

Tutorial 4: Solution Management

Tutorial 4 TeLitabs and solution management	Learning goals <ol style="list-style-type: none">1. Modifying a dataset2. Performing string operations on teilitabs3. Learn about more Quaestor functions4. Managing solutions	Prior knowledge <ol style="list-style-type: none">1. Interface2. Tutorial 1: Getting Started3. Tutorial 2: Objects and TeLiTabs4. Tutorial 3: Interpolation and Integration	
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1 Objective

In this Tutorial, we will evaluate the values of GM for each ship on the criteria stability and comfort for the crew. These criteria will be used to decide which ship is the most ideal, based on GM. Finally, we will generate one solution in which all the results of the previous tutorials are presented.

Start

For this tutorial, the knowledgebase from tutorial 3 is used. You can either use your own (verified) knowledgebase, or download it here: [\[Tutorial 4 Start\]](#)

2 Changing the dataset

- First, clean up the Workbase from any solution.

Remember that we gave attributes to the object Ships? These were used to make the object a multi case entry to the database, and when the Process Manager was started, the entire contents of the object could be selected as data. For the next steps in this tutorial, we want to use the Ships object, containing all our variations, as dataset in part of a relation. As we already discussed with the Hull object, this is only possible when it can be seen as object from the entry point in the dataset. However, at this moment Ships itself is the entry point.

So to use Ships as a separate dataset we should do the following:

- Add a new object Data to the knowledge base, directly in class Top Goals/Undefined (*Determined by: OBJ*) and add this object to the top of the dataset, by dragging it to the Dataset node. Now you have two objects, Data and Ships in the top level of Dataset.
- Next add @DBENTRY and @DBObject to the object Data and remove these from the Ships object. The object Data has now become your entry point.
- Now add a new Ships object to the Data object by dragging the Ships object from the Knowledge Browser to the Data object in the Dataset. Now you have a Ships object in the Data object and you still have the Ships object on the top level.
- Copy the data in the Ships object on the top level to the Ships object inside the Data object in the same way that you copied the contents of the Waterline object Hull object in the previous tutorial (see [here](#)). You will be asked whether or not to create new parameters, select Yes to All and click OK.
- And finally delete the Ships object on the top level. Select this Ships object in the tree and press DEL.

Now you are all set to continue with the next steps of the tutorial.

3 Stability overview in one TeLiTab

It would be nice to have a clear overview of the stability of all your ships. Therefore, we'll create a TeLiTab containing the contents of Ships completed with GM_rounded, a rounded value of GM, and a ship number.

- Add the following relation to the class Geometry:

```
GM_rounded = ROUND(GM, 1)
```

which is GM rounded to 1 decimal place in meters, also see the function ROUND(). Note that Quaestor automatically sets the number of decimal places for the display of a parameter in the Workbase to 2. Obviously, GM_rounded should be presented with only one decimal place, which can be changed in the **Properties** window.

Next, add the following relation to Geometry ,to set the ship number equal to the case number :

```
Ship_no = ORCA(1)
```

Obviously, it is dimensionless. You may want to examine the [ORCA\(\)](#) function. Let's make the ship number the 'leading' parameter in the presentation of results. In its Properties, change the *Output to* value to *HEADER*. As only one parameter can be leading, set the *Output to* value of *Lpp* back to *OUT*.

- Finally, add the relation for the stability overview to Top Goals/Undefined:

```
Stability# = Ships(@GM, @GM_rounded, @Ship_no)
```

By adding # to a parameter, Quaestor automatically makes it of the [TeLiTab](#) type (i.e. its 'dimension' is TeLiTab). Similarly, a \$ results in a string type (see also [QuaestorSyntax](#)).

i One of the quirks of Quaestor is, that a parameter can also be assigned e.g. a string type in its Properties, and it does not get the \$ appended to its name.

The relation defines that *GM*, *GM_rounded* and *Ship_no* should be added as goals in the *Ships* object for each case (*B* and *Lpp* combination). *Stability#* will contain the data from the original selected object *Ships*, augmented with the three columns and all data needed to calculate these results.

- Make sure *Stability#* is determined by *System/function*.

When solving for *Stability#*, it needs the object *Ships*. If you select the object *Data* in the Dataset, the object *Ships* is available, because it is an object within *Data*.

Select *Dataset/Data* in the [Workbase](#), and start the Process Manager. Just select *Data*, and run a solution for *Stability#* (Click on *Next* until the text on the button changes again to *Data input*). You might want to inspect your solution by opening the [TeLiTab](#) (double click on the value (Text /Telitab) of *Stability#* or press *F2*).

Parameter	Value	Dimension
Cb	0.55	-
KB	4.20	m
KG	4.80	m
QKnowledgebaseVersion	1.0	Str
Rho	1025.00	kg/m ³
Ships	Object	Obj
Stability#	Text/Telitab	Telitab
T	6.00	m
Watertype\$	SW (Salt Water)	Str

- Hereafter, delete this solution.

i If Quaestor presents some parameters with an empty cell and waits to continue, these parameters may not be determined by *System /Function* or *System/Equation*. If you just press enter without changing something, the parameter will still be calculated though. If you'd like a fully-automatic solution, you'll have to change the determined by value in the Properties window of the pertaining parameter.

4 Creating a section between TeLiTabs

It is desirable to assign a stability and comfort rating to each of your ships. This rating, based on the rounded value of *GM*, is available in [TeLiTab](#) format:

```

3 "GM_rounded" "Stab" "Comf"
"1" 0.0 1 1
"2" 0.1 1 2
"3" 0.2 1 4
"4" 0.3 2 6
"5" 0.4 5 8
"6" 0.5 6 9
"7" 0.6 7 8
"8" 0.7 8 6
"9" 0.8 9 4
"10" 0.9 9 2
"11" 1.0 9 1

```

Your stability overview also contains values for GM_rounded, so these two TeLiTabs should somehow be combined.

- Add the following relation to Top Goals/Undefined:

```
Stability_check# = SECTION#(Stability#, "", TEXTITEM$(1), "", 1)
```

You may want to evaluate the syntax of this function, the description can be found [here](#).

Note that our rating **TeLiTab** should be included in the *Expression Data* field of the relation editor, as described in tutorial 3. Make sure the syntax is valid, the field should contain:

```

TEXTITEM1=| 0
3 "GM_rounded" "Stab" "Comf"
"1" 0.0 1 1
"2" 0.1 1 2
"3" 0.2 1 4
"4" 0.3 2 6
"5" 0.4 5 8
"6" 0.5 6 9
"7" 0.6 7 8
"8" 0.7 8 6
"9" 0.8 9 4
"10" 0.9 9 2
"11" 1.0 9 1 |

```

If you run a calculation now with Stability_check# as top goal (and select Data as dataset), you will obtain a solution in which Stability_check#, using object Ships, augmented with GM, GM_rounded, Ship_no, Stab, Comf, KB, KG, BM and Moment_of_Inertia.

- Run a solution for Stability_check# using Data in the dataset. Inspect the [TeLiTab](#).

i While you can normally see the TeLiTab result in the Workbase when double clicking a value of a TeLiTab parameter, for Stability_check# it does not open in the Workbase but opens as text. The reason is, that it contains parameters not yet defined in the knowledge base (Comf and Stab). When you would add these to the knowledge base, this changes.

- Delete the solution when done.

5 Display only the relevant parameters

The result of the above calculations contains a large amount of data that will not be necessary in further calculations. To clean up the solution, by removing the parameters we do not want to be displayed, we will use the function **UNFOLD#()**. This function can be used to change the hierarchy of a **TeLiTab** and to include or exclude parameters from a **TeLiTab**. We will adjust the relation that we used to calculate Stability_check#, to exclude parameters.

- Edit the relation for Stability_check# to become:

```
Stability_check# = UNFOLD#( SECTION#( Stability#, "", TEXTITEM$(1), "", 1 ), "", 1, "Ship_no", "B", "Lpp", "T", "DISP", "Stab", "Comf", "GM" )
```

The meaning of this function can be found out by inspecting the documentation on [UNFOLD#\(\)](#). This function can be used to change the hierarchy of a [TeLiTab](#) and to include or exclude parameters. The mode of the function is 1 here, which means that only the parameters at the end of the syntax (`$Ship_no` to `Comf`) are present in the [TeLiTab](#) `Stability_check#`.

6 Selecting the best and the worst ship

From the [TeLiTab](#) `Stability_check#` we can now select the ship that scores best on both "Stab" and "Comf" (Stability and comfort). To do so, we will use the function [MATCHCASE\(\)](#).

- Add the following relations to the class `Stability`:

```
Best_ship_no = MATCHCASE( Stability_check#, 2, "Stab", "Comf", 10, 10, 1)  
Worst_ship_no = MATCHCASE( Stability_check#, 2, "Stab", "Comf", 1, 1, 1)
```

These new parameters are both dimensionless and *System/Equation*.

These functions return the case numbers of the ships that score either highest or lowest on stability and comfort. The function [MATCHCASE\(\)](#) returns integer values, so the number of decimal places should be zero for these new parameters.

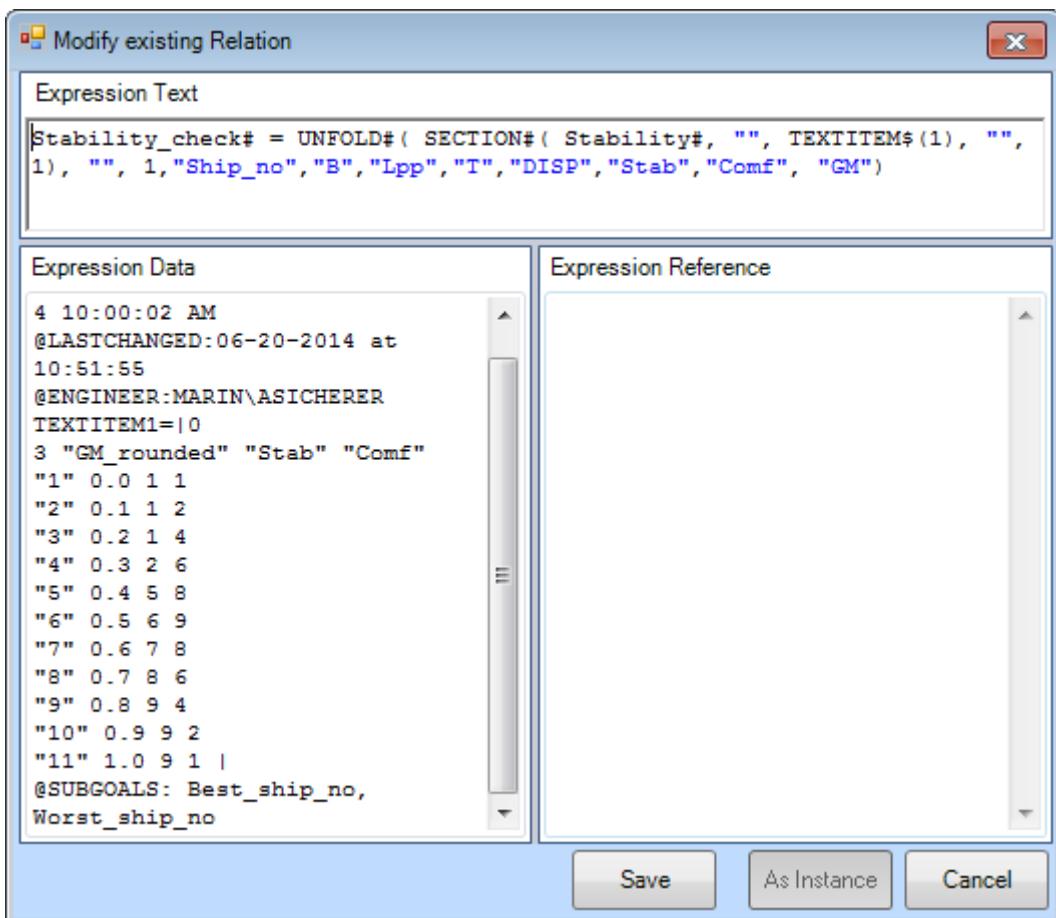
7 One solution for all results

While working with a knowledgebase, it is convenient to have a small number of solutions that contain data in an organized way, rather than have a lot of solutions that contain separate results of calculations. In this paragraph, we will create one solution that contains the [TeLiTab](#) `Stability#` as well as the best and worst ship numbers.

To add a parameter to a solution that will be calculated after a defined top goal, the attribute [@SUBGOALS](#) can be used. It should be placed in the *Expression Data* field of the expression editor of one of the relations that is used to calculate the top goal. We will address the sub goals in the relation for `Stability_check#`.

- In the *Expression Data* field of the relation `Stability_Check#` in the [Expression Editor](#), add the following attribute:

```
@SUBGOALS: Best_ship_no, Worst_ship_no
```



The parameter `Stability_check#` will now return an overview of all ships with stability and comfort rating. If this parameter is calculated, the best and worst ship number will be added to the solution because of the attribute above.

- Run a solution for `Stability_check#` using the Ships data.

The result should look like this:

Parameter	Value	Dimension
Best_ship_no	17	-
Cb	0.55	-
KB	4.20	m
KG	4.80	m
QKnowledgebaseVersion	1.0	Str
Rho	1025.00	kg/m ³
Ships	Object	Obj
Stability#	Text/Telitab	Telitab
Stability_check#	Text/Telitab	Telitab
T	6.00	m
Watertype\$	SW (Salt Water)	Str
Worst_ship_no	25	-

As mentioned in a previous tutorial, by means of the `@ORDER` attribute in the data slot of a parameter, you can organise the order in which the end result is presented.

8 Check

You can verify your results by comparing it to [\[Tutorial 4 Finished\]](#)

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