Parameterized Tests

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Overview

Test parameterization is a powerful practice that allows the same test to be executed multiple times with different parameters. Parameters are similar to input values (variables) that can change with each execution.

Without the ability to define parameterized tests, all values must be hard-coded into the specification, which makes the test static and difficult to modify. Static tests lead to a lot of redundancy since you need to define and clone the same test for the different combinations of values needed to cover different scenarios or variations of the same test.

By extracting the variability of the test specification into a table of test inputs and verifiable outputs, we are effectively doing **data-driven testing**. Ideally, these tests are automated. However, this might not be always possible or viable and manual tests can take advantage of this methodology as well.

Parameterized tests

Let's start with an example:

Suppose we need to validate the login on a website with a set of valid and invalid user names and passwords:

Username	Password	Valid	
admin	123123	valid	
john.doe	######	invalid	
jane.doe	jane123	valid	

The following test cases need to be executed:

#	Action	Data	Expected Result
1	Open the website		The main page is displayed and the user is able to enter login credentials
2	Enter the following login and password and press the Login button	Login: admin Password: 123123	The login is valid.

#	Action	Data	Expected Result
1	Open the website		The main page is displayed and the user is able to enter login credentials
2	Enter the following login and password and press the Login button	Login: john.doe Password: ######	The login is invalid.

#	Action	Data	Expected Result
1	Open the website		The main page is displayed and the user is able to enter login credentials
2	Enter the following login and password and press the Login button	Login: jane.doe Password: jane123	The login is valid.

Instead of creating separate tests, test designers can instead create a single test with the following parameters: Username, Password, and Valid.

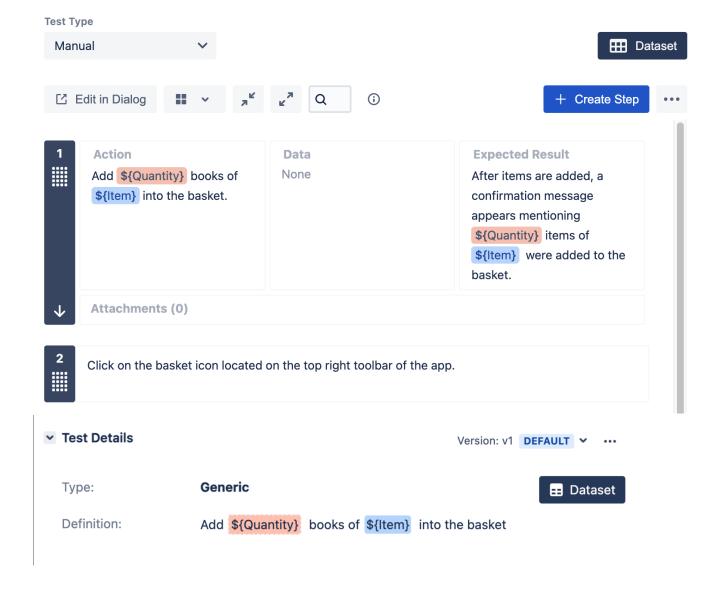
#	Action	Data	Expected Result
1	Open the website		The main page is displayed and the user is able to enter login credentials
2	Enter the following login and password and press the Login button	Login: \${Username} Password: \${Password}	The login is \${Valid}.

Parameterized tests in Xray are defined just like any other test with the addition of some parameter names within the specification.

Parameters are embedded within the test specifications using the following notation: **\${PARAMETER_NAME}** for Steps definitions and Unstructured tests, and **<PARAMETER_NAME>** for Gherkin.

This notation is used to reference parameters within the **test definition**. You can reference parameters in any **text-based** test step **custom field**, **Unstructured** definition, or **Gherkin** Scenarios.

Parameters are defined within datasets. However, it is possible to reference a parameter that is not yet defined (meaning it does not have a corresponding name within the dataset). In this case, the parameter will be highlighted in red.



Datasets

The parameters, along with their values, are defined within a **dataset**. A dataset is a collection of data represented with a tabular view where every column of the table represents a particular variable (or **parameter**), and each row corresponds to a given record (or **iteration**) of the dataset.

The number of rows in the dataset determines the number of iterations to execute. If the dataset contains a single row, there will be a single execution parameterized with the values defined on the dataset row.

Datasets can be defined in different entities and scopes. A dataset can be defined, edited, or simply viewed using the "Dataset" button located in each Xray entity or scope.

Parameter types

Parameters can have the following types:

- Text where the parameter value will be set using an open text field.
- List where the parameter value can be selected from a predefined list of options.

List parameters can be created using either ad hoc or predefined lists.

Ad hoc lists are defined locally for each parameter, while predefined lists are created by administrators at different levels:

- Global managed by Jira administrators
- Project managed by project administrators

Global lists can not be used directly. These must be included in the project by the project administrator before they can be accessed within a dataset of that project.

Having predefined lists is useful if the list parameters are commonly used in multiple datasets. If multiple projects make use of the same list, you can also create a global list so that it can be used by different projects. This way you have a central place to manage common parameter lists.

Examples of predefined lists might be:

- · Profiles,
- Users,
- · Roles,
- · Colors,
- Credit card types,
- Addresses,
- ..

When creating a new list parameter using a predefined list, you can choose a list that is available within the current project. The current project is determined by the parent issue where the dataset is defined.

Combinatorial parameters

Combinatorial parameters are special parameters that will be combined with the remaining parameters (combinatorial or seeding parameters) to generate all possible combinations automatically. This prevents users from typing all the combinations when creating a dataset.

Seeding parameters are those parameters that describe fixed test cases. The seeding parameters will not be combined among each other, only with combinatorial parameters.

Let's consider the following example:

We created a test to check if we can add books to a shopping cart in our online book store. We have parameters like *Item, Price, Rating, In Stock, Conditior*, and *Format.* There are certain books we want to test (3 in this case). However, we would like to test all combinations of these books with the following parameters: *Gift* and *Quantity*.

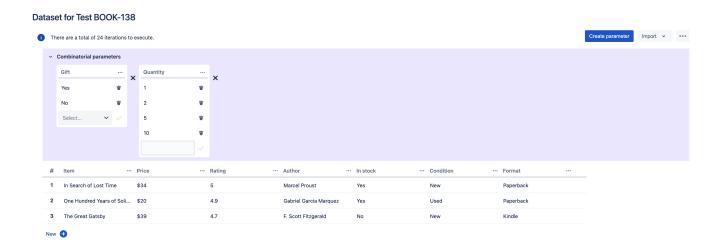
In this case, these will be the seeding parameters:

- Item,
- Price,
- Rating,
- In Stock,
- Condition,Format

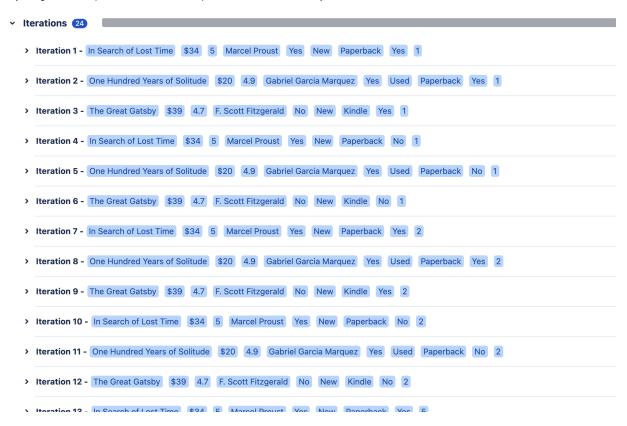
Because we want to test these items with all the combinations of Gift and Quantity parameters, we can create these as Combinatorial parameters:

- Gift*
- Quantity*

Combinatorial parameters are denoted with an asterisc (*) suffix.



Xray will generate all possible combinations upon execution automatically.



Dataset scopes

A dataset can be defined in the following entities/scopes:

- 1. Test (default dataset)
- 2. Test Plan Test
- 3. Test Execution Test (Test Run)

The closest dataset to the test run will be one used to generate the iterations, effectively overriding any dataset defined in higher levels:

Test Execution - Test (Test Run) > Test Plan - Test > Test (default)

The test dataset is the default. If there is the need to override or change this dataset you can do this at the planning or execution phases.

Dataset limits

- Maximum number of #iterations per dataset: 1000
- Maximum Number of #parameters per dataset: 20
- A dataset can not contain duplicate rows.

Parameterized preconditions

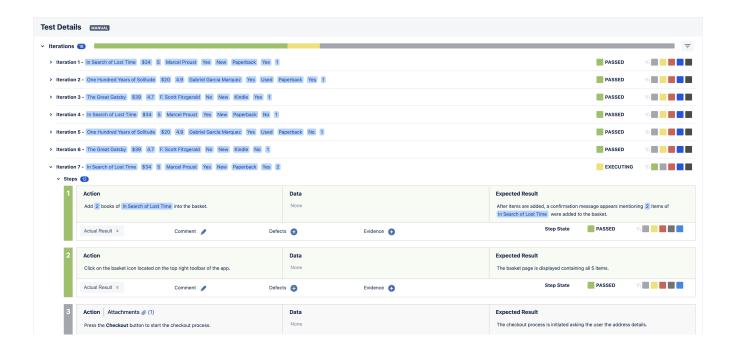
Precondition issues can also be parameterized by including parameter names in the precondition specification.

The parameters will be unfolded on the execution screen, just like Test cases. For this, the dataset must have the same parameters, matched by name.

Precondition Details Manual Steps We must verify if item \${Item} is in stock.

Execution

All iterations for a given test are executed within the context of the same test run. Each iteration can be expanded and the steps executed individually. The step parameters will be replaced by the corresponding iteration values. The steps affect the iteration status that, in turn, affects the overall test run status.



Please check the Execution page for more details.

Parameterized tests vs test environments

Although test environments can be thought of as a particular case of parameterized tests (given that environments can be considered parameters of test cases), datasets might not be the best choice for environmental variables that are not embedded in the test specification (e.g. manual test steps).

As such, it is not good practice to use datasets with environment variables such as Browsers, OSs, Databases, or Devices. This is because:

- Test engineers often configure a specific setup (or environment) to execute a set of tests. In this case, test engineers might want to execute the tests oriented to the environment and not the test case. This means they execute all the test cases first for one environment, and then for another one, and so on. This way, having all these environments within the same test run is not ideal as users would have to jump from one test run to the other without finishing the execution.
- Usually, test environments are independent variables or dimensions. For instance, let's consider the following test environment: *Browser, Databas* e, and *OS*. If a test case fails only in a specific browser, once the bug is fixed, we might not want to re-execute the same test for all databases and *OS*'s as we are confident that the change did not affect these variables. With datasets, if one iteration fails, you need to re-execute all the iterations again (if you use a different test run, of course).
- Xray does not provide reports based on parameters.

In conclusion, if your parameters are environment variables that do not need to be included in the test specification, don't use datasets. Use test environments instead.



Test environments improvements

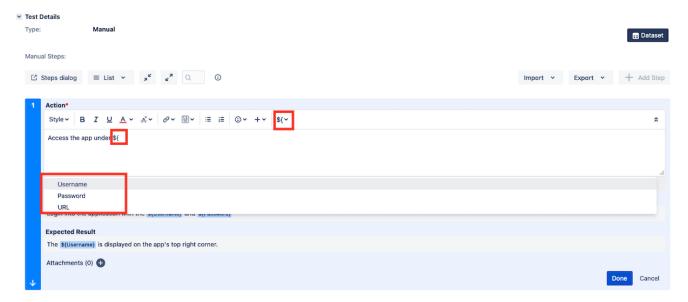
We have plans to improve how test environments are managed in Xray. It will be possible to specify or generate combinations of environments for different variables.

Please check our roadmap.

Defining a parameterized test

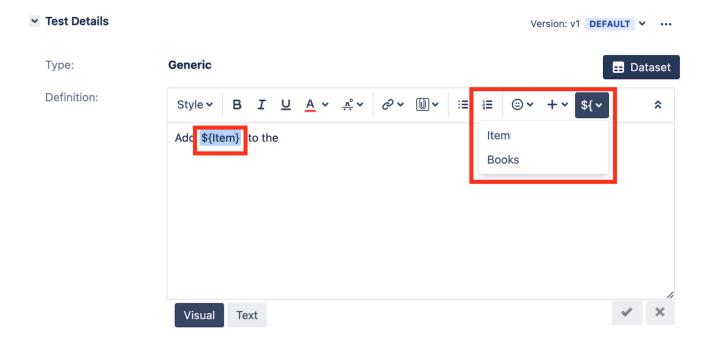
Manual Steps

- 1. Create or edit a given step using either the inline view within the test issue or the steps dialog.
- 2. When specifying a step, to reference a parameter you have two options:
 - a. Start typing \${. If there is a default dataset defined on the test, you should see a list of the available parameters. Choose the desired parameter using the cursor keys or mouse. The parameter will be placed with the text.
 - b. Use the toolbar button \${. After pressing this button, and if there is a default dataset defined on the test, you should see a list of the available parameters. Choose the desired parameter using the cursor keys or mouse. The parameter will be placed on the cursor position.



Generic or Unstructured definition

- 1. Edit the definition using the inline view within the test issue.
- 2. To reference a parameter, you have two options:
 - a. Start typing \${. If a default dataset is defined on the test, you should see a list of the available parameters. Choose the desired parameter using the cursor keys or mouse. The parameter will be placed with the text.
 - b. Use the toolbar button \${.} After pressing this button, and if there is a default dataset defined on the test, you should see a list of the available parameters. Choose the desired parameter using the cursor keys or mouse. The parameter will be placed on the cursor position.

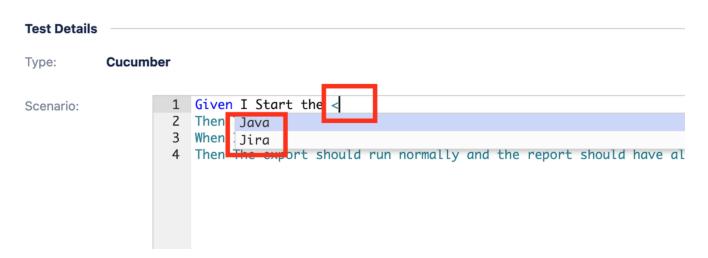


To define parameters on unstructured tests, the Jira markup wiki language must be activated in the Generic Test Definition custom field.

To enable the Rich Text Editor, you have to set the renderer of the definition custom field to Wiki Style Renderer.

Gherkin Scenarios

- 1. Create or edit a given step using either the inline view within the test issue or the steps dialog.
- 2. When specifying a Scenario, to reference a parameter you should start typing <. If there is a default dataset defined on the test, you should see a list of the available parameters. Choose the desired parameter using the cursor keys or mouse. The parameter will be placed with the text.



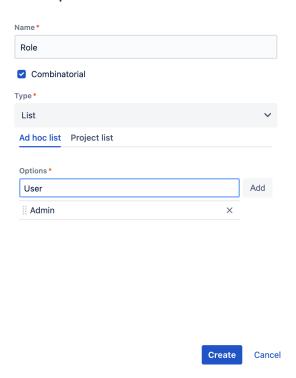
Creating a dataset

In order to create or edit the default dataset (within a test):

- 1. Press the "Dataset" button. This will open the dataset dialog. Here, you can define a dataset by creating parameters and adding values to them.
- 2. Creating parameters:

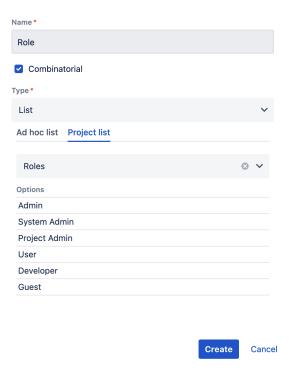
- 2.1. Press the "Create parameter" button located on the dataset main toolbar or on the empty view. This will open a small dialog to specify the parameter attributes.
- 2.2. Specify the name. Parameter names must start with a letter or underscore and can only contain letters, numbers, a space between words, "_", "-" and a max of 64 characters.
- 2.3. Check the **Combinatorial** checkbox if you are creating a combinatorial parameter.
- 2.4. Choose the parameter type: **Text or List**. If the parameter type is a List you can:
 - a. create an ad hoc list just for this parameter. You need to specify the values for the list.

Create parameter



b. use a project **predefined list**.

Create parameter



2.5. Press "Save" to create the parameter. The parameter must be placed on the dataset.

Dataset for Test BOOK-138

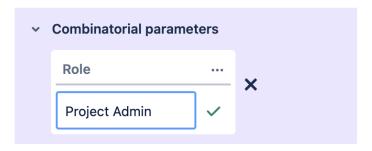


3. Adding combinatorial parameter values:

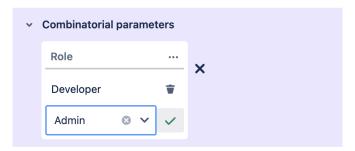
Once you have at least one parameter, you can start filling their values and adding new iterations.

A placeholder is provided within each combinatorial parameter. In order to add new values to combinatorial parameters:

3.1. For text parameters, just type the value and press the check button next to the field.



3.2. For list parameters, select an option and press the check button next to the field.



- 4. Adding rows (filling the parameter values):
 - 4.1. Once you have non-combinatorial parameters, an empty placeholder row will appear so that the parameters can be populated for the default iteration.

Editing parameter values is as simple as editing their corresponding cells. The values will be kept when the cell loses focus.

You can navigate between cells of the same row and also between rows using the keyboard: TAB (forward), SHIFT+TAB (backward).





- 4.2. To create new rows, you can press the "New" button below the table or navigate using the keyboard from the last row (a new row will be created automatically by navigating forward on the last cell of the last row).
 - There are a total of 3 iterations to execute.

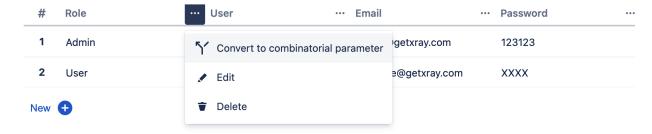




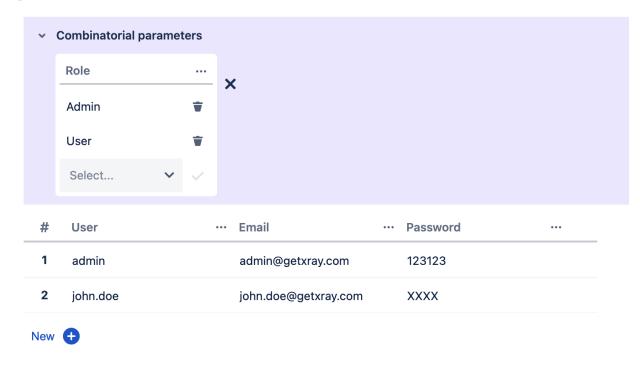
5. Converting a seeding parameter to a combinatorial parameter:

It is possible to convert an existing parameter to a combinatorial parameter. This will remove the parameter column from the seeding parameters table and group all remaining rows automatically. A new combinatorial parameter will be created by grouping all the values.

- 5.1. Next to each column, there is an options button. Clicking this button will reveal a menu with options for *Editing*, *Deleting*, and *Converting* parameters.
- There are a total of 2 iterations to execute.



- 5.2. Click on "Convert to combinatorial parameter."
 - There are a total of 4 iterations to execute.

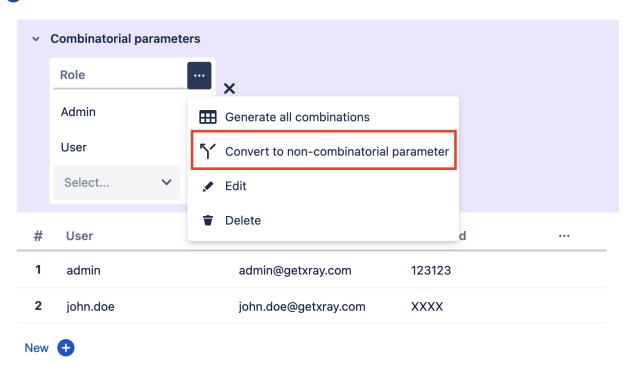


6. Converting a combinatorial parameter to a seeding parameter:

It is also possible to convert a combinatorial parameter back into a seeding parameter.

6.1. Next to each combinatorial column, there is an options button. Clicking this button will reveal a menu with options for *Editing*, *Deleting*, and *Converting* parameters.

There are a total of 4 iterations to execute.



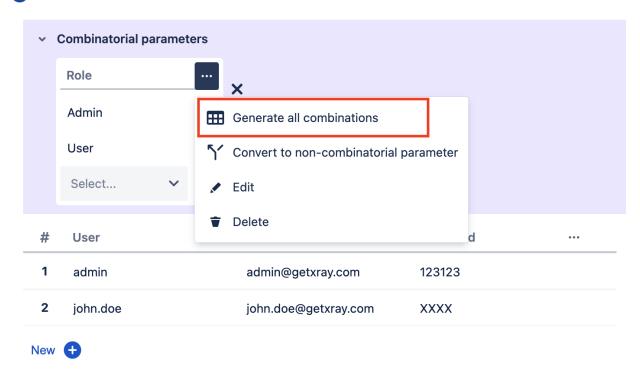
6.2. Click on the "Convert to non-combinatorial parameter".

7. Generating all combinations:

You don't need to generate all the combinations for a given dataset in order to execute all iterations. Xray will do this automatically for all of the combinatorial parameters. However, sometimes we don't need all the combinations. In order to do this, we can generate all combinations and remove some iterations afterward.

7.1. Next to each combinatorial column, there is an **options** button. Clicking this button will reveal a menu with options for *Editing, Deleting, C onverting* parameters, and *Generating all combinations*.

There are a total of 4 iterations to execute.



7.2. Click on the "Generate all combinations." A confirmation dialog will appear. Confirming the changes will apply the cartesian product between the combinational parameter values and the seeding parameter rows.

1 There are a total of 4 iterations to execute.

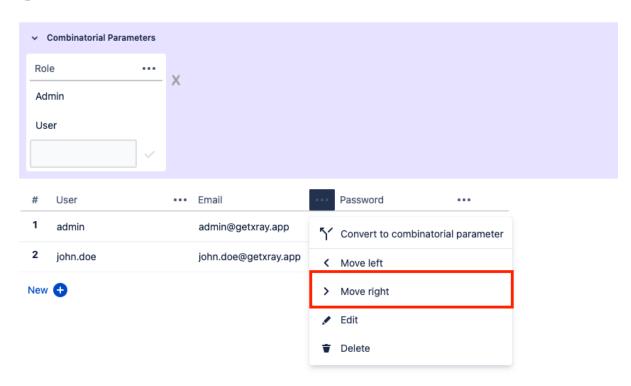


8. Move left/right:

You can re-order any parameters in your dataset, by selecting the "Move left/right" option.

8.1. Open the options menu in either a Combinatorial or non-combinatorial (seeding) parameter, you will have a "Move left/right" option available. Notice that if the parameter is already place on the most outer left (right) position, the "Move left" (right) option is not available.

There are a total of 4 iteration(s) to execute.



- 8.2. Select the move left/right option, This will swap the positions of the parameters.
 - There are a total of 4 iteration(s) to execute.



Importing a dataset from a CSV file

Besides defining a dataset by creating parameters and setting their values directly using the Xray UI, it is also possible to import an existing dataset from a CSV file.

In order to import a CSV file:

- 1. Open the dataset dialog.
- 2. Choose the "Import from CSV" option available on the Import dropdown button (located on the empty state view or on the dataset main button toolbar). A dialog will appear.
- 3. Select and fill the following options:
 - File find a local CSV file with the desired dataset
 - CSV delimiter defaults to "," but you can choose any other character
 - File encoding defaults to UTF-8
 - Overwrite existing parameter values if checked, this option will delete any values from existing parameters
 - Create new parameters If checked, it will create non-existing parameters automatically, based on the CSV column name. Otherwise, it will just append/update the values on the existing parameters.

Import from CSV



4. Press "Import" to import the external dataset.



Combinational parameters

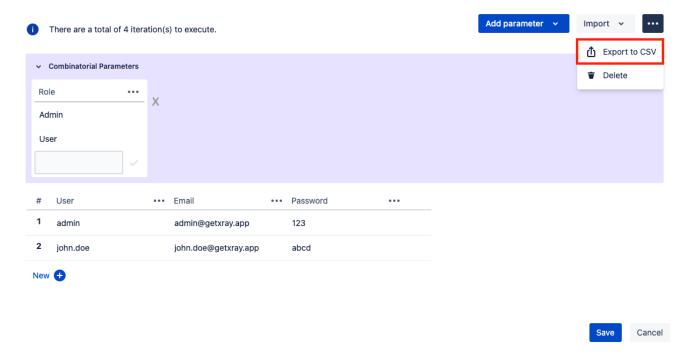
You can also import combinational parameters. Any parameter with an **asterisk suffix** will be considered a combinational parameter. E.g., Quality*. In this case, the "Create new parameters" option must be enabled.

Exporting a dataset to a CSV file

To export a dataset to a CSV file:

- 1. Open the Dataset dialog.
- 2. Click the options button next to the import button. Clicking this button will reveal a menu with options for Export to CSV and Delete.

Dataset for Test "BOOK-3" in Test Exec "BOOK-4"



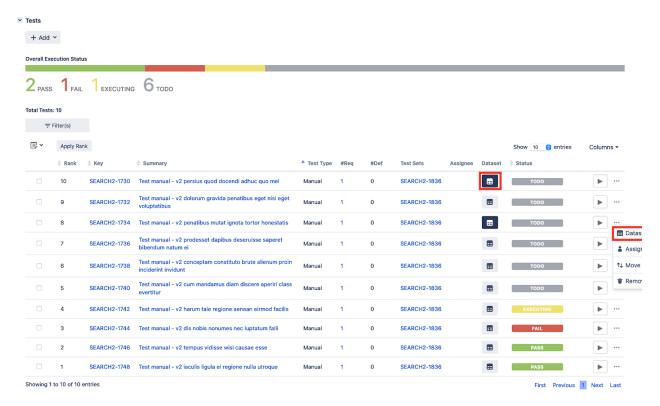
3. Click the Export to CSV. A file should be downloaded.



Overriding a dataset in a test plan or test execution

To define or override a dataset at the test plan or test execution level:

- 1. Navigate to the desired test plan or test execution issue
- 2. A menu action is provided on each test row. A new **column** named "Dataset" is also available by configuring the column layout for the Test Plan or Test Execution datatable. If there is a dataset already defined at this level, the dataset button will be displayed with a *selected* style.
 - 2.1. Open the dataset dialog by pressing the "Dataset" button in the column or
 - 2.2. Open the dataset dialog by selecting the "Dataset" action from the test row options menu.



- 3. The dataset dialog is opened.
 - 3.1. If there is a dataset defined on a parent level, it is possible to Override the parent dataset and modify its values.

Dataset for Test BOOK-138 in Test Execution BOOK-230



Sav

- $3.2. \ \mbox{Otherwise}, \ \mbox{you can start defining a new dataset at this level.}$
- 4. Once the dataset is defined (or overridden) you need to press "Save" to persist the changes to the database.