Computer-based assessment systems

Web Programming

Uta Priss
ZELL, Ostfalia University

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Outline

Background

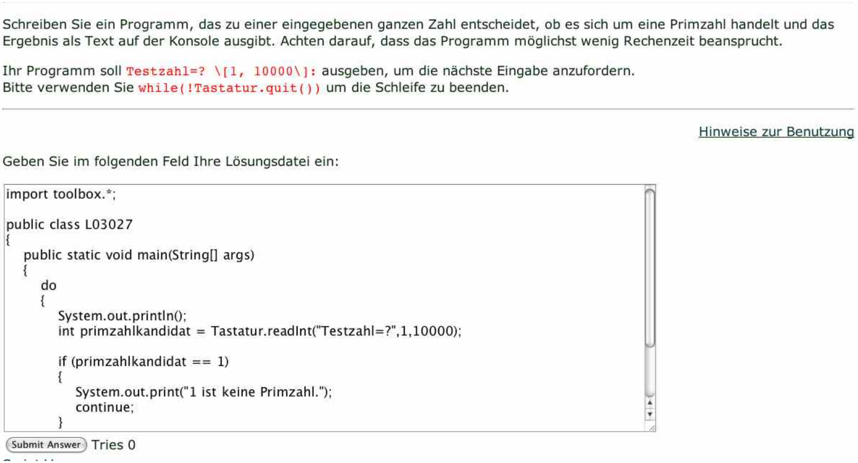
Implementation

More Details

Background of the project

- ZELL - Centre for Successful Teaching and Learning
  Ostfalia University of Applied Sciences
- eCULT: project funded by German Ministry of Education and Science (6 million Euros across Germany)
- Goal: improving the availability and didactic foundation of e-learning technologies

Computer-based Assessment (CBA) Tool: Screenshot 1



Schreiben Sie ein Programm, das zu einer eingegebenen ganzen Zahl entscheidet, ob es sich um eine Primzahl handelt und das Ergebnis als Text auf der Konsole ausgibt. Achten darauf, dass das Programm möglichst wenig Rechenzeit beansprucht.

Ihr Programm soll `Testzahl=? \[1, 10000\]:` ausgeben, um die nächste Eingabe anzufordern.
Bitte verwenden Sie `while(!Tastatur.quit())` um die Schleife zu beenden.

Hinweise zur Benutzung

Geben Sie im folgenden Feld Ihre Lösungsdatei ein:

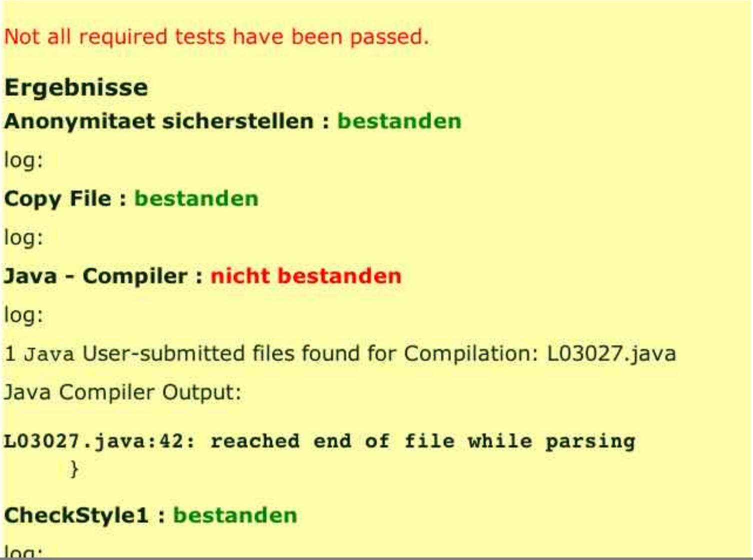
```
import toolbox.*;

public class L03027
{
   public static void main(String[] args)
   {
      do
      {
         System.out.println();
         int primzahlkandidat = Tastatur.readInt("Testzahl=?",1,10000);

         if (primzahlkandidat == 1)
         {
            System.out.print("1 ist keine Primzahl.");
            continue;
         }
```

Tries 0

CBA Tools: Screenshot 2 (Feedback)



Not all required tests have been passed.

Ergebnisse

Anonymitaet sicherstellen : bestanden

log:

Copy File : bestanden

log:

Java - Compiler : nicht bestanden

log:

1 Java User-submitted files found for Compilation: L03027.java

Java Compiler Output:

```
L03027.java:42: reached end of file while parsing
     }
```

CheckStyle1 : bestanden

log:

Types of CBA Tools

- Submission system:
  code is tested elsewhere then submitted
  large files possible
- On-line development environment:
  small files, code snippets
  for programming beginners

LON-CAPA

Legacy system

- $>$ 200000 materials
- Used by hundreds of universities
- Written in Perl
- Supports exercises (e.g., multiple choice) but not programming exercises
- Management of courses, users, materials

Praktomat

- Used by a few German universities
- Written in Django
- For programming exercises
- Limited management of users and materials

Question

How would you create an interface between these two systems?

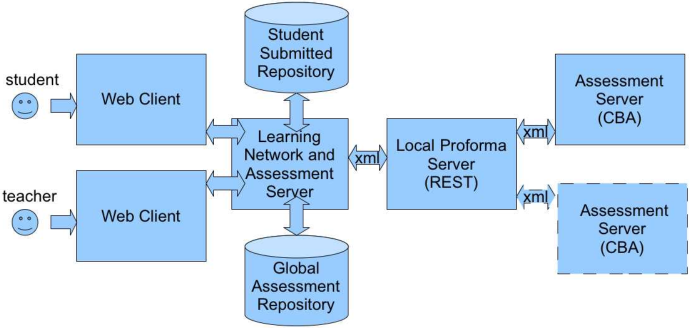
IFrame

- Easy to implement
- Praktomat exercise is displayed within LON-CAPA
- Problem: results are not recorded in LON-CAPA

REST Interface

- More complex to implement
- XML format for representing exercises and results
- Results are recorded in LON-CAPA
- Other tools can use this as well.

System architecture


student
Web Client
teacher
Web Client
Student Submitted Repository
Learning Network and Assessment Server
Global Assessment Repository
xml
Local Proforma Server (REST)
xml
Assessment Server (CBA)
xml
Assessment Server (CBA)

Testing

Static checks:

- Number of lines of code
- Regular expression searches of the source code
- Checkstyle
- FindBugs
- Code coverage
- Compilation

Dynamic checks:

- Execution time, memory use
- Unit tests

Exchange Format for Programming Exercises

```
<task version =’0.9’ lang =’...’>
<description></description>
<language version=’... ’></language>
<submission />
<files />
<model-solutions />
<tests />
<grading-hints />
<meta-data />
```

Security

- Sandboxing
- Java Security Manager (uses profiles)
- Virtual hosts
- Client-side compilation and execution

If anybody would like to write a Bachelor Thesis in this topic area:

talk to Prof. Nils Jensen.