# Automating Feedback & Assessment in WebLab

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### 2010-2011



### Concepts of Programming Languages

Eelco Visser





TI1220 Concepts of Programming Languages

Challenge the future

### Paper Exams on Programming

 $F(x, \overline{x})$ if x=0 then  $F := H(x, \overline{x})$  $F := S(x-1, F(x-1, \overline{x}), \overline{x})$ else flagso  $F(x,\overline{x})$ it x= o pten saveregisters  $F:=H(x,\bar{x})$ restore regioners if flag is a then flag -+ goro Save regimes flog + t  $F' := F(x-1, \overline{x})$ else

### x 5 pages x 150 students

Tedious to grade!

Is this a correct solution?

Can you grade that objectively?

Is programming on paper a useful skill?

am: In BLOKLE	TERS invullen a.u.b.	Automated grading						
ntamen:	Va	kcode:						
□ dag □ avond /akje volledig invullen ■		StudentNummer         0	Easy to make (for	students)				
1       D       A       B       C         2       B       C       D       A         3       C       B       A       D         4       A       C       D       B         5       C       A       B       D         6       B       D       C       A         7       D       B       A       C         9       C       A       D       B         10       B       D       A       C         11       D       B       C       A         12       B       C       A       D         13       C       B       D       A	Question 10 (Interp following expression? eval { Let("x", Number(1) Let("f", Fun("y Let("x", Number App(Var("f") }	<pre>oreter): Given ), ", Plus(Var("x"), er(2), ), Number(3))))</pre>	the definitions in Figure 3, w	what is the value of the				
14	A: NumValue(3)	B: NumValue(	4) C: NumValue(5)	D: NumValue(6)				
16       C       A       D       B         17       B       D       A       C         18       D       B       C       A         19       B       C       A       D         20       C       B       D       A       D         20       C       B       D       A       D         21       A       D       B       C       A         22       D       A       B       C       D         23       A       B       D       C       Z         24       B       A       C       D       Z         25       C       D       B       A       Z         26       D       C       A       B       Z         28       B       A       D       C       Z         29       C       D       A       B       Z         30       D       C       B       A       B	47       A       D       B       C       62         48       D       A       C       B       63         49       A       B       D       C       64         50       B       A       C       D       65         51       C       D       B       A       66         52       D       C       A       B       67         53       A       B       C       D       68         54       B       A       D       C       69         55       C       D       A       B       70         56       D       C       B       A       71         57       A       D       C       B       72         58       D       A       B       C       73         59       B       C       D       A       74         60       C       B       A       D       75	D       C       A       B         A       B       C       D         B       A       D       C         B       A       D       C         C       D       A       B         D       C       B       A         D       C       B       A         D       C       B       A         D       C       B       A         D       A       D       C         B       C       D       A         C       B       A       D         A       C       D       A         C       B       A       D         A       C       D       B         C       A       B       D         A       C       D       B         D       B       A       C         B       D       C       A         D       B       A       C         A       C       B       D         A       C       B       D	Easy to guess Hard to design					
Opmerkingen: 		niet inkleuren a.u.b. 4124	Not test of relevan	nt skills				



	department.st.ewi.tudelft.nl	×	
← → C 1	department.st.ew	i.tudelft.nl/weblab/sub	mission/7/10
WebLab			Mon, 6 Feb 2012 23:34 I Signed in as ee
TI1220 2011-	2012 > Course > Tutorial	s > Week 1 > 1: Solving	Assignments [Previous: Course] [Next: 2
Title	1: Solving Assignments	Solution	Test
Go To	Assignment	4	methods in this editor. We will normally give you a solution
Deadline	10/02/2012 23:59	5	skeleton such as the one below. Go ahead and just uncomment the line in the greet() function then press the [Save & Compile] button.
Extension	12/02/2012 23:59	8	Hmm. It looks like there is a compilation error: we've forgotten to
Student	eelcovisser	9	close the string. Go ahead and correct the error then [Save & Compile] a
Completed	$\checkmark$	10	Now that the compilation is successful you see two buttons: * [Run Your Test]
Submitted	06/02/2012 23:09	12	* [Run Specification Test]

14 Whenever you [Run Your Test] we will run your tests against your own solution. 15 If you [Run Specification Test] we will test your solution against our tests. 16 Go ahead and [Run Your Test]. Hmm. It looks like one of your own tests is failing 17 Switch to the "Test" editor and try to fix it. 18 19 \*/

20 21<sup>▽</sup> object Speak { 22 237 def greet() = { 24 "Hello cruel world" 25 3 26 27 }

#### [Save & Compile] [Run Your Test] [Run Specification Test] [Submit]

Test score: 1/1

#### Solution •

the editors.

click on that link now.

editor with two tabs:

Test

Go to the "Solution" tab for the rest of these instructions.

### Christmas Break 2011

#### Status: Done

Grade

[Review]

[Reset]

[Extend Deadline]

Good, you're here. For most assignments we will provide you with a solution skeleton that

you have to modify as part of the assignment.

To the right of this text you can see a text box

questions you will have to place your solution in

"Submission | 1: Weblab tutorial". You should

Good. To the right of this text you have an

containing such a solution skeleton. This text

box is actually an editor. When you answer

Right above these instructions you see

÷

10.0

: 2: Program Output!]

again.

4 1

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elcovisser | Sign out

a 🤍

An integrated learning management system with support for programming education



usability scalability security

# demonstration

### Monitoring Student Progress

	WebLa	b Courses	About	Admin						E. \	/isser	Sign	out				
Actions - Edit Assignment							1 2	3	4 5 6 7 8	}	/ 🗉		A 0	+	t	+	
Week 3:	Func													TI2606 / CPL	. / LA	3 / WEEK 3:	FUNC
Dates & Weights			Submissions														
Weight	5.0						Type to filt	er		showing: 71 - 80 / 1	49 (149	3)					
Minimum	3.5	į			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,												
Due	Fri, Feb 27, 2015 23:5	b 27, 2015 23:59		Student	ţţ	Submission 11		Started	ţţ	Completed	ţţ	Grade	↓₹	Passed	lt I	Unenroll	
Deadline	Fri, Feb 27, 2015 23:5	eb 27, 2015 23:59				submission		×		1		8.3		<b>~0</b>			
Extension	Sun, Mar 1, 2015 23:5	Mar 1, 2015 23:59				submission		×		×		8.3		<b>~0</b>			
Penalty	2.0					submission		×		×		8.2		<b>v 0</b>			
				submission		×	×		8.2			<b>v 0</b>					
Statistics				submission		×		×		8.1		<b>v 0</b>					
Last statistics update	29 minutes	ago				submissio	ı	×		×		8.0		<b>~0</b>			
Wed, Mar 4, 201		4, 2015 20:15				submissio	ı	×		1		8.0		<b>v 0</b>			
Enrolled for grade	ed for grade 144					submission		×	×			8.0		<b>v 0</b>			
tarted 136 (94%)					submission		×		×		7.8		<b>~ 0</b>				
Completed	leted 115 (84%)				submission		×		×		7.7		<b>~ 0</b>				
Passed 123 (90%)				144	<b>4</b> 71	- 80 / 149 (14	9)	bb bbl	10								
Mean 7.52794				144		201110(14	-)										
Median	8.4																

# WebLab

Program in browser, compile & run on server	
	Alignment between teaching & assessment
Automatic grading with unit testing	
	Objective automated assessment
Use for programming exams	
	Rapid (immediate) feedback to students
Automate lab logistics	
	Scales to large numbers of students
Works everywhere without installation	
	Reduces tedious work of instructor
Instructor uses same environment	
	Continuous monitoring of student progress
Also: MC, essay questions, grading rubrics	

# To Do

aka

# Research Agenda

WebLab Team

Eelco Visser, Vlad Vergu, Elmer van Chastelet, Oscar Castaneda

**Improving Assessment & Feedback** 

Programming environment

grow into online IDE

### **Reduce effort of creating tests**

Generate tests from more declarative specification of correctness Property-based testing

Testing beyond functional correctness

Non-functional requirements Recognizing good design

### Feedback

How to help students when they are stuck? Generating hints / solution strategies from assessment Personalized learning paths

#### Translating assessment into meaningful grades

Relative weight of tests Gamification

### Can we apply this to other programming courses?

Algorithms & Data Structures (Java) Algorithmics (Java) Embedded Software (C) (and at courses at TU Darmstadt) *Your course?* 

### Can we apply this to non-programming courses?

Automate correctness testing

Define evaluation function that produces

- a grade (correctness degree)
- feedback (explanation of non-correctness)

### Plagiarism

How can we make sure that students really do the work themselves? My current answer: digital exam with physical presence

### **Learning Analytics**

Monitoring students in a course

We need to record more data

### **Evaluating the effects**

Does it work? Do students learn more? better? How can we tell?

### **Evaluating learning processes**

What can we learn from sequence of intermediate solutions about solution strategies?

## WebLab is open for education

# What do *you* need for *your* course in WebLab?

# http://weblab.tudelft.nl