

# **Adaptive Student Solutions**

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T-FLIP Kickoff September 2015

# What we want to achieve



## WP4: Behovsbasert Læring

- Automated testing.
- Tests tailored for students.
- Flexible automated feedback.
- Active students.

# Different students



## **Student A:**

Experienced at programming.  
Finished with the assignments early.  
Not challenged enough.



## **Student B:**

Struggles with programming.  
Needs repetitive practice even with  
easy assignments.  
Tasks are too difficult.



## **Student C:**

Finds the logical programming  
assignments easy.  
Needs repetitive practice with object  
orientation.

# Suggestion 1: Stochastic Selection of Assignments

- The environment consists of assignments which students can either fail or pass.
- The tasks are categorised, e.g.
  - (1) Program control
  - (2) Variables
  - ...
- The aim is to learn the how much a particular student needs to practice in category (1), and how much he needs to practice in category (2).

# Suggestion 1: Stochastic Selection of Assignments

- For each category for each student there is a learning automata.
- The automata yields the probability of providing an assignment from a category the student.

# Suggestion 1: Stochastic Selection of Assignments

- If a student A fails one attempt at an assignment from category (1):
  - LA\_A1 will be punished.
  - The probability of choosing an assignment from this category (1) increases.
  - The probability of choosing an assignment from any other category decreases.
- If a student A passes one attempt at an assignment from category (1):
  - LA\_A1 will be rewarded.
  - The probability of choosing an assignment from this category decreases.
  - The probability of choosing an assignment from any other category increases.

# Suggestion 1: An example

Assignments	p
(1.1) P. Control	.80
(1.2) P. Control	
(1.3) P. Control	
(1.4) P. Control	
(2.1) Variables	.20
(2.2) Variables	
(2.3) Variables	
(2.4) Variables	

(1.1) →



FAIL

Assignments	p
(1.1) P. Control	.85
(1.2) P. Control	
(1.3) P. Control	
(1.4) P. Control	
(2.1) Variables	.15
(2.2) Variables	
(2.3) Variables	
(2.4) Variables	

(1.1) →



PASS

Assignments	p
(1.2) P. Control	.75
(1.3) P. Control	
(1.4) P. Control	
(2.1) Variables	.25
(2.2) Variables	
(2.3) Variables	
(2.4) Variables	

(1.3) →



PASS

Assignments	p
(1.2) P. Control	.60
(1.4) P. Control	
(2.1) Variables	.40
(2.2) Variables	
(2.3) Variables	
(2.4) Variables	

(2.2) →



FAIL

Assignments	p
(1.2) P. Control	.35
(1.4) P. Control	
(2.1) Variables	.55
(2.2) Variables	
(2.3) Variables	
(2.4) Variables	

(2.2) →



FAIL

Assignments	p
(1.2) P. Control	.25
(1.4) P. Control	
(2.1) Variables	.75
(2.2) Variables	
(2.3) Variables	
(2.4) Variables	

(2.2) →



PASS

## Suggestion 1: Expected Behaviour

- Learns which category of tasks each student needs to practice with.
- Lets the struggling students practice on the easy tasks.
- Lets the achieving students be assigned with difficult tasks.
- Everyone gets appropriately challenged.
- □P



## Suggestion 2:

### Can we model the Learning Curve of the student?

- Given different topics the student might have different learning curves
- How can we model this learning curves?
- Constrained Optimization:
  - Limited Budget: Amount of time dedicated to Learning
  - Partially known Learning Curve: not fully observable

## Suggestion 2: Characterizing Optimal Solution

- Problem have analogy to Marginal Utility Theory from Economics.
- Already some related work from Granmo,

Oommen : [Solving stochastic nonlinear resource allocation problems using a hierarchy of twofold resource allocation automata](#), IEEE transaction on Computer, 2009.

*“However, the amount of time required to master a topic will vary, simply because the nature of a topic influences the student’s “learning curve” for that specific topic. Thus, finding an optimal allocation in this problem must involve “trial and error,” and unknown success probabilities...”*