Improving Engagement of Students in Software Engineering

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https://impress-project.eu/

ERASMUS+

Project 2017-1-NL01-KA203-035259

IMPRESS

- A recently started EU-funded project aiming at improving students' engagement in Software Engineering courses through gamification.

Open Universiteit

Universiteit Utrecht

UNIVERSIDAD COMPLUTENSE MADRID

UNIVERSITÄT PASSAU

inesc id lisboa

- Sept. 2017 – Aug. 2020

Teaching software engineering

- waterfall, iterative, agile
- 14 UML diagram types
- 23 design patterns
- over 80 refactorings
- ...

IMPRESS case study: quality assurance

- Developers need to **test** the modules they build.
- and invest in **formalizing** the modules' specification

```
public static void getMax_spec1(int[] a) {
    // preconditions
    pre(a != null);
    pre(a.length > 0);

    // call the actual function implementation
    int retval = getMax(a);

    // postconditions
    post(exists(a, i -> a[i] == retval)); // A
    post(forall(a, i -> a[i] <= retval)); // B
}
```

A lesson in writing formal specifications

- We can write **simple expressions**:
  - constants like 1,2,3
  - identifiers like x,y,Students
  - properties, e.g. x.age, y.goal
  - $e_1 \otimes e_2$ where $\otimes$ is + , - , * , = , > , ≥ , < , ≤ , ∈
- A **simple formula** is a simple expression of type Boolean

A lesson in writing formal specifications

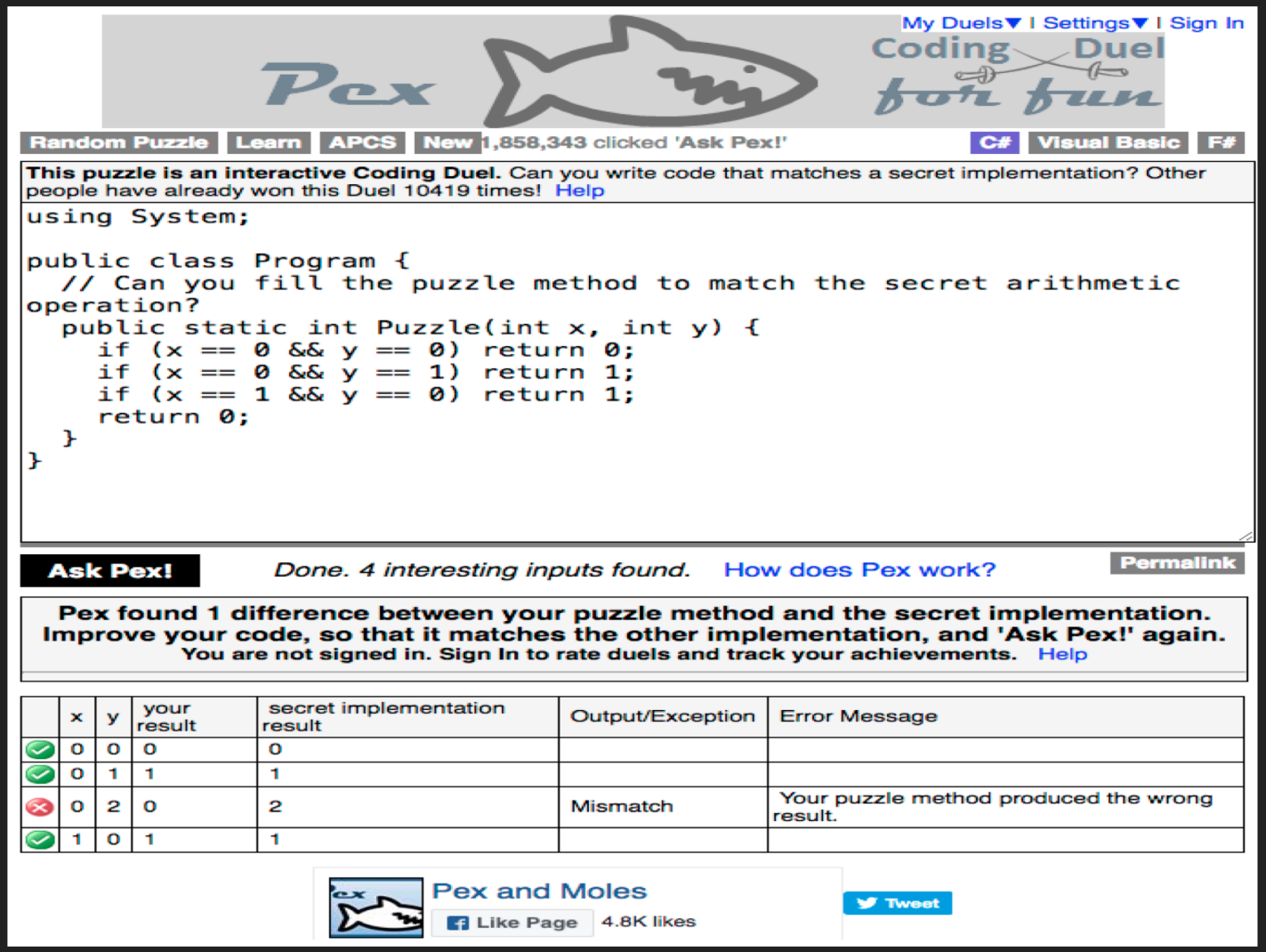
- A **formula** is either:
  - a simple formula
  - ∀identifier∈simple-expression● formula
  - ∃identifier∈simple-expression● formula)
- For example:
  - ∀x∈Students● x.age ≥ 16
  - ∃x∈Students● x.age = 16

A lesson in writing formal specifications

IMPRESS

- Can gamification improve the engagement in SE courses?
- Different gamification level:
  - Gamified class room SE quizzes
  - “Serious” education game
  - “Playful” education games
- AI for story build up
- Integrated analytics

Example of SE education games



Pex (Microsoft)

Example of SE education games

Code Defenders

In production: Formal-Z game

- a game to train student to write formal specifcations interpretable in Java
- will lean more towards the “engagement” aspect
- https://git.science.uu.nl/impresshs/javawlp

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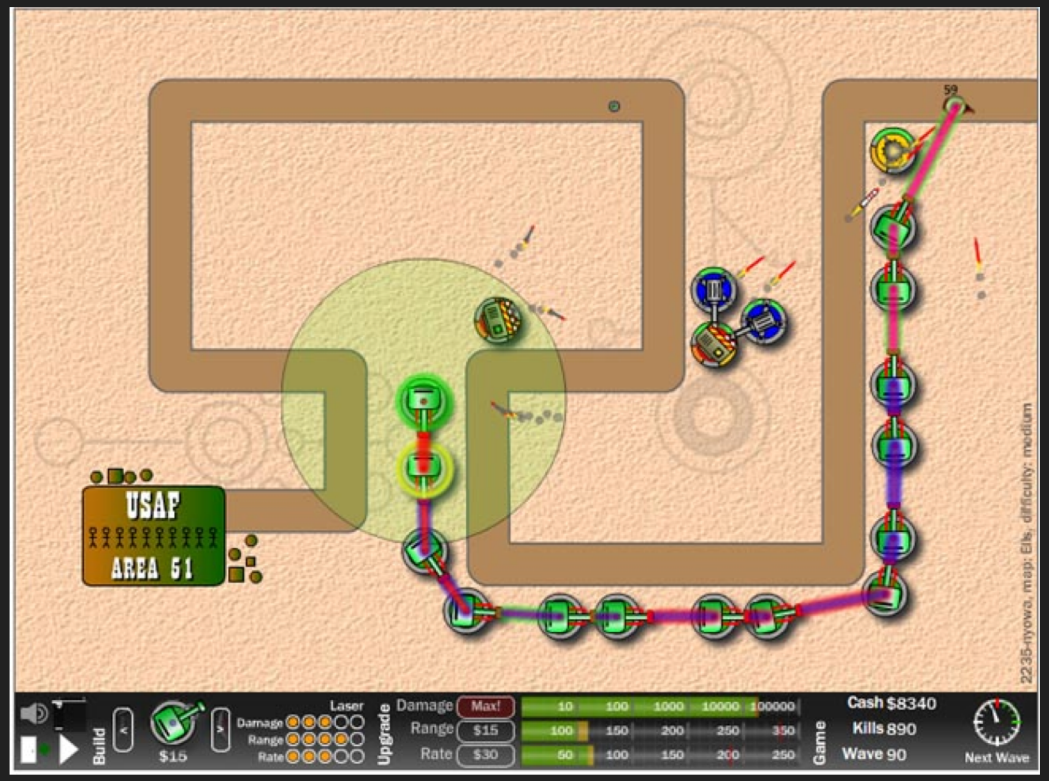
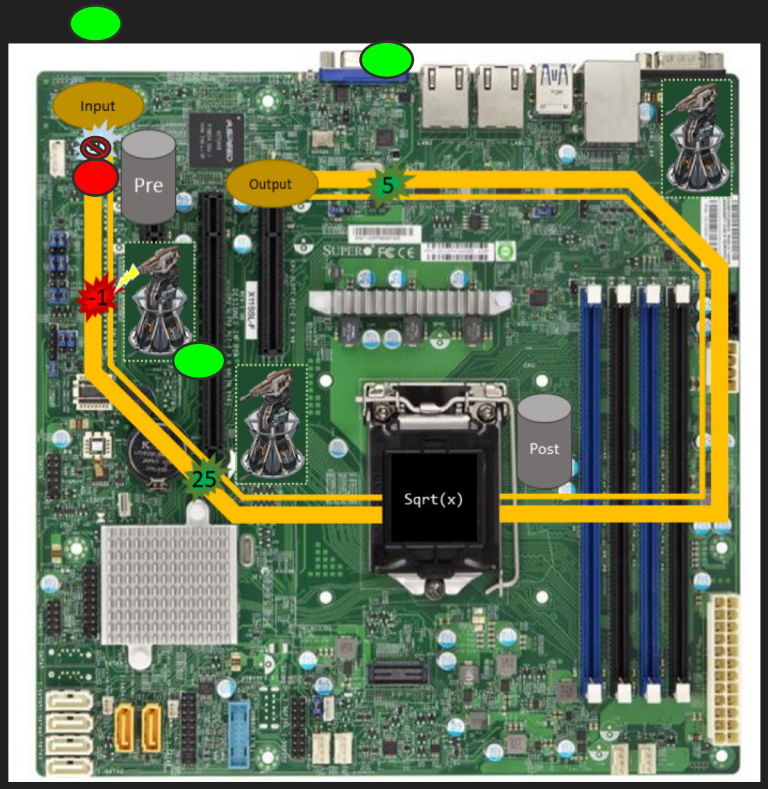
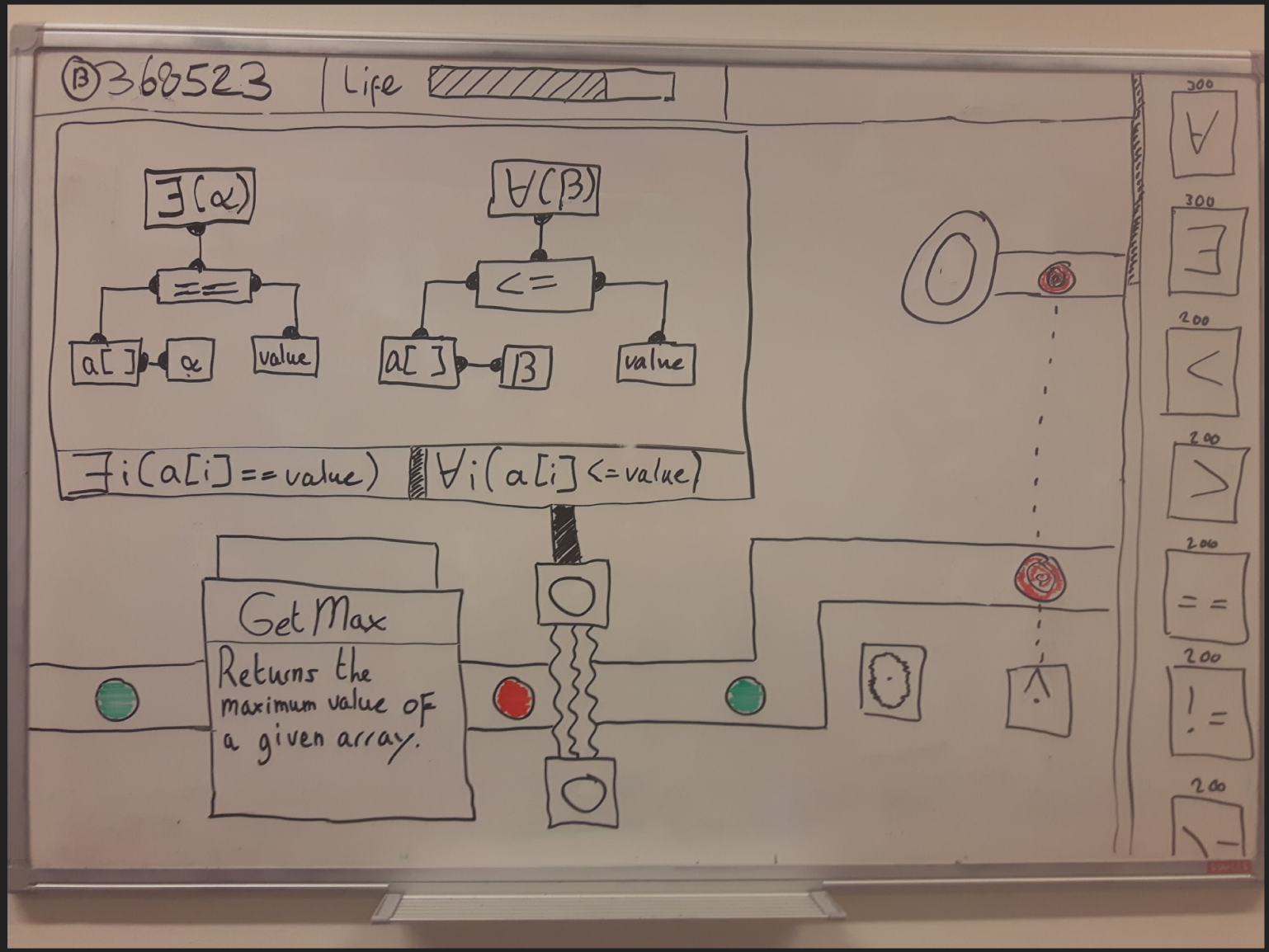
The concept of Fomal-Z



From tower defense to computer defense

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Life
∃(α)
==
a[ ]
α
value
∀(β)
<=
a[ ]
β
value
∃i(a[i] == value)
∀i(a[i] <= value)
Get Max
Returns the maximum value of a given array.
300
300
200
200
200
200
200

IMPRESS future work

- Education quizzes and games for Software Engineering, experimenting with the balance between “seriousness” and “excitement”.
- Data analytics.
- Studying these innovations in actual class rooms.
- If you are interested: Tanja.Vos@ou.nl