


# Tutorial 4: Solution Management

<b>Tutorial 4</b> Telitabs and solution management	<b>Learning goals</b> <ol style="list-style-type: none"><li>1. Modifying a dataset</li><li>2. Performing string operations on telitabs</li><li>3. Learn about more <a href="#">Quaestor</a> functions</li><li>4. Managing solutions</li></ol>	<b>Prior knowledge</b> <ol style="list-style-type: none"><li>1. <a href="#">Interface</a></li><li>2. <a href="#">Tutorial 1: Getting Started</a></li><li>3. <a href="#">Tutorial 2: Objects and TeLiTabs</a></li><li>4. <a href="#">Tutorial 3: Interpolation and Integration</a></li></ol>	
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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](#)).

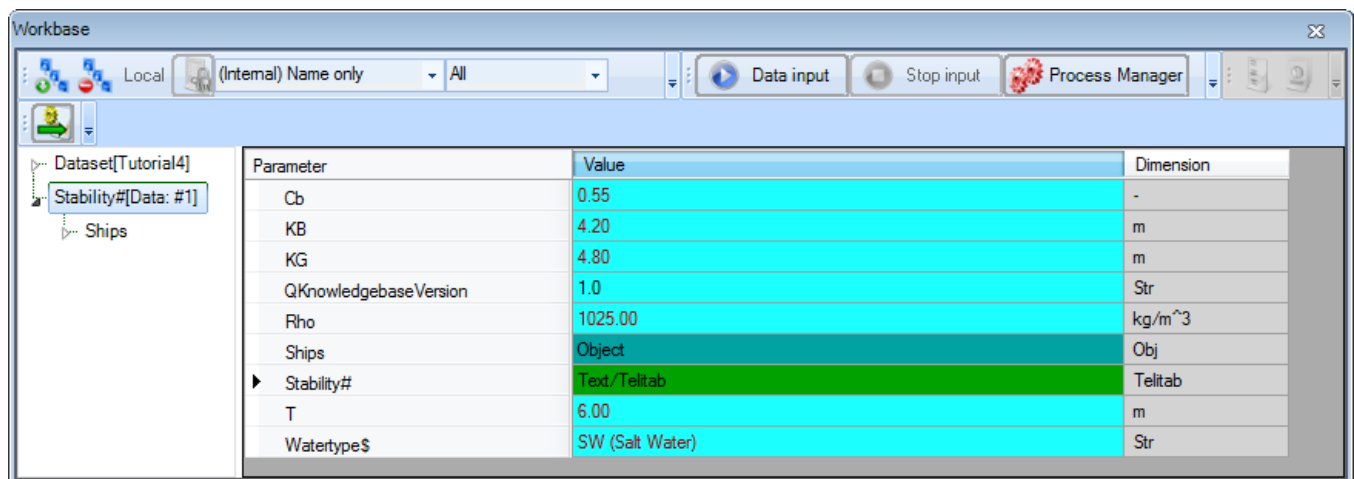
**i** One of the quirks of Quaestor is, that a parameter can also be assigned e.g. a string type in its Properties, and it does not get the \$ appended to its name.

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).



The screenshot shows the 'Workbase' window with a table of parameters. The table has three columns: 'Parameter', 'Value', and 'Dimension'. The 'Stability#' parameter is highlighted in green, indicating it is the current focus. The 'Ships' object is also highlighted in the left sidebar.

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](#).



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](#). Now, only the relevant data is displayed 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
```

**Modify existing Relation**

Expression Text

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

Expression Data

```
4 10:00:02 AM
@LASTCHANGED:06-20-2014 at
10:51:55
@ENGINEER:MARIN\ASICHERER
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 |
@SUBGOALS: Best_ship_no,
Worst_ship_no
```

Expression Reference

Save As Instance Cancel

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:

Workbase

Local (Internal) Name only All Data input Stop input Process Manager

Dataset[Tutorial4]

Stability\_check#[Data: #1]

Ships

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 <sup>3</sup>
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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