MathDox Select: A tool for creating SCORM packages from existing exercises

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Abstract

Learning Management Systems are often used in e-Learning and e-Learning content has to be made available for use inside such systems. This is usually quite easy to do. SCORM is a standard for this. However, if the content needs to run on a dedicated server, which might be different from the server running the LMS, this can be complicated. This is for example the case with interactive mathematical exercises in the MathDox system.

A tool has been developed to easily create basic SCORM packages that contain references to MathDox exercises. These packages contain scripts that communicate results on the exercises between the LMS and the underlying interactive exercise system (MathDox). In this way we have created a method for teachers to use MathDox exercises in SCORM compatible LMS like Moodle, ILIAS, or Blackboard without the need of a plugin.

As our set up is independent of MathDox, it should be fairly easy to extend this to other exercise systems or e-learning applications.

1   History

At the Eindhoven University of Technology MathDox has been developed [2,3,7]. This is both a document format and a set of tools to show interactive mathematical documents on the web. The last years MathDox has been extensively used to create and serve exercises to students [4, 6, 9, 13]. The exercises are offered through the Learning Management System (LMS) called Moodle [8].

We use a standard for serving e-learning content via an LMS: SCORM [11]. Some editors to create SCORM packages are eXe [5] and RELOAD [10]. However, the packages created by these tools are not suitable for e-learning content that, such as MathDox exercises has to run outside the LMS on a remote and dedicated server.

We have created our own tool, *MathDox Select* to easily create basic SCORM packages from a database of MathDox exercises, such that these exercises can
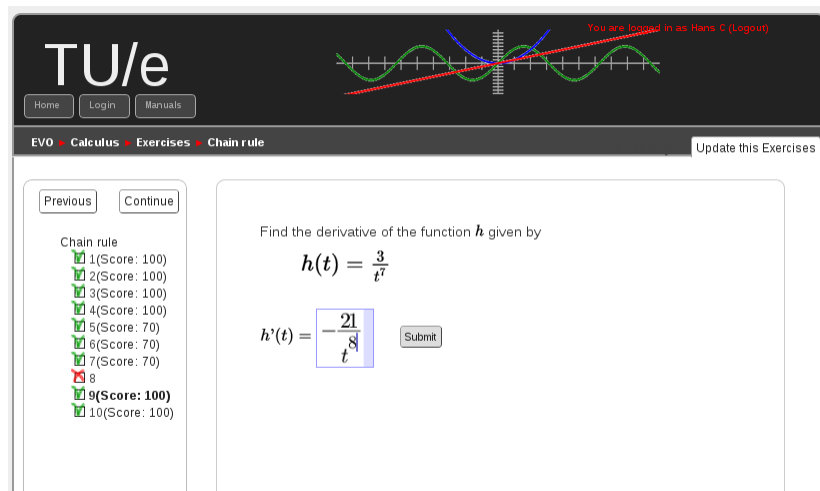
TU/e

Home   Login   Manuals

EVO ▸ Calculus ▸ Exercises ▸ Chain rule

Update this Exercises

Previous   Continue

Chain rule
1(Score: 100)
2(Score: 100)
3(Score: 100)
4(Score: 100)
5(Score: 70)
6(Score: 70)
7(Score: 70)
8
9(Score: 100)
10(Score: 100)

Find the derivative of the function h given by

$$h(t) = \frac{3}{t^7}$$

$$h'(t) = -\frac{21}{t^8} \quad \text{Submit}$$

Figure 1: MathDox exercises running in a SCORM package within Moodle

run on our dedicated MathDox server, while the LMS might be running somewhere else. Our SCORM packages allow us to communicate user information and scores of exercises to the grade book of the LMS.

Since it is not necessary to install a plugin this means it is possible to add these packages as a teacher without administrative rights. The tool has been tested on Moodle and Blackboard.

As our setup is largely independent from MathDox, it can easily be extended to other types of e-learning content with scoring that one wants to deploy inside an LMS but has to run on a remote host. Here one can think of exercises from systems like ActiveMath [1], STACK [12] or WIMS [14].

With exercise systems it is important that the results of the exercises can be seen by the student and teacher. Exercises systems usually provide their own interface to results. WIMS and ActiveMath have their own interface, where you can log in. For teachers it is useful if they can see the results in their own LMS. Note that STACK has a plugin for Moodle, which is included by default in newer versions of Moodle. The advantage of our tool is that it only needs SCORM support to provides access to exercises and stores results.

MathDox Select was formerly called SPG (SCORM package generator) and earlier versions were written by M. Zubair Afzal and Matthijs Brouwer. This tool is being developed further for the ONBETWIST project [9]. Recent additions are support for multiple formats, metadata import, search functionality on metadata, and support to run exercises from a remote host.

2 MathDox Select

MathDox Select consists of a database of MathDox exercises (other types of e-learning content is also allowed), a web based front end to access the database, and a set of tools to create SCORM packages. Indeed, the front end makes it easy to select exercises and group them in a package. Such package can then be downloaded in SCORM format and imported into the LMS. The packages contain several scripts that make communication between the MathDox server on which the exercises reside and the LMS possible. In this way user information about the student available in the LMS is also available to the MathDox server, and information on the exercises, such as metadata and scores obtained by students, can be transferred to the LMS.

Inside MathDox Select the packages can be copied, shared with other users and grouped (to relate them to courses in the LMS).
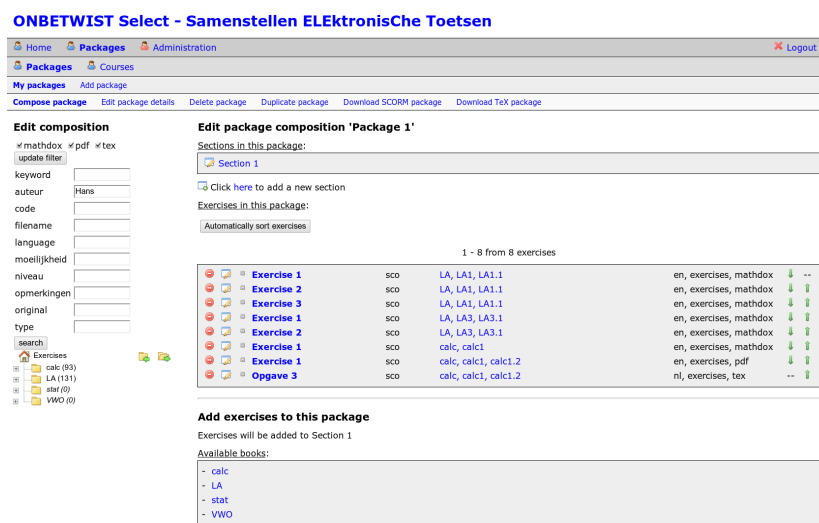

Figure 2: Selecting exercises and adding them to a package

3 Metadata and searching

The MathDox exercises in our database are XML-documents containing metadata based on the LOM-standard. Moreover, these exercises are ordered by a taxonomy.

The taxonomy is used to present the exercises inside the front end of the database in a tree structure. The database can also be searched by using the metadata.

To enable this search, our tool only shows the metadata fields from the

exercise sources that are actually used. As there are many metadata standards around, the choice has been made to allow metadata fields of any name and not just restrict to the metadata standard used within the MathDox exercises. In this way our front end is aware all possible metadata elements.

Because of this flexibility it is easy to use our tool for other collections e-learning content with existing metadata in possibly other format or standards.

4 The SCORM package

A SCORM package created by MathDox Select consists of HTML files with metadata together with some JavaScript files. The HTML files contain an iframe pointing to the exercises on the MathDox server. Since SCORM uses JavaScript for communication permission errors can occur when one wants to communicate between the LMS in which the packages are deployed and the remote server on which the exercises are running. The HTML5 solution is to use PostMessage to communicate between iframes. For this we use both JavaScript in the SCORM package and on a wrapper page on the server. It is easy to modify this JavaScript for use with exercises of another format.

5 Translation services

Besides the above described features, our tool is enhanced with some extra services. If exercises are the MathDox XML-format it is possible to automatically translate them into another format. An application we offer is conversion to LaTeX.

6 Multiple Formats

The set up of MathDox Select is almost completely independent of the MathDox system. As a consequence, it is possible to include e-learning content in various other formats in the database.

A similar approach as we have taken for MathDox exercises could easily be applied to e-learning content which consist for example of webMathematica pages, or of interactive exercises in the ActiveMath system or in WIMS.

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