

# CamilleX Documentation

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None

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*None*

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# 1. CamilleX User Manual

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**CamilleX** new constructs (called `XMachines` and `XContexts`) for `Event-B` modelling. The new constructs are text files which are automatically translated into the corresponding `Rodin`'s `Event-B` constructs (i.e., `Machines` and `Contexts`) accordingly. Facility for translating to and from `Rodin`'s components to `CamilleX` components can be invoked manually. `CamilleX` is inspired by `Camille` text editor for `Rodin` and is based on `XText` technology, hence the name `CamilleX`.

- *Getting Started:*
- *Installation:* Information for installing the *CamilleX* feature.
- *Basic tutorial:* This tutorial provides a step-by-step walk-through working with `CamilleX` constructs.

## 2. Getting Started

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### 2.1 Installation

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[CamilleX](#) is available from the main Rodin update site (under [CamilleX](#) category). There are two versions of the feature, the standard version for users and the SDK version for software developers which include source code.

### 2.2 Configuration

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Windows users must change the workspace text file encoding to *UTF-8*. This can be updated under the [Rodin Preferences](#) [General/Workspace](#) then in the [Text file encoding](#) section, select Other: [UTF-8](#).

### 2.3 IMPORTANT

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Currently, *CamilleX* not only supports *standard* Event-B machines and contexts, but also supports *Machine Inclusion* (for composition), and *Record* extension to the Event-B modelling language.

Since the *XContexts* and *XMachines* are compiled to the Rodin files, the corresponding Rodin contexts and machines will be **OVER-WRITTEN**. Any changes in the Rodin files will not be lost.

**DO NOT USE** the *CamilleX* if you use modelling plug-ins that use the Rodin files as source such as *UML-B* state-machines and class-diagrams, as the additional modelling elements will be over-written.

## 2.4 Basic Tutorial

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### 2.4.1 Task 1. Create an Event-B Project

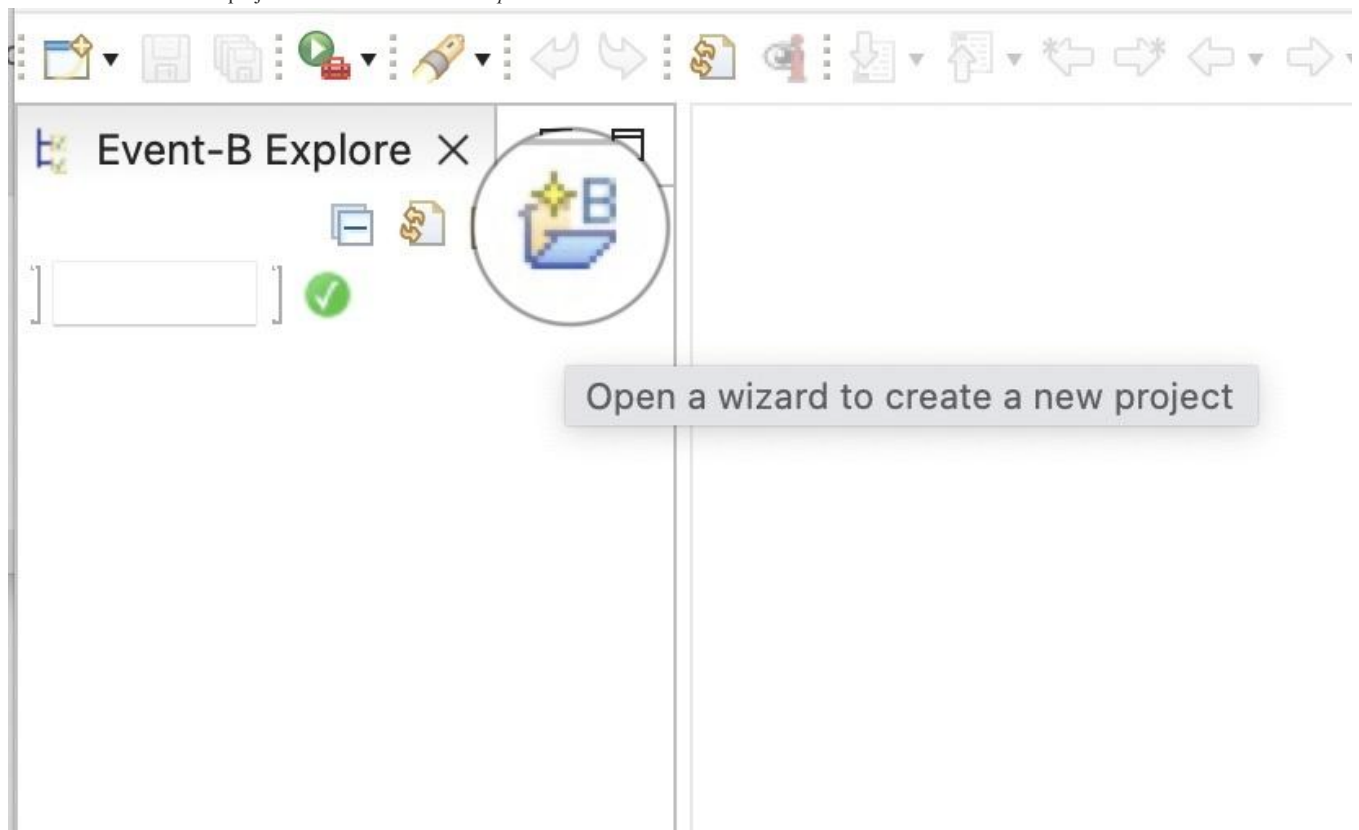
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#### Introduction

The purpose of this task is to create an Event-B project for the CamilleX constructs.

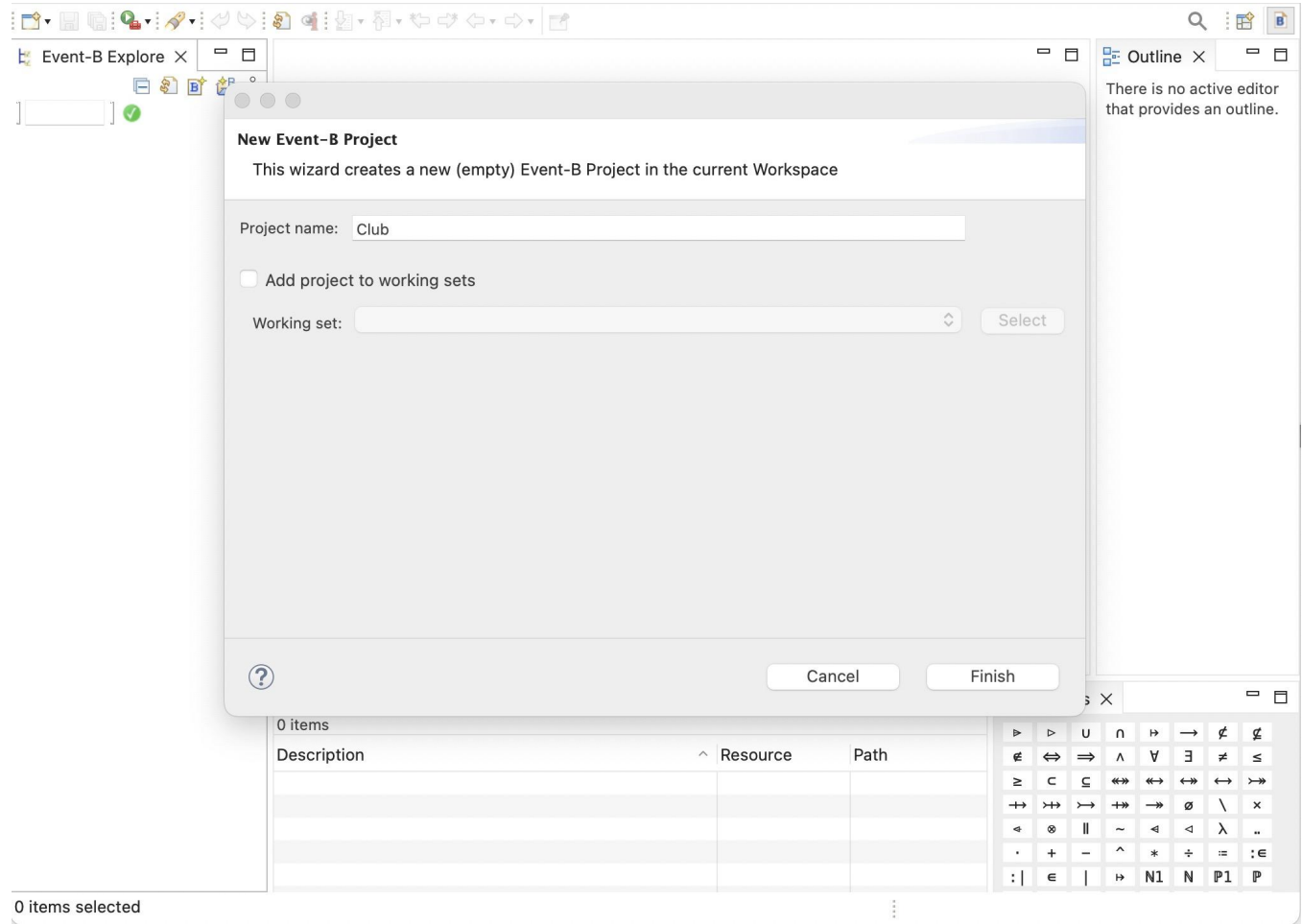
#### Step 1. Create a New Event-B Project Named `Club`

- Click on the new Event-B project button on the *Event-B Explorer*.



(The same wizard can be invoke through the menu `File -> New -> Event-B Project`.)

- From the pop-up dialog, enter Club as the Project name



- Click **Finish** to confirm the creation of the project.

**New Event-B Project**

This wizard creates a new (empty) Event-B Project in the current Workspace

Project name:

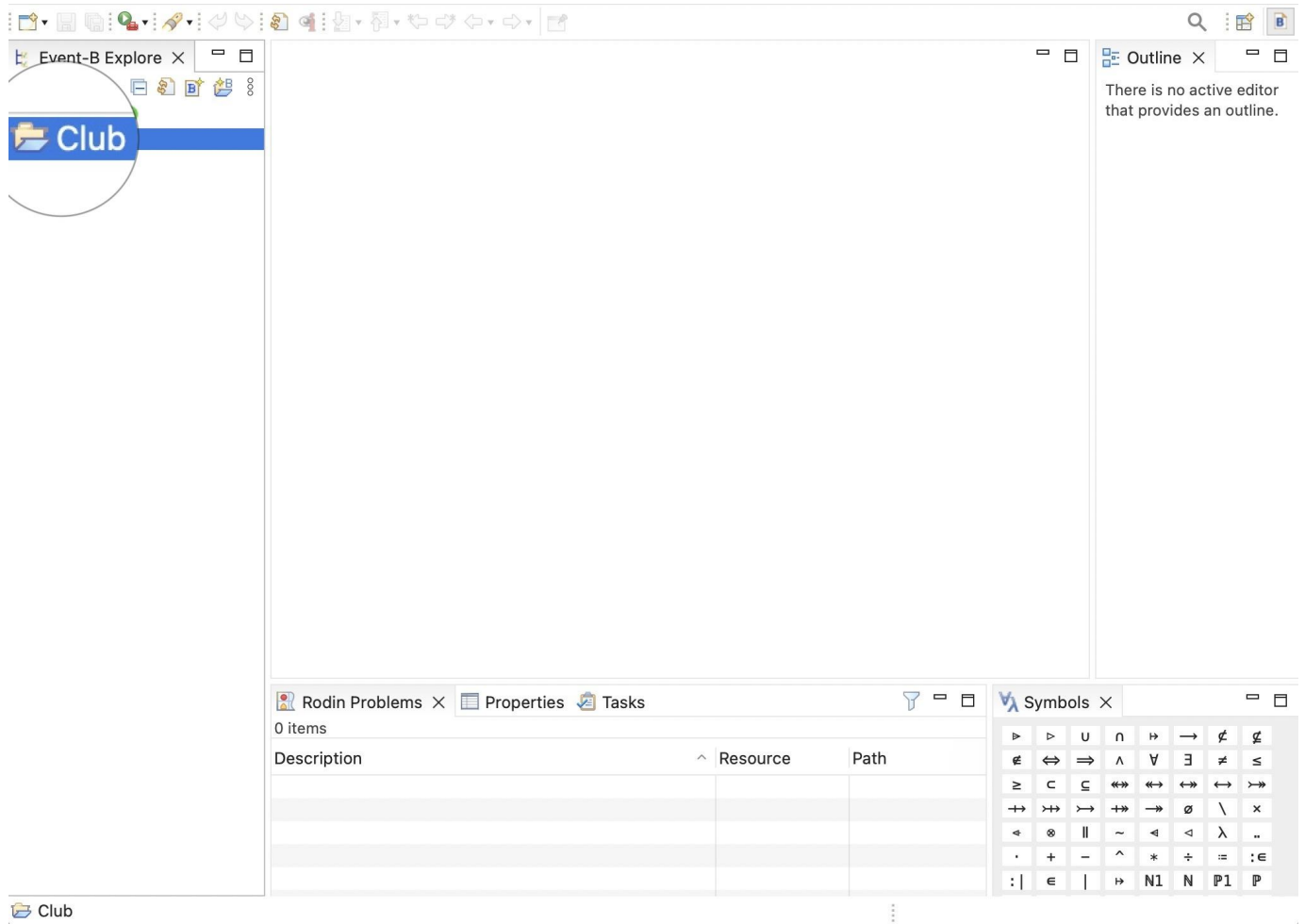
☐ Add project to working sets

Working set:  Select

? Cancel Finish

## Conclusion

By now, the project `Club` should be visible in the *Event-B Explorer*.





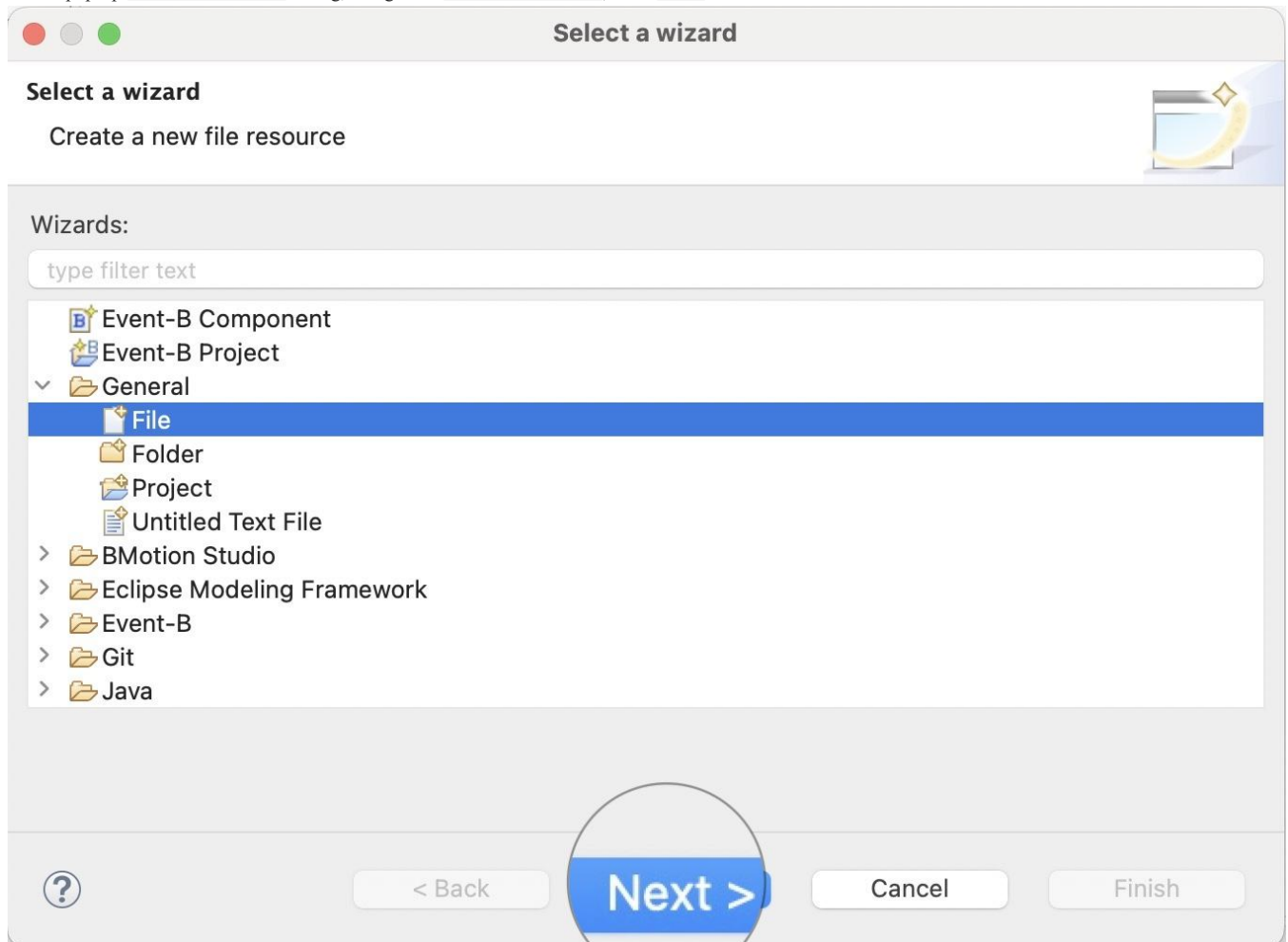
## 2.4.2 Task 2. Create an XContext

### Introduction

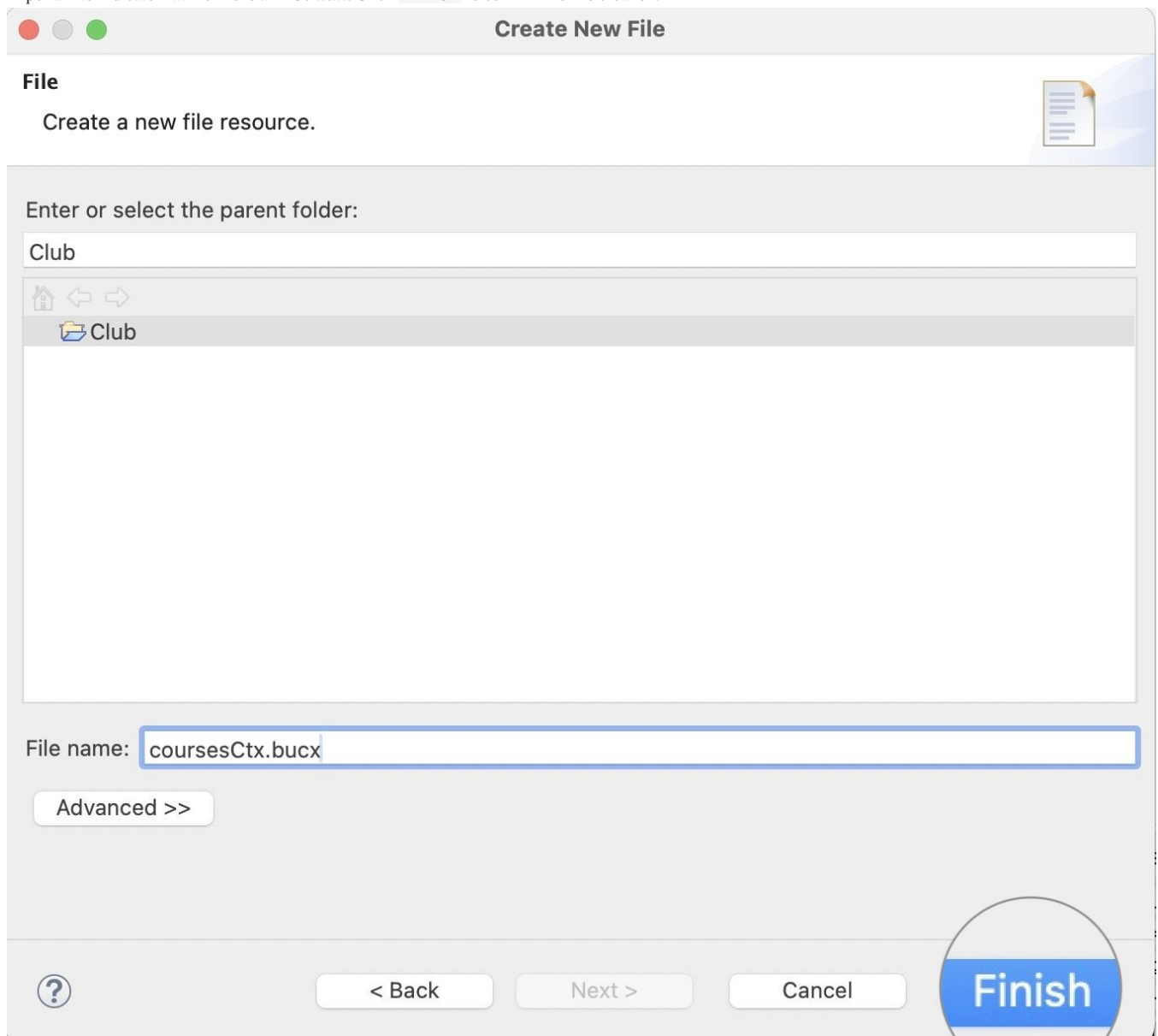
The purpose of this task is to create a simple XContext within the newly created project.

### Step 1. Create a New XContext Named `coursesCtx.bucx`

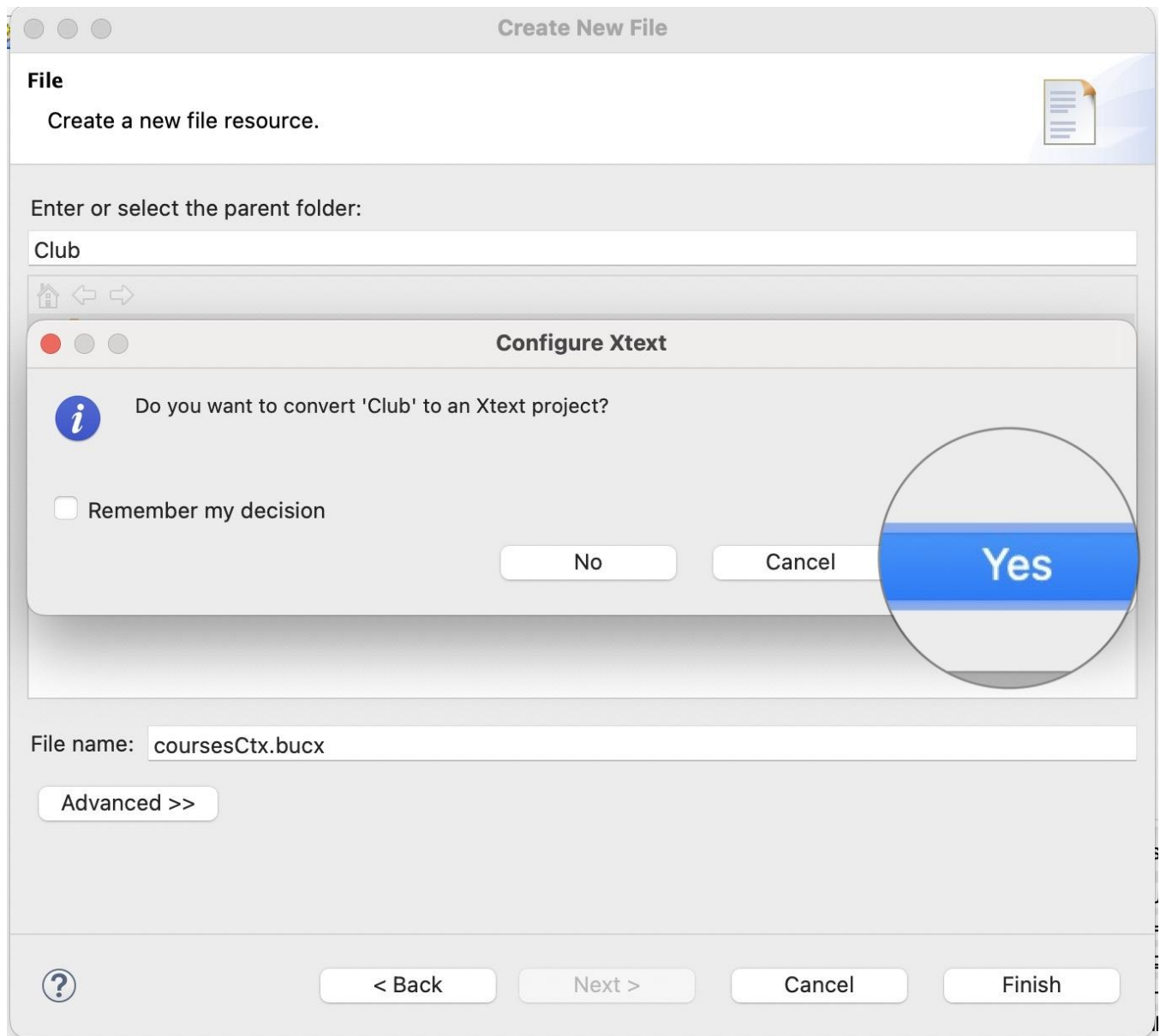
- Use the menu `File -> New -> Other` to open the `Select a wizard` dialog.
- On the pop-up `Select a wizard` dialog, navigate to `General -> File`, click `Next`.



- On the `Create New File` dialog, choose `Club` project as the parent folder, and put `coursesCtx.bucx` as the `File name`. The file extension `.bucx` is important to indicate that the file is an *XContext*. Click `Finish` to confirm the file creation.



- Important:** A pop-up dialog will be displayed asking to convert the `Club` project to an *XText* project, please answer **Yes**. This enables the *XText* builder to work automatically for converting CamilleX constructs to Rodin constructs.



(If you miss this step, you can invoke it via right click on the `Club` project from the *Event-B Explorer* and `Configure -> Convert to XText Project`). The new created file `coursesCtx.bucx` will be opened automatically in an editor. It has some error markers and we will fix this in the next step.

## Step 2. Set the Content of `courseCtx.bucx`

- Using the editor, set the content of `coursesCtx.bucx` as follows.

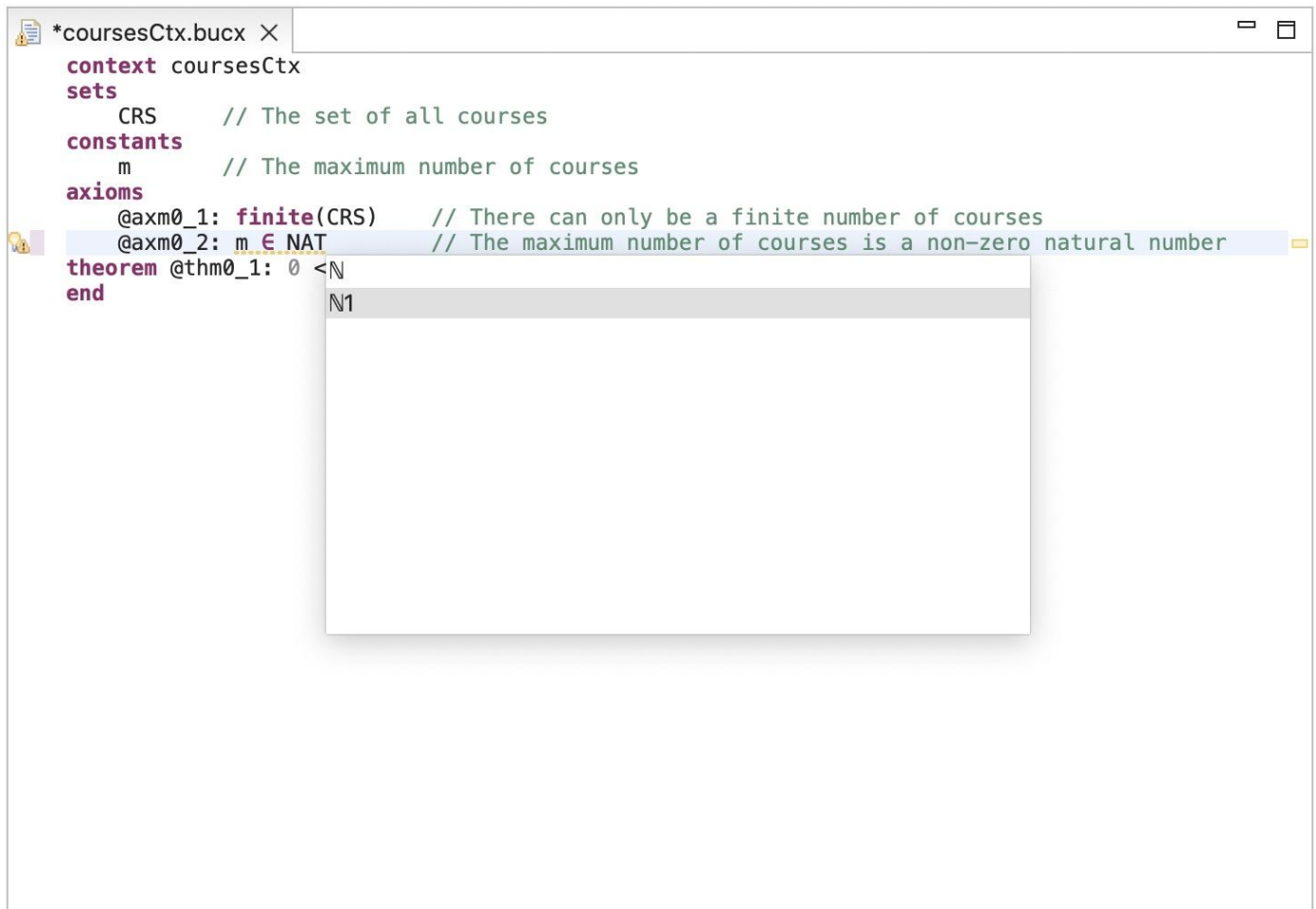
```
context coursesCtx
sets
  CRS    // The set of all courses
constants
  m      // The maximum number of courses
axioms
  @axm0_1: finite(CRS)    // There can only be a finite number of courses
  @axm0_2: m ∈ N1        // The maximum number of courses is a non-zero natural number
theorem @thm0_1: 0 < m    // The maximum number of courses is positive
end
```

```
coursesCtx.bucx ×
context coursesCtx
sets
  CRS // The set of all courses
constants
  m // The maximum number of courses
axioms
  @axm0_1: finite(CRS) // There can only be a finite number of courses
  @axm0_2: m ∈ ℕ1 // The maximum number of courses is a non-zero natural number
theorem @thm0_1: 0 < m // The maximum number of courses is positive
⊖ axiom
  @axm0_3: m ≤ card(CRS)
end
```

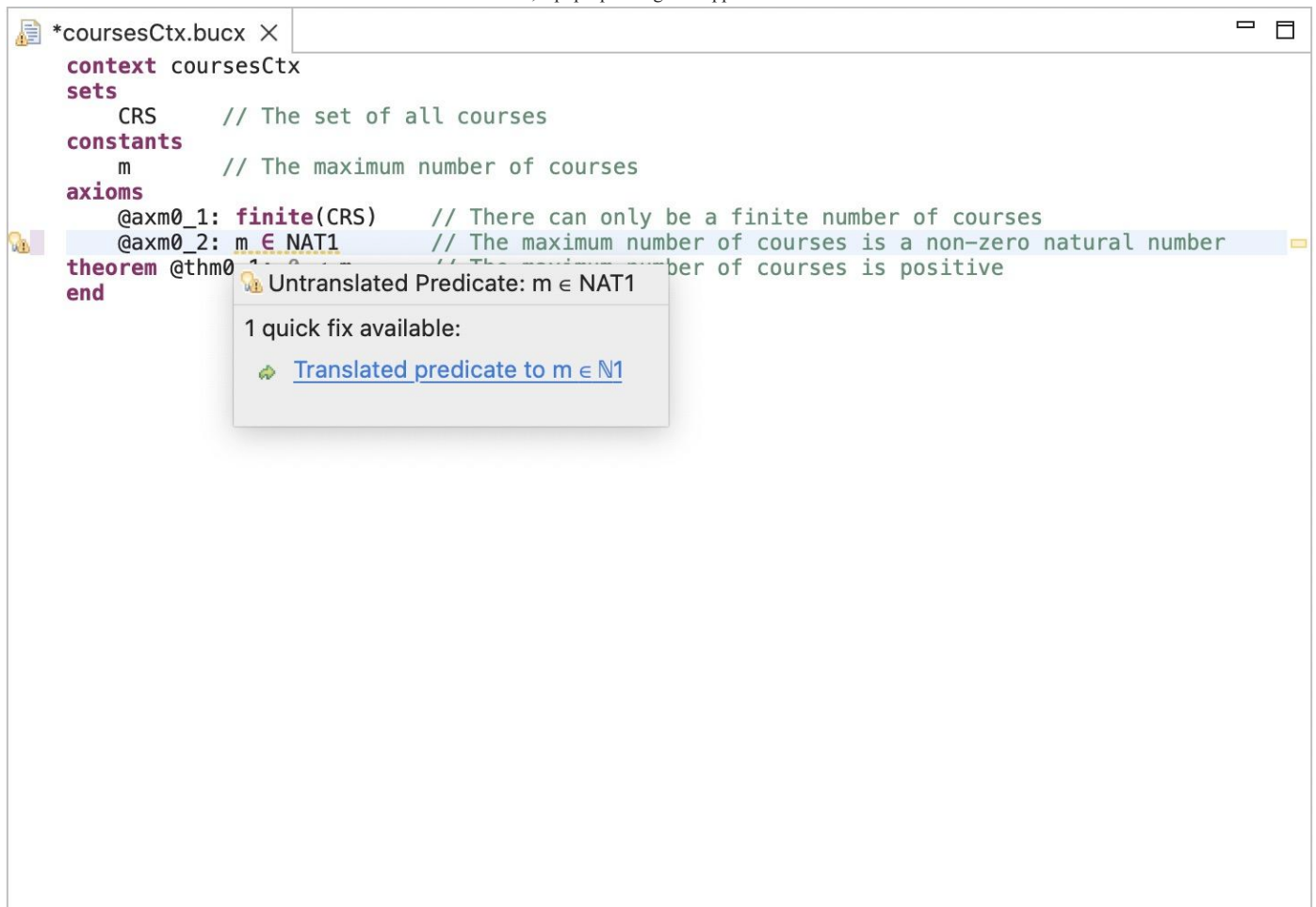
**TYPESETTING MATHEMATICAL SYMBOLS**

In order to typeset Event-B mathematical symbols, e.g.,  $\mathbb{N}_1$ , there are three different approaches.

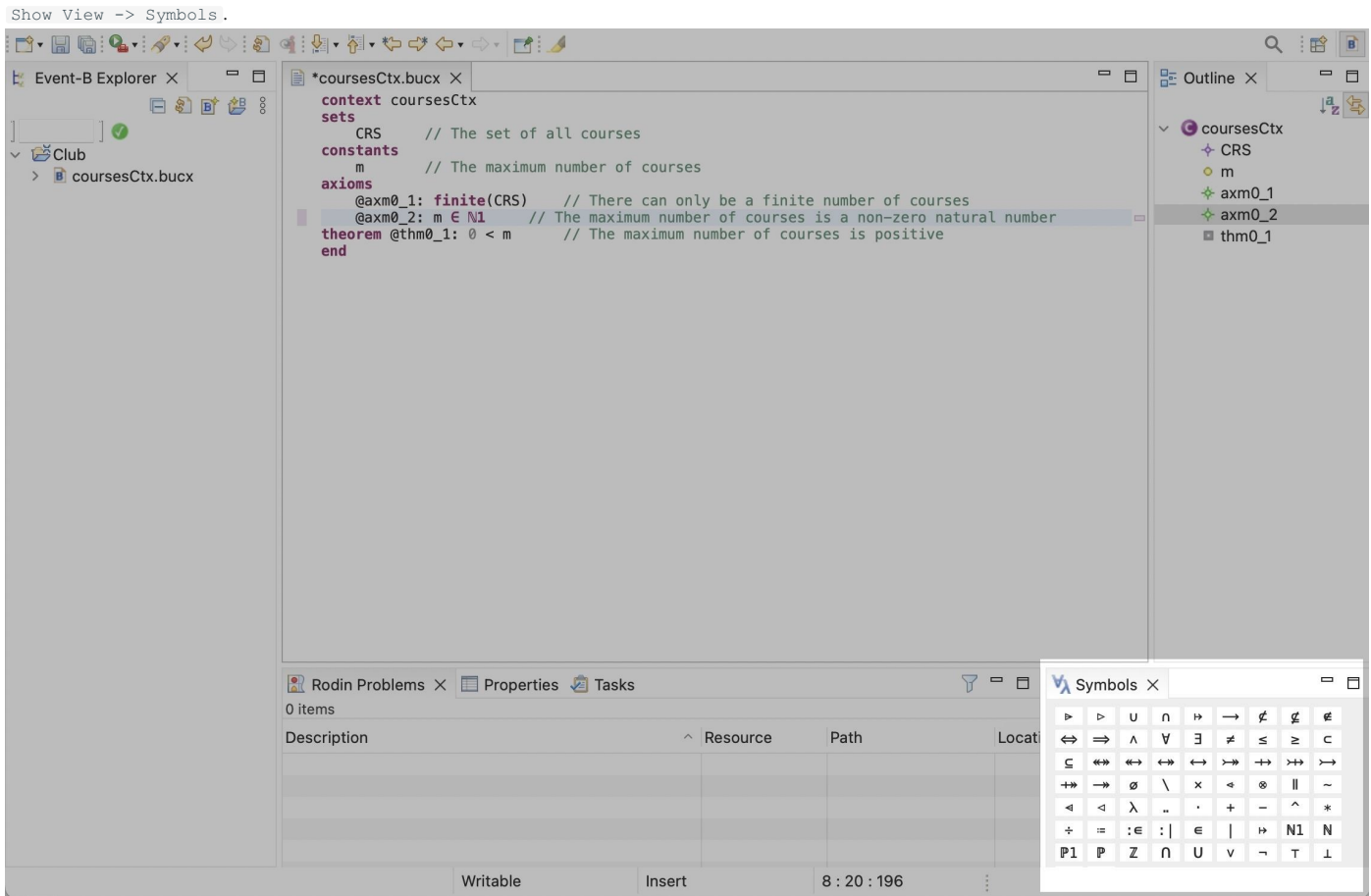
1. Using *Content Assist*. *Content Assist* can translate *ASCII* characters into Unicode symbols. For example, when typing `NAT` and invoking content assist (e.g., on `Ctrl` + `Space` on Mac OS), a dropdown list will appear with options for typesetting `N` and `N1`.



2. Using *Quick Fix*. The *CamilleX* editor offer quick fixes for ASCII untranslated formula. Untranslated formula are indicated by warnings with yellow squiggly lines under the formula. Hover the mouse over the untranslated formulae, a pop-up dialog will appear to offer to translate the formulae.



3. Using *Symbols* Table. Symbols can be inserted into the *CamilleX* editor. (If the *Symbols* table is not visible in your Rodin, you can open it from the menu `Window ->`



### Step 3. Save the `coursesCtx.bucx` file

Save the file `coursesCtx.bucx`, the *XText* builder will generate Rodin context `coursesCtx` automatically.



## Conclusion

By now, the XContext “coursesCtx.bucx” and the corresponding Rodin Context “coursesCtx” should be visible in the Event-B Explorer.

The screenshot displays the Event-B Explorer interface. On the left, the 'Event-B Explorer' pane shows a tree structure with 'Club' expanded, revealing 'coursesCtx' and 'coursesCtx.bucx'. The main editor window shows the content of 'coursesCtx.bucx' with the following code:

```

context coursesCtx
sets
  CRS // The set of all courses
constants
  m // The maximum number of courses
axioms
  @axm0_1: finite(CRS) // There can only be a finite number of courses
  @axm0_2: m ∈ N1 // The maximum number of courses is a non-zero natural number
theorem @thm0_1: 0 < m // The maximum number of courses is positive
end
  
```

On the right, the 'Outline' pane shows the 'coursesCtx' context expanded, listing its components: CRS, m, axm0\_1, axm0\_2, and thm0\_1. At the bottom, the 'Rodin Problems' pane is empty, and the 'Properties' and 'Tasks' panes are also visible. The 'Symbols' pane on the far right contains a grid of mathematical symbols.

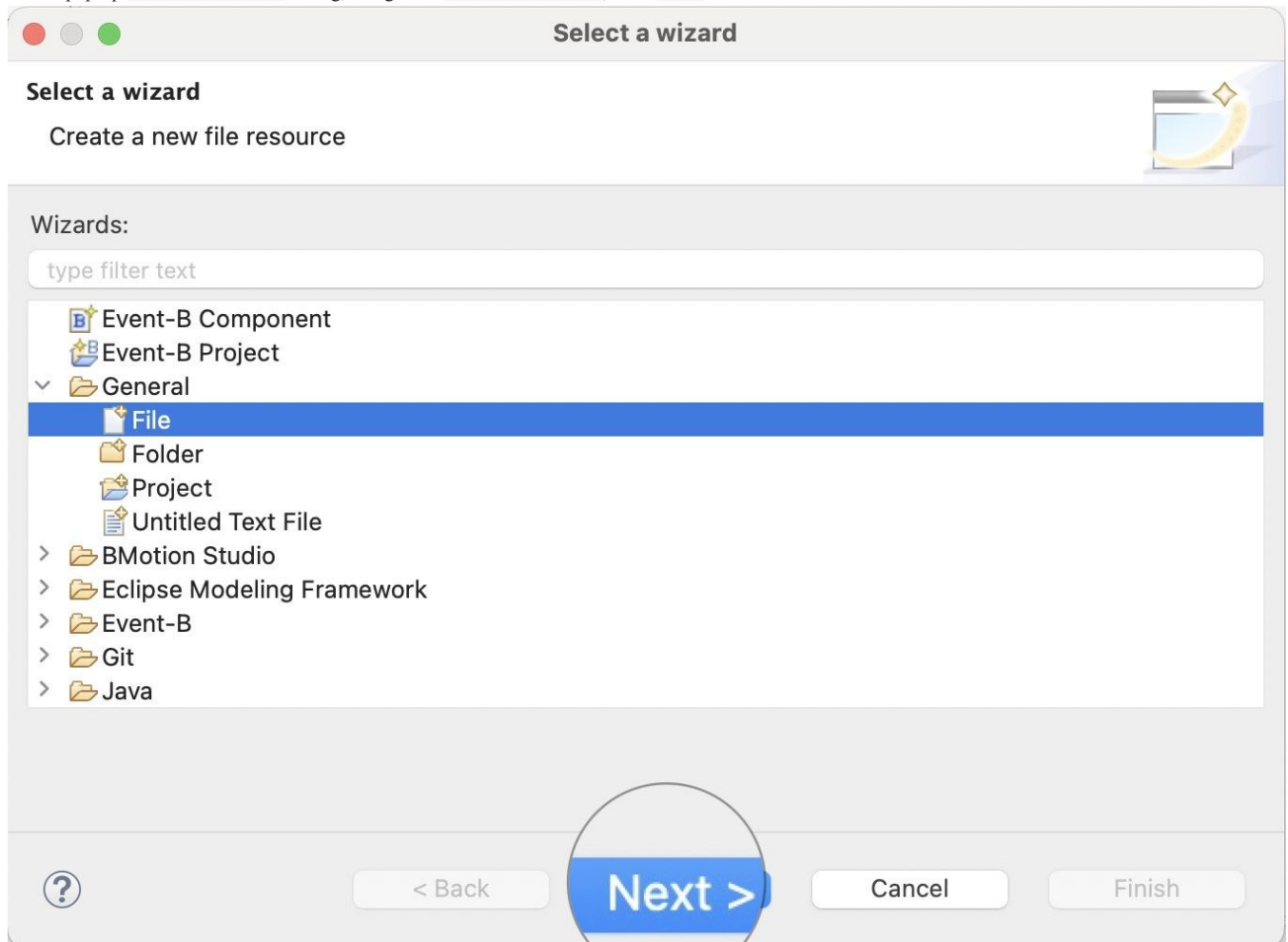
## 2.4.3 Task 3. Create an XMachine

### Introduction

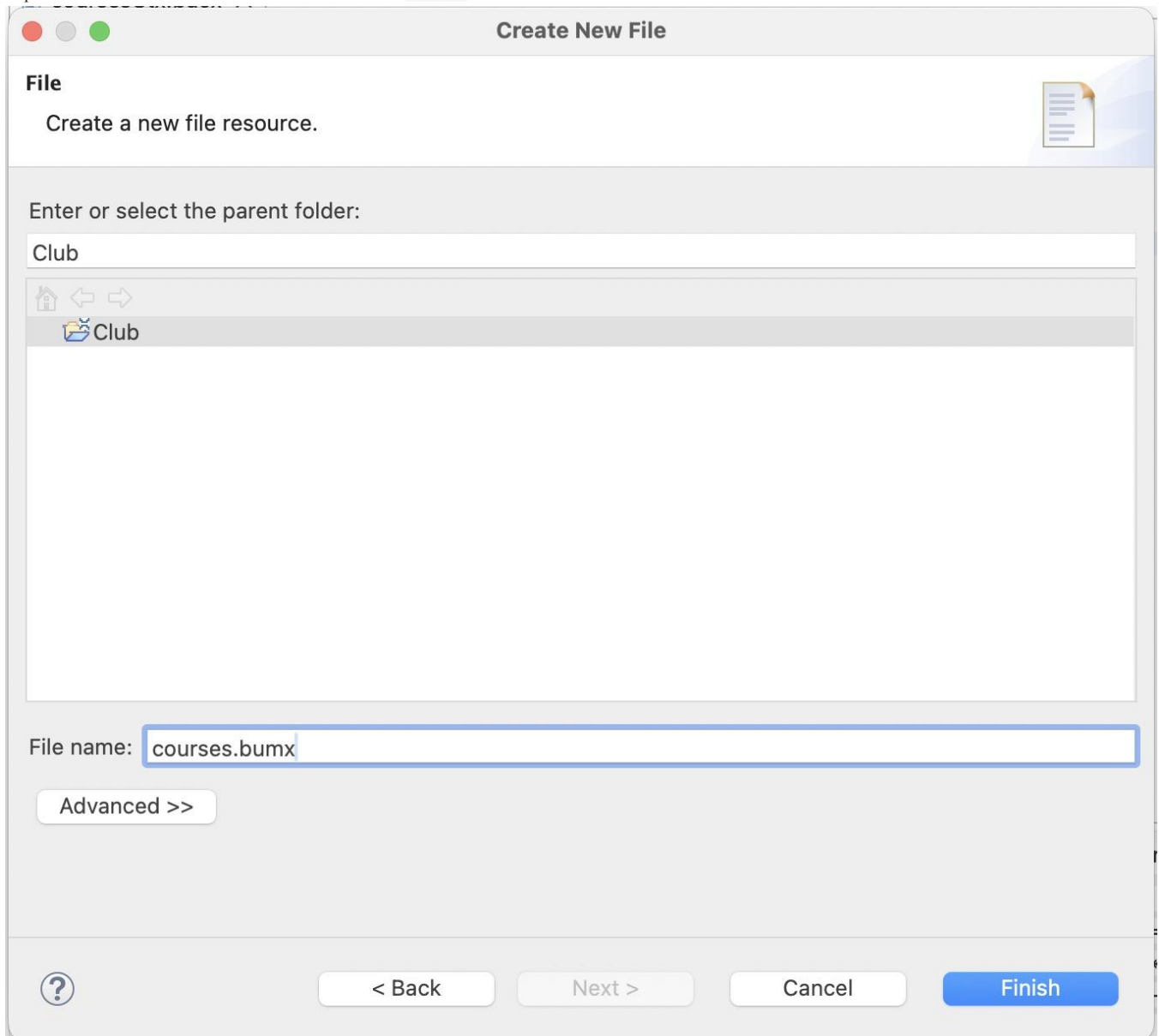
The purpose of this task is to create a simple XMachine within the newly created project.

### Step 1. Create a New XMachine Named `courses.bumx`

- Use the menu `File -> New -> Other` to open the `Select a wizard` dialog.
- On the pop-up `Select a wizard` dialog, navigate to `General -> File`, click `Next`.



- On the **Create New File** dialog, choose **Club** project as the parent folder, and put **courses.bumx** as the **File name**. The file extension **.bumx** is important to indicate that the file is an *XMachine*. Click **Finish** to confirm the file creation.



## Step 2. Set the Content of `course.bumx`

- Using the editor, set the content of `courses.bumx` as follows.

```

machine courses

sees coursesCtx

variables
  crs    // The set of existing courses

invariants
  @inv0_1: crs  $\subseteq$  CRS

theorem
  @thm0_2: finite(crs)

invariant
  @inv0_2: card(crs)  $\leq$  m

event INITIALISATION
begin
  @act1: crs =  $\emptyset$ 
end

```

```

/*
 * Event to open a set of courses using non-deterministic assignment.
 */
event OpenCourses
when
  @grd0_1 : card(crs) ≠ m
  theorem @thm0_3 : crs = CRS
then
  @act0_1 : crs := | crs ⊂ crs' ∧ card(crs') ≤ m
end

/*
 * Event to close a set of courses using event parameters
 */
anticipated event CloseCourses
any cs
where
  @grd1: cs ⊆ crs
  @grd2: cs ≠ ∅
then
  @act1: crs = crs \ cs
end

```

coursesCtx.bucx

courses.bumx ×

**machine** courses**sees** coursesCtx**variables**

crs // The set of existing courses

**invariants**

@inv0\_1: crs ⊆ CRS

⊖ **theorem**

@thm0\_2: finite(crs)

⊖ **invariant**

@inv0\_2: card(crs) ≤ m

⊖ **event** INITIALISATION**begin**

@act1: crs = ∅

**end**

⊖ /\*

\* Event to open a set of courses using non-deterministic assignment.

\*/

⊖ **event** OpenCourses**when**

@grd0\_1 : card(crs) ≠ m

**theorem** @thm0\_3 : crs = CRS**then**

@act0\_1 : crs := | crs ⊂ crs' ∧ card(crs') ≤ m

**end**

⊖ /\*

\* Event to close a set of courses using event parameters

\*/

⊖ **anticipated event** CloseCourses**any** cs**where**

@grd1: cs ⊆ crs

@grd2: cs ≠ ∅

**then**

@act1: crs = crs \ cs

**end**

**Step 3. Save the `coursesCtx.bucx` file**

Save the file `coursesCtx.bucx`, the *XText* builder will generate Rodin context `coursesCtx` automatically.

**Conclusion**

By now, the XContext “`coursesCtx.bucx`” and the corresponding Rodin Context “`coursesCtx`” should be visible in the Event-B Explorer.

The screenshot shows the Event-B Explorer IDE interface. The main editor displays the content of the `coursesCtx.bucx` file, which defines a Rodin context `coursesCtx`. The context includes a set `CRS`, a constant `m`, and two axioms: `@axm0_1: finite(CRS)` and `@axm0_2: m ∈ N1`. A theorem `@thm0_1: 0 < m` is also defined. The left sidebar shows the Event-B Explorer tree with the `Club` project containing `coursesCtx` and `coursesCtx.bucx`. The right sidebar shows the Outline of the `coursesCtx` context, listing `CRS`, `m`, `axm0_1`, `axm0_2`, and `thm0_1`. The bottom status bar indicates the file is writable and in insert mode, with a cursor at line 9, column 1, position 257.

```

context coursesCtx
sets
  CRS // The set of all courses
constants
  m // The maximum number of courses
axioms
  @axm0_1: finite(CRS) // There can only be a finite number of courses
  @axm0_2: m ∈ N1 // The maximum number of courses is a non-zero natural number
theorem @thm0_1: 0 < m // The maximum number of courses is positive
end

```