)

An automatical suffix is added, as well. If you want to find out what p-value is go to the section of data input. P-values appear only if data is specified.

To **add** an expert:

✓ Press ENTER if you finished writing the name of the item.

✓ Press ↓ to create a new item entry.

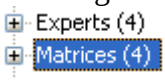
To **delete** an expert:

✓ Select an item you want to delete

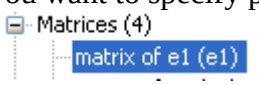
✓ Press CTRL+DEL

3.4. Data input

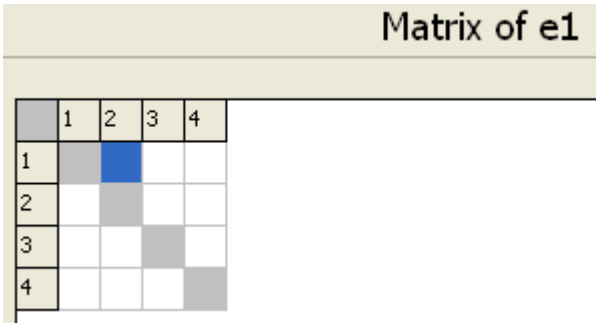
In order to specify the data of paired comparisons you should go to the Matrices node in the navigational panel. The number in brackets corresponds with number of experts.



✓ Expand the node in order to get an access to an appropriate data matrix. Select the expert you want to specify preference of.



✓ Go to the main panel and click in the blue cell.



Start specifying the preference. The value from the i*th* row and from the j*th* column should represent the preference of item i_i to i_j.

To specify preference:

- ✓ Press **1** or > if $i_i > i_j$.
- ✓ Press **0** or < if $i_i < i_j$.
- ✓ Press 2 or = if $i_i = i_j$.

If you specify the preference for one pair UNIBALANCE will lead you automatically to the next cell. You can use arrow keys (→,←,↑,↓) if you want to go to the exact cell. You can fill either lower or upper triangular of the matrix. If you fill one cell the diagonal-symmetric cell will be filled automatically. If an expert has not specified his preference leave the cell blank.

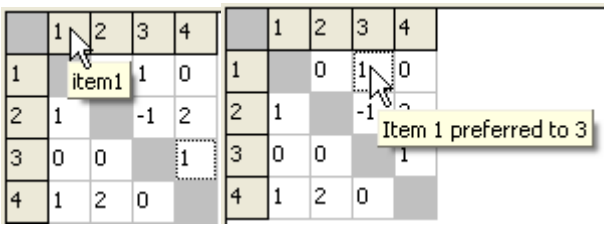
To change the format of displaying data

- ✓ change the state of **Numerical format of data** checkbox. It is possible to switch between two modes:

	1	2	3	4
1		<	>	<
2	>			=
3	<	<		>
4	>	=	<	

	1	2	3	4
1		0	1	0
2	1		-1	2
3	0	0		1
4	1	2	0	

If you want to obtain the name of the item instead of numerical value you can go the the proper cell (either fixed cell or data cell) and click. Then you should notice a hint message with either the name of the item (if you clicked a fixed cell) or with the specified preference (if you clicked data cell).



4.3.1. Randomness of data

Sometimes experts may provide inconsistent answers. The intransitivity in data may appear if the respondent prefers $i_j > i_i, i_k > i_j, i_i > i_k$.

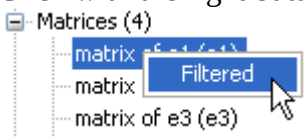
This inconsistency is referred in the literature as a *circular triad*. The presence of circular triads may indicate that either the experts give their preference by chance or the differences among the items are indistinguishable. In both of the cases it is useful to know that such a situation occurs. If there are too many CT we can claim that an expert specified his preference randomly. Further information about the statistical test can be found in Kendall M. G. (1975). *Rank correlation methods.* Charles Griffin & Company LTD.

P-value represents the probability that given the hypothesis of randomness is true the data is specified randomly. We usually set the threshold value as 0.05 (confidence level). Thus if specified data obtains p-value >= 0.05 the software package suggest filtering (removing) the expert from the dataset.

There is no evidence to reject the hypothesis that the expert has specified his preference randomly. Is is recommended to filter the expert.

If you want to exclude the expert from the project (without physical deleting) you can do it in two ways:

- ✓ Click with the right button on the matrix you want to filter and click **Filtered** or



- ✓ Go to the Experts panel, right click the expert you want to exclude and click Filter.

After that the expert and corresponding data will be grayed faded.

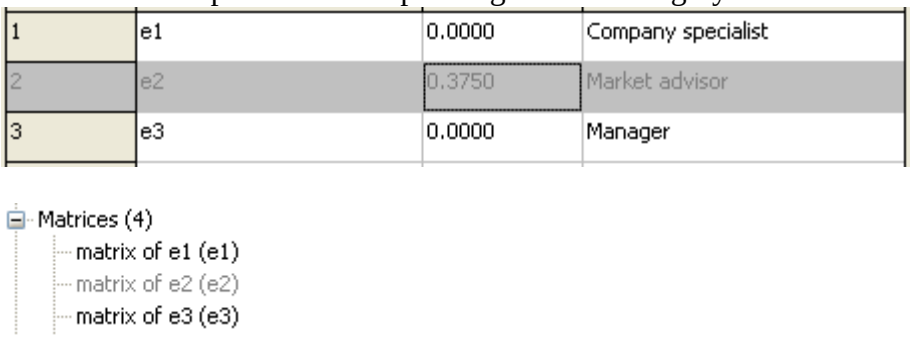
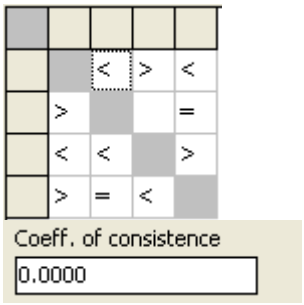


Figure 5-1 The menu after filtering

Another parameter which provides information about the presence of circular triads in data is *coefficient of consistence* ζ. It reaches the maximum value 1 if there are no inconsistencies in the data, which implies that the output of comparison process might be expressed as a ranking. The value decreases if the number of circular triads increases. The lowest value of ζ is 0.



4.3.2. Data validation

✓ Go to the main menu and select

✓ Then go to the context bar in order to check if there are no data problems

If you double click you will see a message with a brief description of the problems present in data

Of course not all of the problems are important and not all of them disable further calculations but it is recommend to get rid of all of them except a circular triads problem (since you are not allowed to change experts answers).

4. Preliminary information

If data of the experts is specified we can analyze their answers without running any model. First of all we can explore preliminary information from the data.

4.1. Summary matrix

From summary matrix you can find out how many experts preferred item i_i (row item) to item i_j (column item).

✓ To display a matrix choose **Matrices** node from the *navigational panel*.

	1	2	3	4
1		2	3	2
2	1		2	2
3	0	0		3
4	1	0	0	

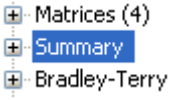
Similarly we can check the probability of preferring item i_i (row item) to item i_j (column item). In order to see these probabilities click 

from the main panel (if you display summary matrix panel).

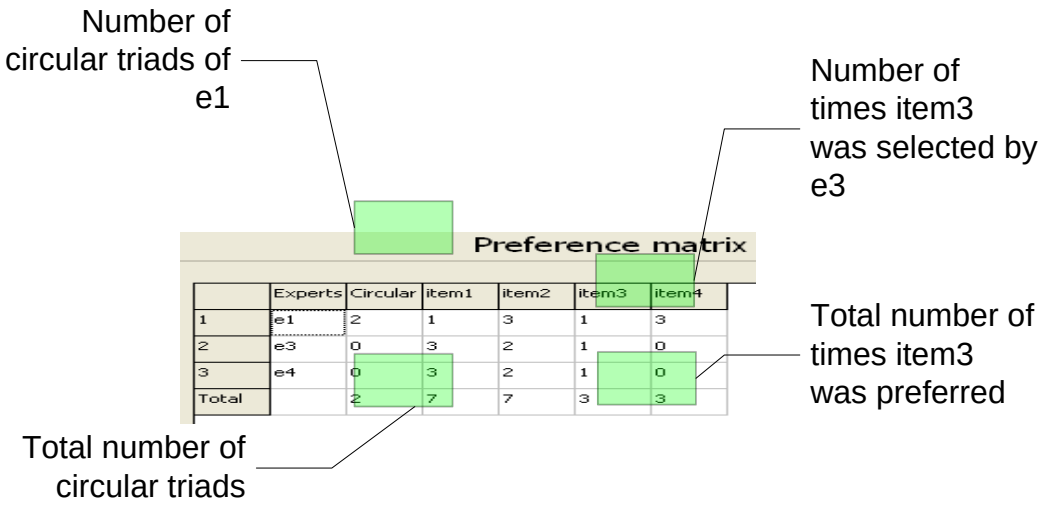
	1	2	3	4
1		0.67	1.00	0.67
2	0.33		1.00	0.67
3	0.00	0.00		1.00
4	0.33	0.00	0.00	

4.2. Preference matrix

✓ In order to get a detailed summary of data go to the *Summary panel*.

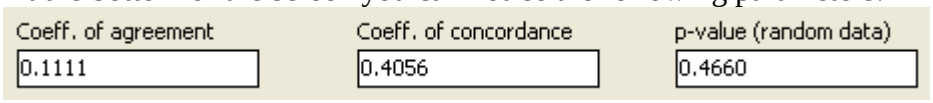


From the preference matrix you can obtain the following information:

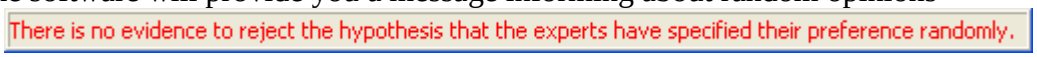


	Experts	Circular	item1	item2	item3	item4
1	e1	2	1	3	1	3
2	e3	0	3	2	1	0
3	e4	0	3	2	1	0
Total		2	7	7	3	3

At the bottom of the screen you can notice the following parameters:



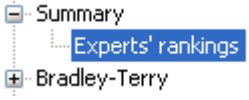
- **Coefficient of agreement –** a real number varying from $-\frac{1}{T-1}$ (if T is even) or $-\frac{1}{T}$ (if T is odd) to 1 (T is a number of items). It provides information about a degree of similarity of answers. If all experts specify the same matrices it should reach 1. If they completely disagree in preference it should be 0. Please note that if our experts are supposed to represent a certain population some level of disagreement is desirable
- **Coefficient of concordance –** a real number varying from 0 to 1. It provides similar information as coefficient of agreement but is computed based on different parameters.
- **p-value** – we might be interested if all of our experts stated their preference randomly. This can be computed based on a statistical test. If p-value is bigger than a confidence level you may claim that the set of expert specified their preference randomly. If so, the software will provide you a message informing about random opinions



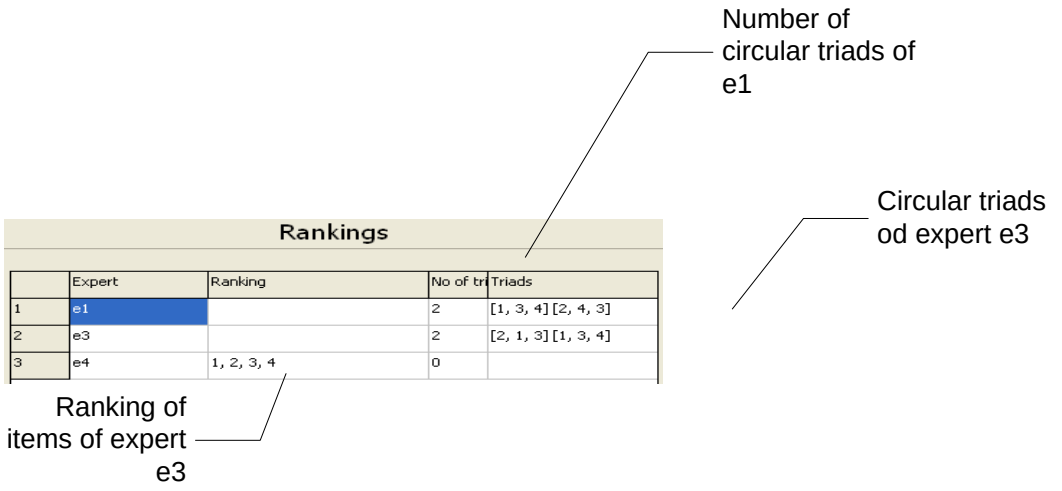
4.3. Ranking

If an expert is consistent you can easily obtain a ranking of items based on his answers. If he specified circular triads there is no valid ranking. In order to get information about rankings you should

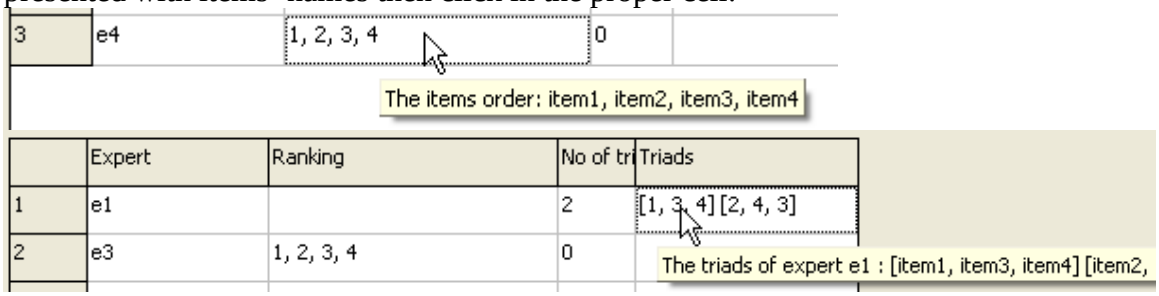
- click **Expert's rankings** node in the *navigational panel*.



Then you can obtain the following information.

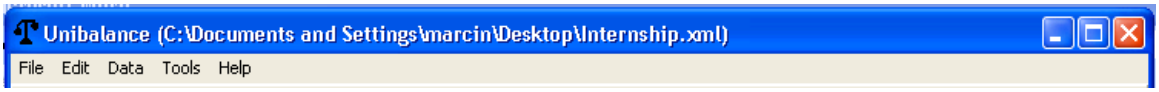


The *ranking panel* provides the ranking or triad specification of items specified as the numbers referring to the order of items in the items' list. If you want to obtain the order presented with items' names then click in the proper cell:



5. Saving project

If all the data is specified it is recommended to save the project.
While saving you will also save results of computations so if you want to have up to date results in the file do not forget to save it every time you recalculate models.
In order to save a project you can choose **File -> Save** or press the **Save project** button
If the file is saved correctly you should be able to see the path to a project file in the software bar:



If the project has not been already saved you will be asked of a name of the project.

The file is saved in *XML format*. You can open the file in your web browser. Programmers will appreciate this solution because XML is an easily exchangeable format and is also easy to transform.
A structure of a sample XML file is presented below:

```
- <project>
  - <Project>
      <name>project20</name>
      <creationDate>2006-07-24</creationDate>
      <authorName>marcin</authorName>
      <remarks>project redfgmarks</remarks>
      <excelPath>c:\Program Files\Microsoft Office\OFFICE11\excel.exe</excelPath>
      <unigraphPath>c:\Program Files\Unicorn Pro\unigraph.exe</unigraphPath>
      <numberOfSamples>5000</numberOfSamples>
      <expertsNo>4</expertsNo>
      <itemsNo>4</itemsNo>
    </Project>
  - <Experts count="4">
      <e1 name="e1" description="Company specialist" filtered="False" />
      <e2 name="e2" description="Market advisor" filtered="True" />
      <e3 name="e3" description="Manager" filtered="False" />
      <e4 name="e4" description="Student" filtered="False" />
    </Experts>
```

Figure 7-1 A fragment of XML project file (possible to open in a browser)

6. Opening new project

To open a project you can choose **File -> Open** from the menu bar or **Open project**  button from the *button bar*.

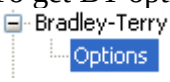
After you open a project the Project panel will appear in the *main pane*l.

7. Setting options

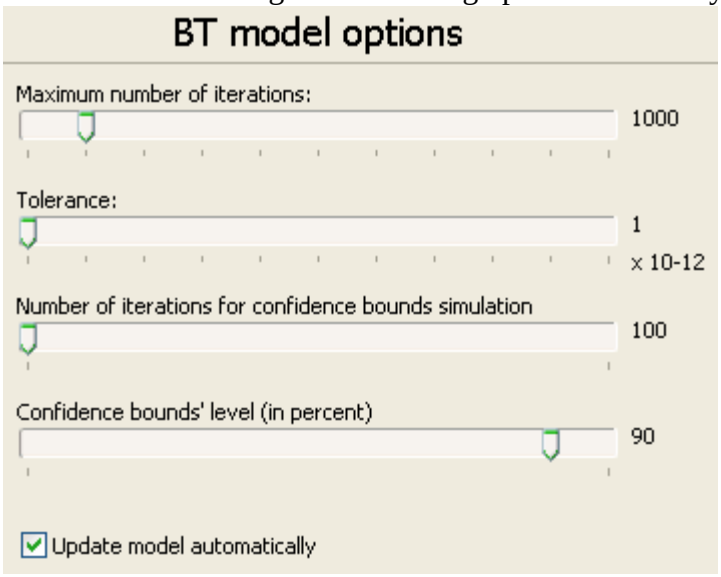
Before the models are computed you should check the default options and adjust them to fit your problem. The default options might be also change. Appropriately chosen options are especially important if probabilistic inversion model is used.

7.1. Bradley-Terry

✓ To get BT options panel select



You are able to change the following options of Bradley-Terry model



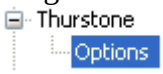
If you compute solution of Bradley-Terry it is obtained in an iterative process. Thus you are able to set **maximum number of iterations** and **tolerance**. Algorithm stops if the error (difference in improvement) is smaller than tolerance or if maximum number of iterations is reached.

If you run BT model you also estimate confidence bounds of the model. It is done via simulation and you can set the **number of iterations for confidence bounds**. You can also set the **confidence bound's level**. More times you run simulation, more accurate results you will obtain. However, it may significantly increase the time of updating the model.

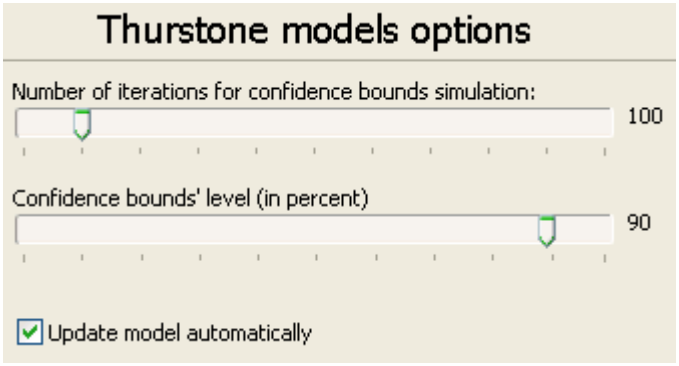
If you want to update model anytime you make some changes in data or in items, select **Update model automatically**. Then you are sure you have always up to date results but it might cause that the application works slowly (due to updating in background).

7.2. Thurstone

✓ To get to Thurstone options panel select:



Thurstone model is not solved by an iterative procedure and you are not able to choose any 'iterative options'. In Thurstone case however confidence bounds are also estimated via simulation. Thus you can change simulation parameters in the similar way as in BT model.



If you want to update model anytime you make some changes in data or in items,

✓ select **Update model automatically**.

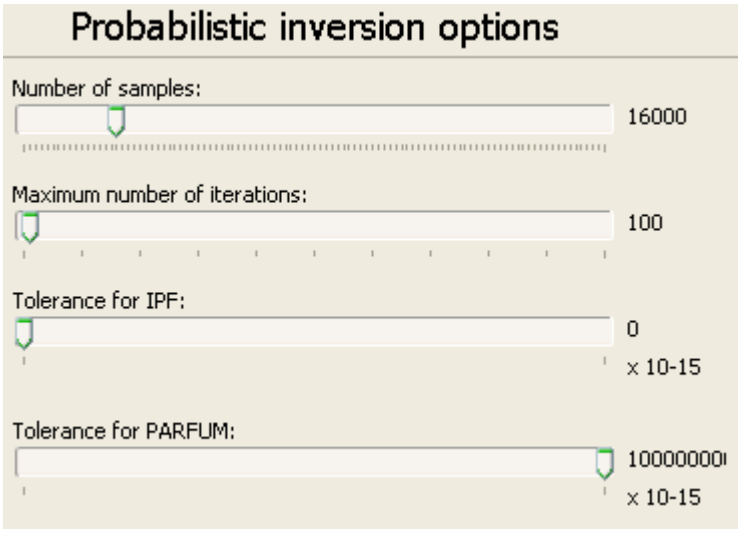
Then you are sure you have always up to date results but it might cause that the application works slowly (due to updating in background).

7.3. Probabilistic inversion

✓ To get to Probabilistic inversion options you have to select the proper node in navigational panel:

Setting probabilistic inversion options is crucial for the results obtained from simulation procedures. An extensive analysis of parameters can be found in author's master's thesis. A general description of parameters will be provided in this document but for details you are referred to the mentioned source.

You are able to change the following probabilistic inversion's parameters:



In order to obtain accurate results of PI approach you have to work with a large sample. The bigger sample the more accurate results. However, bigger samples increase calculation time. Thus you have to try different values of **number of samples**. We recommend setting 16000 of samples because in most cases you can obtain good results and also this is a critical value of samples that can be drawn by *Unigraph* software.

Execution time can be also limited by the value of **maximum number of iterations**. If you set a low value it might happened that the algorithm will not converge (a desirable level of error will not be achieved).

You can set the **tolerance for IPF** and **tolerance for PARFUM** independently. You have to bear in mind that PARFUM is a slower algorithm compared to IPF. If you decide to use the same values of tolerance PARFUM might run significantly longer.

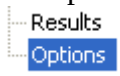
Because simulation takes some time you cannot select automatic updates of this model.

We recommend 1E-15 for IPF tolerance and 1E-09 for PARFUM tolerance.

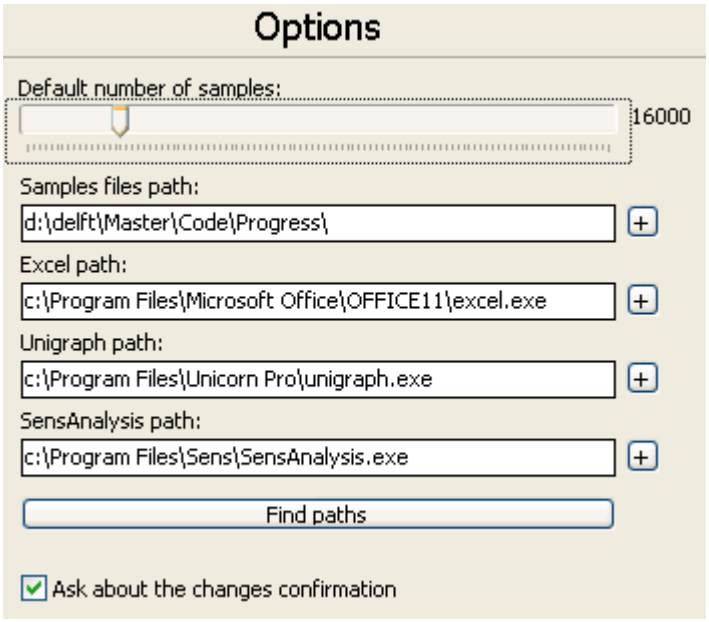
7.4. General options

Several options relate to the whole software package rather to particular models.

✓ In order to change these options you have to select a proper node from navigational panel

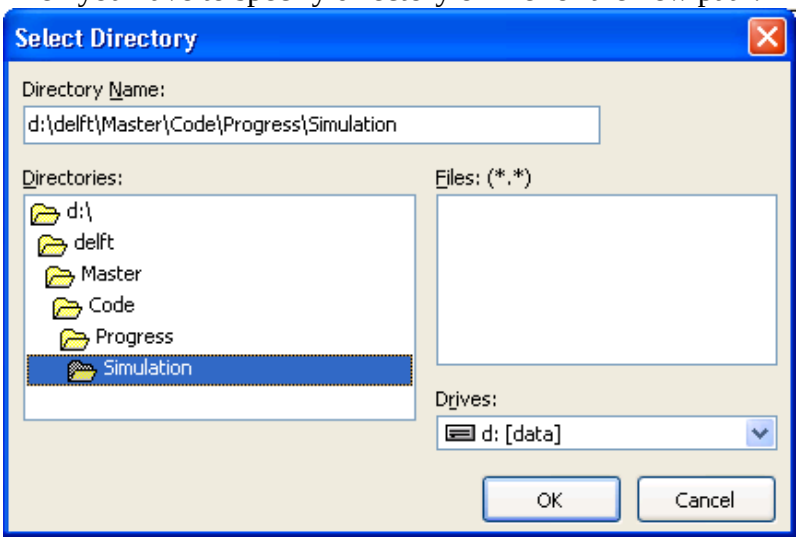


Then you can change the following options:



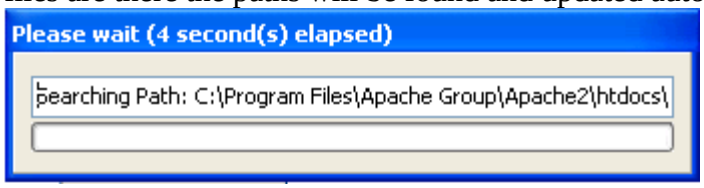
Default number of samples determines how many samples will be used in probabilistic inversion simulation for new projects by default.
Samples files path indicates location where the sample files and weight file will be saved.
Excel path, Unigraph path and **Unisens path** relate to the software packages that are used in probabilistic inversion panel. For further information you are referred to a proper the section of probabilistic inversion.

In order to change the default paths you have to click 
Then you have to specify directory or file for the new path:



If you do not know the location of packages you can allow for the application to find them. In order to do that you have to click 

Then the application starts looking the files in your PROGRAM FILES directory. If the files are there the paths will be found and updated automatically.



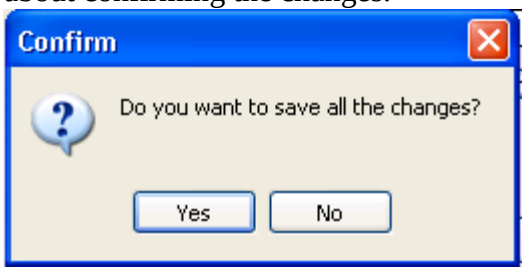
Automatic paths updating might be a time-consuming task. Thus if you now locations of software executable files (Excel, Unigraph, Unisens) it is always recommended to update them by hand.

If you change you data you are supposed to press **OK** button in order to confirm the changes. However, sometimes while switching the panels you might forgot about confirming the changes by clicking OK. If you do not want to loose the changes in such a case

✓ select 

.

Every time you forget pressing OK after making changes in a panel you will be asked about confirming the changes.



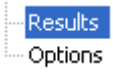
Sometimes however this confirmation might be annoying that is why we allowed for the user to switch off this option.

8. Results

If all options are set correctly you are able to run the models. If you want to compute all the models (except Probabilistic inversion) at once

✓ click **Perform calculations**  button on button bar.

You can also

✓ go to Results node 

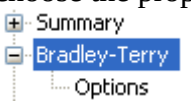
and click **Calculate** in the *main panel*.

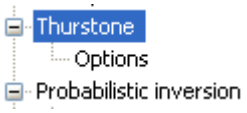
You can, however, calculate models separately and control results step by step.

8.1. BT and Thurstone

Bradley-Terry and Thurstone panel are so similar that they might be explained in the same section. In order to work with these panels you have to

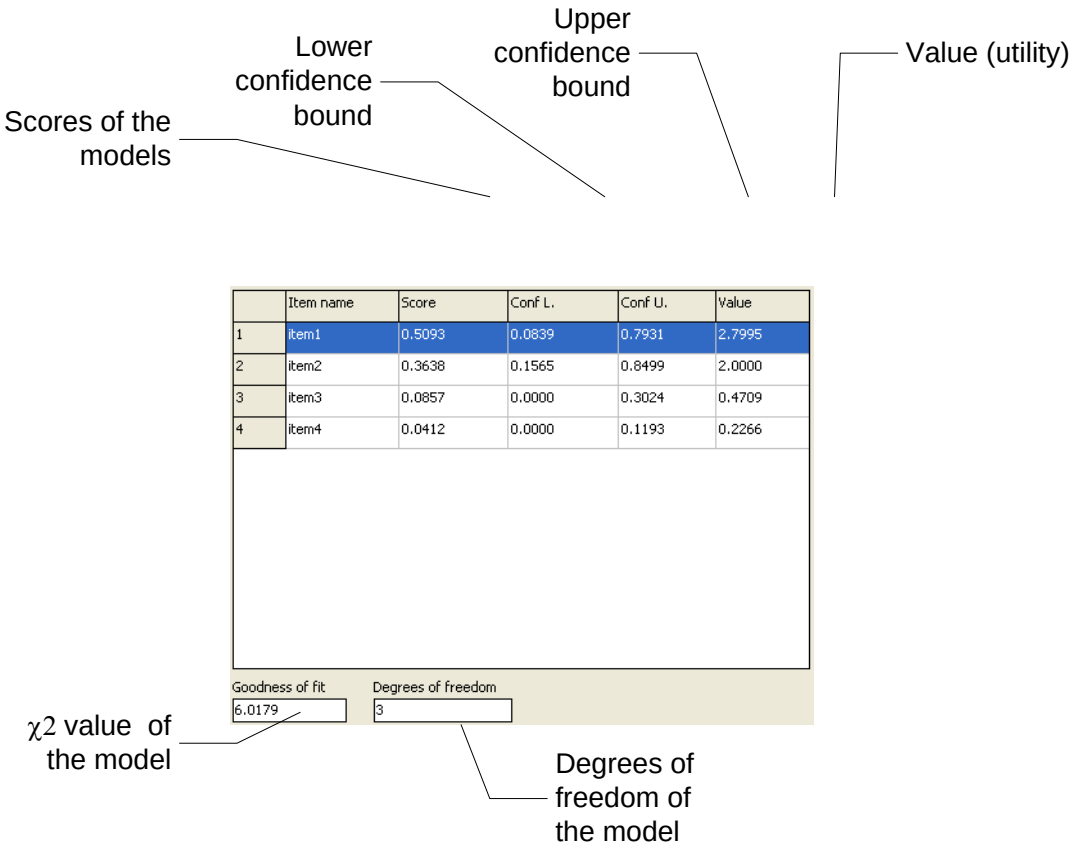
✓ choose the proper node in the navigational panel.





✓ Click **Calculate** in order to obtain results.

Then you have the following information printed on the screen:

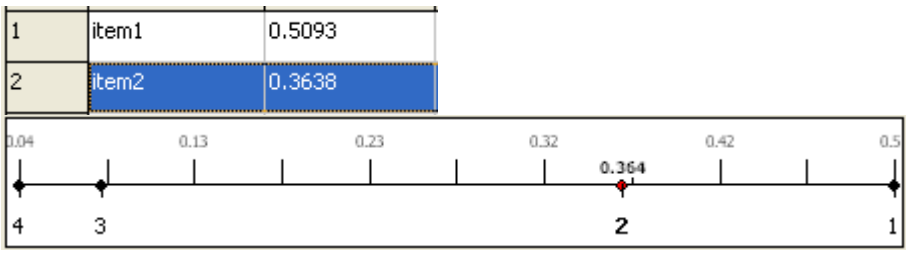


Please note the value column will be filled only if you specified reference values for the models in Items panel. Values printed here represent a scaled utility. Scaling is done with respect to values specified in Items panel.

Based on χ^2 value and degrees of freedom you are able to compute p-value which will inform you about the fit of the model.

8.2. Scales

At the bottom of the main panel a scale is printed. The points on the scale represent the scores of the items. If you click a certain score in the grid a corresponding scale value will be focused on the scale.



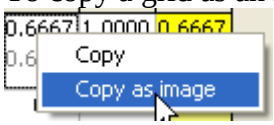
8.3. Copying and Pasting

You have extensive abilities of copying and pasting results. We will mention a few of them.

3.8.1. Grid

You can copy a grid either as an image or as a tabulated text.

To copy a grid as an image right click on a grid and select **Copy as image**



To copy a grid as a text select the whole grid before and the after a right click just **Copy.**

If you select the whole grid data cells will be copied together with fixed cells.

As a result you will obtain the following text

	1	2	3	4		
1	0	0.666666666666667		1	0.666666666666667	
2	0.333333333333333		0	1	0.833333333333333	
3	0	0	0	1		
4	0.333333333333333	0.166666666666667		0	0	

It does not look as you wish that is why we recommend using this type of copying together with Excel or converting the text into a table form. When pasted in Excel it looks in the following way:

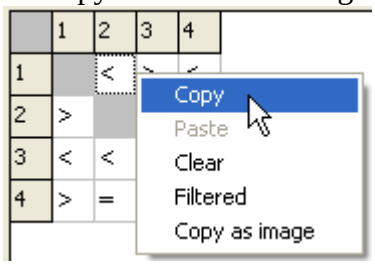
	1	2	3	4
1	0	0.666667	1	0.666667
2	0.333333	0	1	0.833333
3	0	0	0	1
4	0.333333	0.166667	0	0

Figure 10-1 A tab delimited matrix data after pasting to Excel

3.8.2. Data matrix

If the answers of experts do not differ so much it might be useful to copy and paste data matrix in order to spend less time with filling them.

✓ To copy the data matrix right click it and select **Copy**

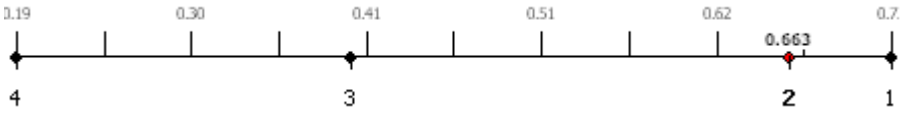


✓ Then go to a matrix you want to fill. If the system clipboard contains information with a matrix (it is checked automatically) then you are able to select **Paste**.

3.8.3. Scale

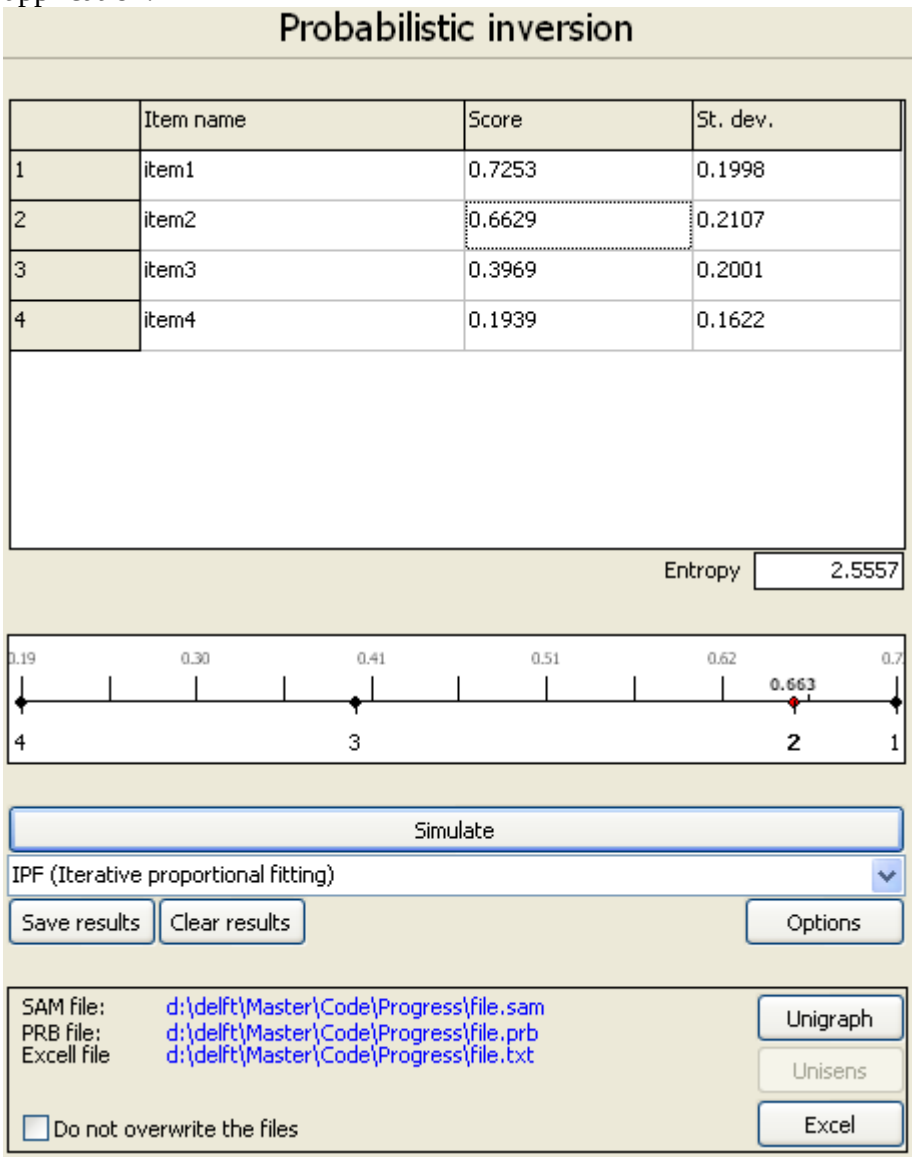
✓ In order to copy scales right click and select **Copy**.

The result of copying is presented below



8.4. Probabilistic inversion

Probabilistic inversion panel is the most sophisticated and rich in features panel in the application.

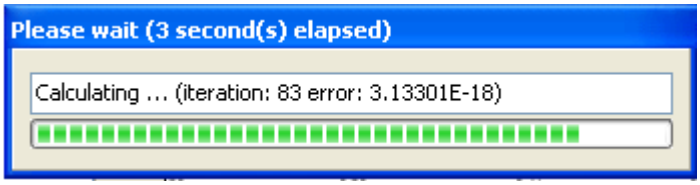


You always have to remember about setting options before you decide to run algorithm. In order to adjust the options click **Options** button. You can read more about options in *General options* section.

- ✓ Then you have to choose the proper version of algorithm you want to use

- ✓ To calculate the scores click **Simulate**

You will be informed of the progress of simulation via a progress window:



Simulation process contains four main steps:

- **Updating the weight**s: information about current iteration and the error is provided
- **Resampling**: information about progress in resampling provided in the form of progress bar
- **Calculating the scores**: averaging result of all the samples
- **Saving files**: several files are saved, the one with weights, with utility values and with samples

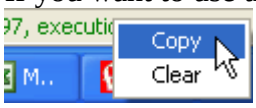
Then you can observe **scores** and **standard deviations** of items' utilities.
Please note that it is important for result's accuracy if algorithm has not converged or not. You can find this information in the *context bar*.

The algorithm has converged. Total number of iterations: 597, execution time: 17.3

The algorithm has not converged. Try changing the values of maximum iterations or tolerance, execution time: 3.0

Figure 10-2 The messages about (lack of) convergence

If you want to use the information from a context bar you can copy it with a right click:



As you see you can also clear a message from the context bar.

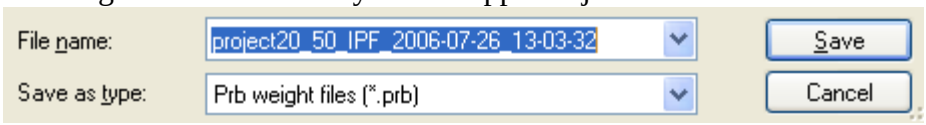
If you have one of the sample files opened than creating a new file will be impossible and you will see the following message

Cannot create the file

4.8.1. Multiple runs of simulation

Pretty often you will have to run your simulation several times. Then you might want to store your sample files from every simulation. In order not to overwrite sample files you have to check ☑ Do not overwrite the files

Then every time you will reach *Saving files* step in your simulation you will be asked for a name for every file of the simulation process. Fortunately, the application will suggest a meaningful name and then you are supposed just to click **Save**.



You might want to save the results from all the simulations you performed. Of course you could copy all the information from different places of the application but this would be

laborious. Thus you can save all the results to a tab separated text file by clicking

Save results

If you want to remove old results from internal storage and start saving them again starting from the empty results' set click

Clear results

After saving results you can open them via Excel in order to have a nice looking tabulated form of data. The file with results might look as follows:

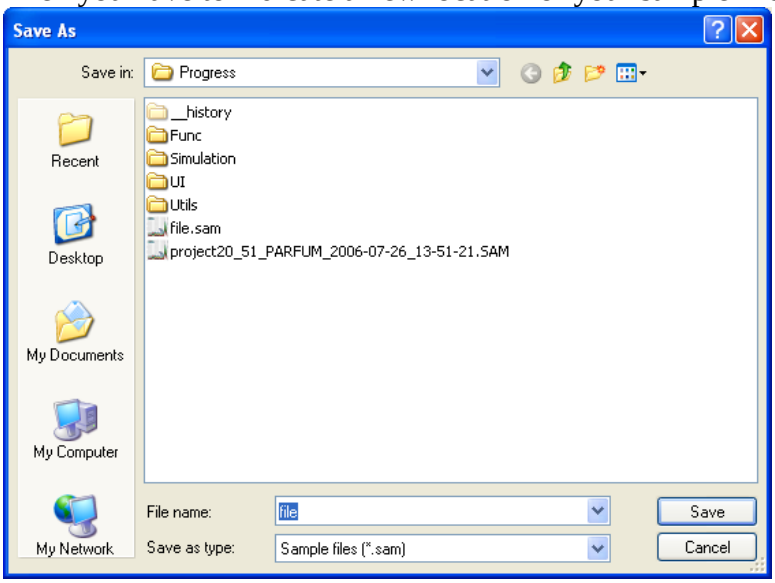
Simulation	item1	item2	item3	item4	Type	Samples	Iterations	Error	Convergen	Entropy	Sum^2	maxIter	Tolerance	Time
1	0.725311	0.662912	0.396905	0.193868	IPF	16000	100	2.69E-16	0	2.5557	0.046296	100	0	0.6
2	0.731413	0.664909	0.395149	0.196227	IPF	97931	100	1.78E-15	0	2.5338	0.046296	100	0	3.8
3	0.732599	0.667134	0.400072	0.202031	IPF	97931	100	3.89E-18	0	2.5454	0.046296	100	0	3.7
4	0.733013	0.668427	0.403953	0.201761	IPF	97931	100	2.32E-15	0	2.5196	0.046296	100	0	3.7
5	0.689673	0.637043	0.374042	0.292205	PARFUM	97931	100	1.48E-05	0	1.9971	0.015606	100	1.00E-06	2.5
	0.722402	0.660085	0.394024	0.217218				2.96E-06	0	2.43032				

In the file you will find all the necessary information about the convergence, tolerance, number of samples etc…
This feature is very useful if you want to perform a detailed analysis of a case.

You might want to change paths for saving sample files manually.

✓ Then you have to click on the hyperlink of the path:

Then you have to indicate a new location of your sample file

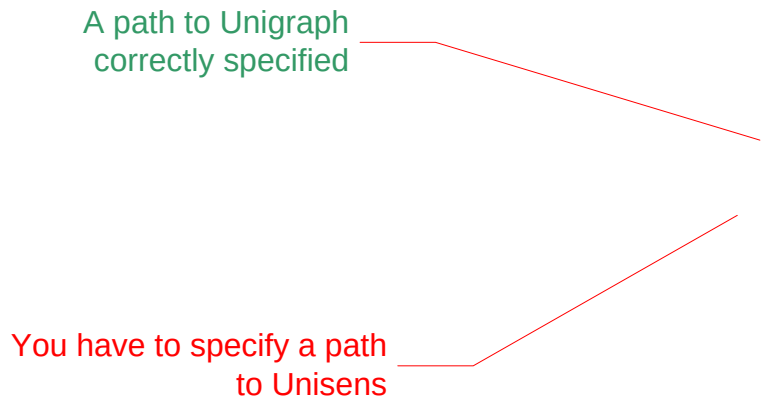


You can do this for each of three files that are saved.

4.8.2. External applications

If you run you simulation you can use external applications for a detailed view on the results.

First of all the path of applications should be specified. Otherwise the buttons will be disabled:

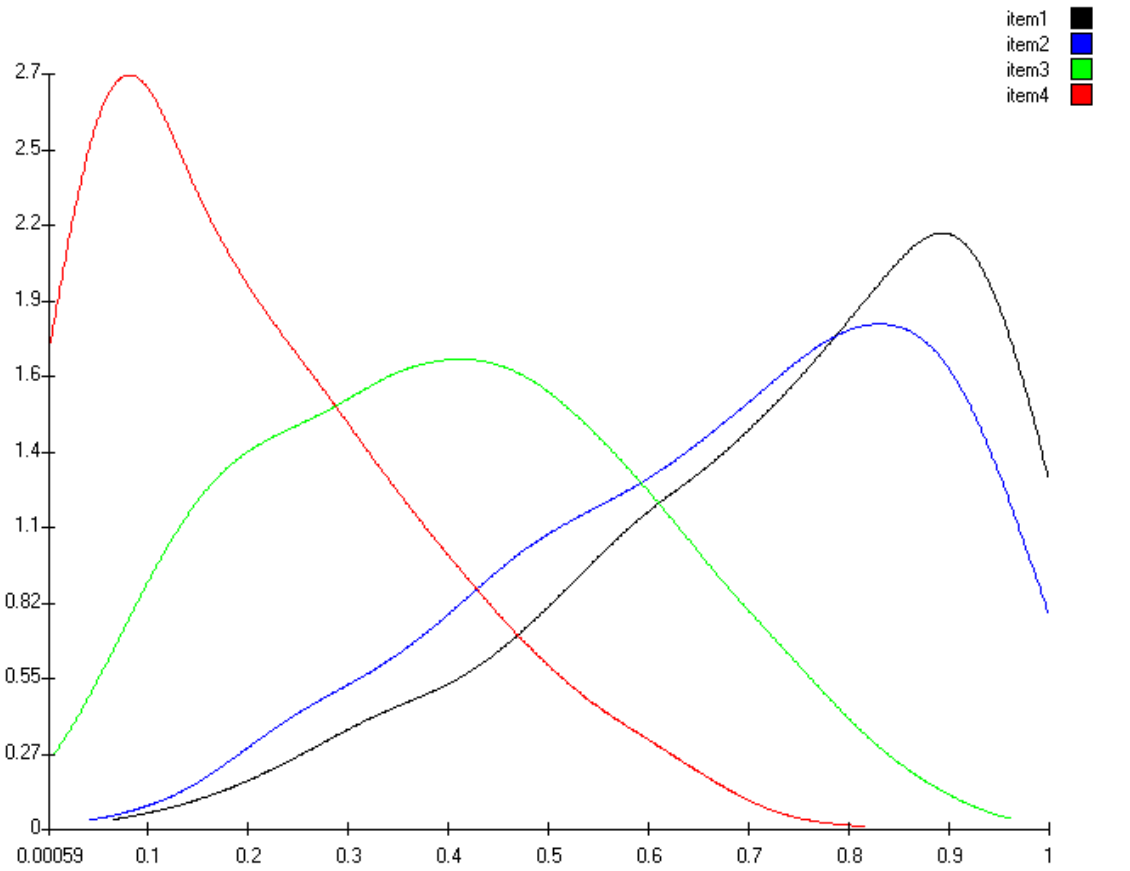


You can find more details about these paths in *General options* section.

Then you can run the applications in order to:

- **Unigraph**: draw utilities' densities
- **Unisens**: compute correlation related issues
- **Excel**: analyze samples values

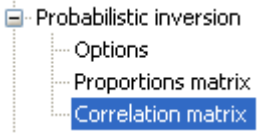
Running these packages you can obtain the following information:



	A	B	C	D	E	F	G	H	I	J
1	item1	item2	item3	item4	I12	I13	I14	I23	I24	I34
15997	0.910699	0.914915	0.885189	0.269083	0	1	1	1	1	1
15998	0.647018	0.569049	0.563985	0.385343	1	1	1	1	1	1
15999	0.703995	0.351249	0.350951	0.320718	1	1	1	1	1	1
16000	0.96634	0.597659	0.299358	0.017499	1	1	1	1	1	1
16001	0.742895	0.835825	0.440799	0.123542	0	1	1	1	1	1
16002	0.742895	0.835825	0.440799	0.123542	0	1	1	1	1	1
16003	0.732925	0.677406	0.407843	0.209305	<- The utitlity (the average values of columns)					

4.8.3. Proportions and correlations matrices

In order to analyze more parameters you might want to check correlation between the items and proportions computed based on data and based on simulated samples.



Correlation matrix represents the correlation between utilities of the items.

Correlation matrix

	1	2	3	4
1	1	0.2825	0.4731	0.3087
2	0.2825	1	0.5285	0.3466
3	0.4731	0.5285	1	0.6384
4	0.3087	0.3466	0.6384	1

Please note that the intensity of the color corresponds to the correlation value. The bigger correlation the more intense color is.
It is assigned a green color for a positive correlation and a yellow for negative correlated items. This feature becomes a really helpful if you have to analyze a big correlation matrix:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	0.5398	-0.1270	0.1258	-0.3964	-0.5025	-0.2450	-0.2190	-0.0005	-0.0466	0.3334	0.2925	0.1323	-0.6662	-0.4356
2	0.5398	1	-0.1699	0.2409	-0.5881	-0.3890	0.1532	0.2735	0.1021	0.1327	0.5441	0.5444	0.2537	-0.7482	-0.4394
3	-0.1270	-0.1699	1	0.0948	0.0545	-0.1375	0.0453	-0.4045	0.5803	-0.6037	-0.1395	-0.6560	0.0752	-0.0194	-0.5428
4	0.1258	0.2409	0.0948	1	-0.4099	0.3802	0.3432	0.0660	-0.4099	0.4953	0.6217	0.2144	0.0518	-0.4410	0.0790
5	-0.3964	-0.5881	0.0545	-0.4099	1	0.1483	0.0330	-0.0138	-0.0584	-0.3072	-0.3491	-0.1710	-0.2467	0.5891	0.2660
6	-0.5025	-0.3890	-0.1375	0.3802	0.1483	1	-0.0589	-0.1532	-0.3120	0.4158	-0.0986	-0.1236	-0.2773	0.4138	0.4489
7	-0.2450	0.1532	0.0453	0.3432	0.0330	-0.0589	1	0.2454	-0.2829	0.2163	0.3553	0.2025	-0.1096	-0.0307	0.1549
8	-0.2190	0.2735	-0.4045	0.0660	-0.0138	-0.1532	0.2454	1	-0.2246	0.3150	0.4864	0.6263	0.2192	-0.2511	0.2746
9	-0.0005	0.1021	0.5803	-0.4099	-0.0584	-0.3120	-0.2829	-0.2246	1	-0.4428	-0.4209	-0.5774	0.2012	0.1314	-0.5814
10	-0.0466	0.1327	-0.6037	0.4953	-0.3072	0.4158	0.2163	0.3150	-0.4428	1	0.2467	0.3981	0.1825	0.0460	0.6559
11	0.3334	0.5441	-0.1395	0.6217	-0.3491	-0.0986	0.3553	0.4864	-0.4209	0.2467	1	0.6949	0.0830	-0.7616	-0.0894
12	0.2925	0.5444	-0.6560	0.2144	-0.1710	-0.1236	0.2025	0.6263	-0.5774	0.3981	0.6949	1	0.1504	-0.5265	0.2223
13	0.1323	0.2537	0.0752	0.0518	-0.2467	-0.2773	-0.1096	0.2192	0.2012	0.1825	0.0830	0.1504	1	-0.1706	0.0665
14	-0.6662	-0.7482	-0.0194	-0.4410	0.5891	0.4138	-0.0307	-0.2511	0.1314	0.0460	-0.7616	-0.5265	-0.1706	1	0.4624
15	-0.4356	-0.4394	-0.5428	0.0790	0.2660	0.4489	0.1549	0.2746	-0.5814	0.6559	-0.0894	0.2223	0.0665	0.4624	1

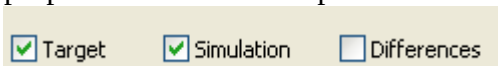
Then you can easily notice biggest correlations in the matrix.

You might be also interested in model fit. You can explore it via comparing probabilities that item i_i is preferred to item i_j. You have these probabilities computed from data obtained from experts (p_{ij}) but also they can be computed based on the resampled utility values.
You can compute these values visually:

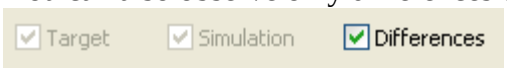
Proportions matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	0.4444 0.2470	0.7222 0.7157	0.3333 0.2007	0.1111 0.1009	0.2778 0.2504	0.9444 0.7912	0.4444 0.4101	0.4444 0.3027	0.5556 0.2750	0.7222 0.5144	0.6667 0.5416	0.0000 0.0000	0.7778 0.5588	0.2222 0.1992
2	0.5556 0.7530	0	0.8889 0.6525	0.8889 0.2415	0.4444 0.4383	0.5556 0.2924	1.0000 1.0000	0.7222 0.6918	0.6667 0.4700	0.7222 0.6638	1.0000 1.0000	0.7778 0.6378	0.1667 0.1673	0.8333 0.7530	0.2778 0.3270
3	0.2778 0.2843	0.1111 0.3475	0	0.0000 0.0000	0.1111 0.0536	0.1111 0.0793	0.2222 0.5775	0.4444 0.4181	0.2778 0.0780	0.5556 0.2493	0.5556 0.6336	0.5556 0.4897	0.1667 0.0275	0.7778 0.6165	0.4444 0.2175
4	0.6667 0.7993	0.1111 0.7585	1.0000 1.0000	0	0.1111 0.5391	0.3333 0.5499	0.8333 0.9933	0.7778 0.8411	0.5556 0.5996	0.7778 0.8686	0.7222 0.9443	0.7778 0.6475	0.2778 0.3463	0.8889 0.9840	0.4444 0.5953
5	0.8889 0.8991	0.5556 0.5617	0.8889 0.9464	0.8889 0.4609	0	0.4444 0.4510	1.0000 1.0000	0.8889 0.9007	0.7778 0.7837	0.8889 0.9733	1.0000 1.0000	0.7778 0.6743	0.3333 0.3506	1.0000 1.0000	0.6667 0.3774
6	0.7222 0.7496	0.4444 0.7076	0.8889 0.9207	0.6667 0.4501	0.5556 0.5490	0	0.8889 0.9672	0.6667 0.8390	0.5556 0.6458	0.8889 0.9681	0.7778 0.9229	0.8889 0.6414	0.6111 0.5635	0.9444 0.9575	0.5556 0.3720
7	0.0556 0.2088	0.0000 0.0000	0.7778 0.4225	0.1667 0.0067	0.0000 0.0000	0.1111 0.0328	0	0.3333 0.1949	0.3889 0.2818	0.1667 0.0961	0.4444 0.4099	0.6667 0.4037	0.1111 0.0276	0.5000 0.5187	0.0556 0.0615
8	0.5556 0.5899	0.2778 0.3082	0.5556 0.5819	0.2222 0.1589	0.1111 0.0993	0.3333 0.1610	0.6667 0.8051	0	0.3889 0.3297	0.3333 0.1985	0.8889 0.8061	0.4444 0.4853	0.0000 0.0000	0.6667 0.6217	0.2222 0.2326
9	0.5556 0.6973	0.3333 0.5300	0.7222 0.9220	0.4444 0.4004	0.2222 0.2163	0.4444 0.3542	0.6111 0.7182	0.6111 0.6703	0	0.5556 0.5937	0.7222 0.7015	0.5556 0.6427	0.3333 0.2921	0.7778 0.7786	0.3333 0.3479
10	0.4444 0.7250	0.2778 0.3362	0.4444 0.7507	0.2222 0.1314	0.1111 0.0267	0.1111 0.0319	0.8333 0.9039	0.6667 0.8015	0.4444 0.4063	0	0.6667 0.8408	0.7778 0.6463	0.0000 0.0000	0.7778 0.7075	0.4444 0.1697
11	0.2778 0.4856	0.0000 0.0000	0.4444 0.3664	0.2778 0.0557	0.0000 0.0000	0.2222 0.0771	0.5556 0.5901	0.1111 0.1939	0.2778 0.2985	0.3333 0.1592	0	0.4444 0.2704	0.0000 0.0000	0.5000 0.6185	0.3333 0.0582
12	0.3333 0.4584	0.2222 0.3622	0.4444 0.5103	0.2222 0.3525	0.2222 0.3257	0.1111 0.3586	0.3333 0.5963	0.5556 0.5147	0.4444 0.3573	0.2222 0.3537	0.5556 0.7296	0	0.3333 0.3279	0.4444 0.5488	0.3333 0.3790
13	1.0000 1.0000	0.8333 0.8327	0.8333 0.9725	0.7222 0.6537	0.6667 0.6494	0.3889 0.4365	0.8889 0.9724	1.0000 1.0000	0.6667 0.7079	1.0000 1.0000	1.0000 1.0000	0.6667 0.6721	0	1.0000 1.0000	0.6667 0.5067
14	0.2222 0.4412	0.1667 0.2470	0.2222 0.3835	0.1111 0.0160	0.0000 0.0000	0.0556 0.0425	0.5000 0.4813	0.3333 0.3783	0.2222 0.2214	0.2222 0.2925	0.5000 0.3815	0.5556 0.4512	0.0000 0.0000	0	0.0556 0.0556
15	0.7778 0.8008	0.7222 0.6730	0.5556 0.7825	0.5556 0.4047	0.3333 0.6226	0.4444 0.6280	0.9444 0.9385	0.7778 0.7674	0.6667 0.6521	0.5556 0.8303	0.6667 0.9418	0.6667 0.6210	0.3333 0.4933	0.9444 0.9444	0

Here again the biggest differences are indicated by the most intense color of the cell.
You can also select if you want to observe only proportions that come from data, proportions that are computed based on simulation values or both of them in a one grid.



You can also observe only differences of the proportions



	1	2	3	4
1	0	0.1974	0.0065	0.1
2	-0.1974	0	0.2364	0.6
3	-0.0065	-0.2364	0	0.0
4	-0.1327	-0.6474	0.0000	0

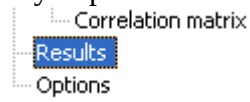
But if you are interested just in a one number the will give you the information about the fit you can check the value of

Sum squared diff.
0.0450

You can say it is an average difference per one cell.

9. Comparing results

If you perform all the calculations you can go the **Results** node



Results

	Item name	Bradley-Terry	Thurstone C	Thurstone B	Prob. inv.
1	1	0.0398	-0.0642	-0.0889	0.4468
2	2	0.1012	0.5105	0.6486	0.6397
3	3	0.0203	-0.4877	-0.6490	0.3252
4	4	0.0668	0.2458	0.2980	0.5754
5	5	0.1806	0.8381	1.1297	0.8413
6	6	0.1239	0.6170	0.9134	0.5477
7	7	0.0151	-0.7010	-0.8533	0.2400
8	8	0.0289	-0.2605	-0.3500	0.5407
9	9	0.0475	0.0394	0.0630	0.4539
10	10	0.0346	-0.1761	-0.2186	0.5519

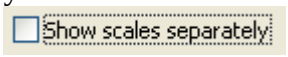
Here you can easily compare scores of four different models. In Thurstone model you can distinguish two different cases:

- **Thurstone C**: judgments are independent, unit standard deviation of stimuli
- **Thurstone B**: constant correlations between stimuli, almost constant standard deviation

This form of scores is difficult to compare so you might want to standardize the scores (scale them to fit in interval from 0 to 1). It can be done with all the models except Bradley-Terry since we cannot scale ratio scores.

✓ In order to standardize scores you have to check

On the scale you can see the scores on the model you selected in the grid. But you might also want to see all the scores from different models in one scale. To obtain this result you have to uncheck



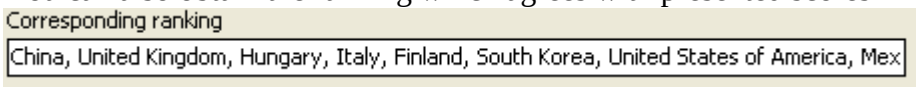
Then all the scale points are present on the scale and they are colored differently:

Different colors correspond to different models:

	Bradley – Terry
	Thurstone C
	Thurstone B
	Probabilistic inversion

If you select standardize feature Bradley-Terry points will not be displayed in the overall scale

You can also obtain the ranking which agrees with presented scores

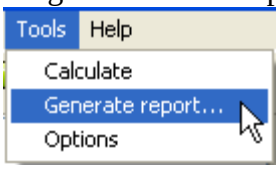


If you need this information you can copy this ranking as well.

10. Reporting

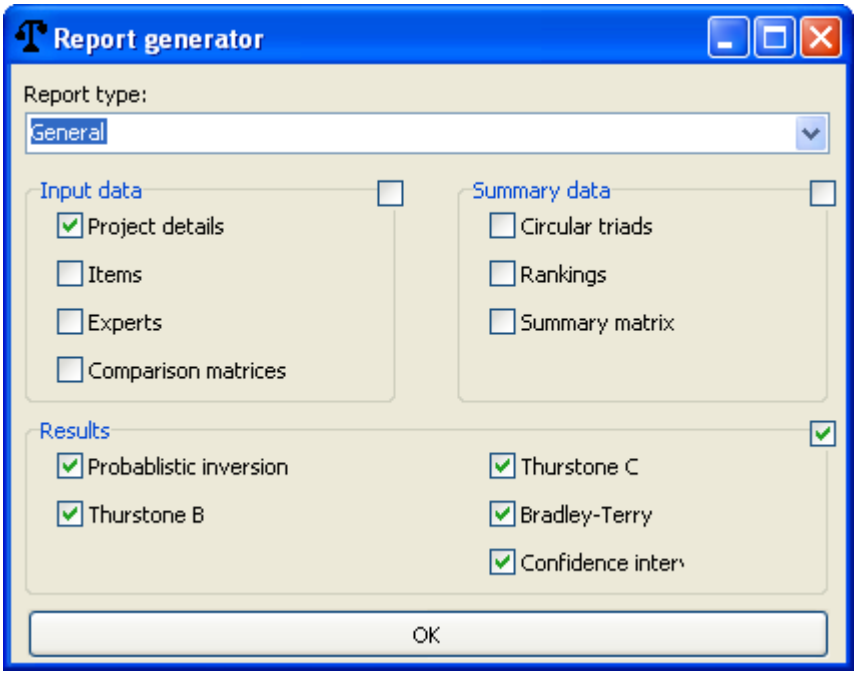
Sometimes people want a text version of results of research etc. The application has also this feature built in.

✓ To generate a text report select



Then you can choose one of two predefined report types:

- General: only basic information will be printed
- Detailed: a detailed information will be printed



You can also modify what will be printed by hand by checking appropriate options
If you want to select the whole block just

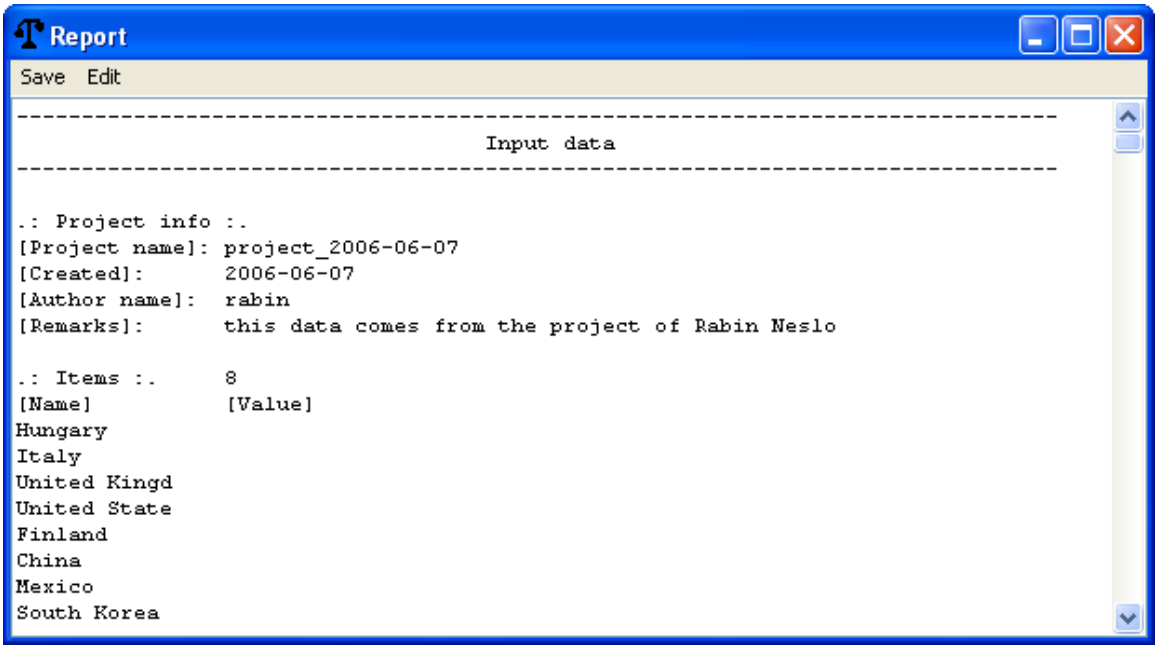
✓ click the checkbox present in the top right corner of the block.

Click here to select or deselect all options in the block

If you select all the options you want to be present in a report

✓ click **OK**.

The report window will appear with the whole text of the report.



Then you can **Save** the text file.
You can also change displaying the report by enabling/disabling *word wrapping* (**Edit -> Word wrap**).