ITP2200
Introduction to Software Testing

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Lecture 6
Integrating testing in the software development process

So, more programming this week?

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What do we remember from last time?

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Beizer levels

Level 0 - There's no difference between testing and debugging.
Level 1 - The purpose of testing is to show that the software works.
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Level 3 - The purpose of testing is not to prove anything specific, but to reduce the risk of using the software.
Level 4 - Testing is a mental discipline that helps all IT professionals develop **higher quality software**.

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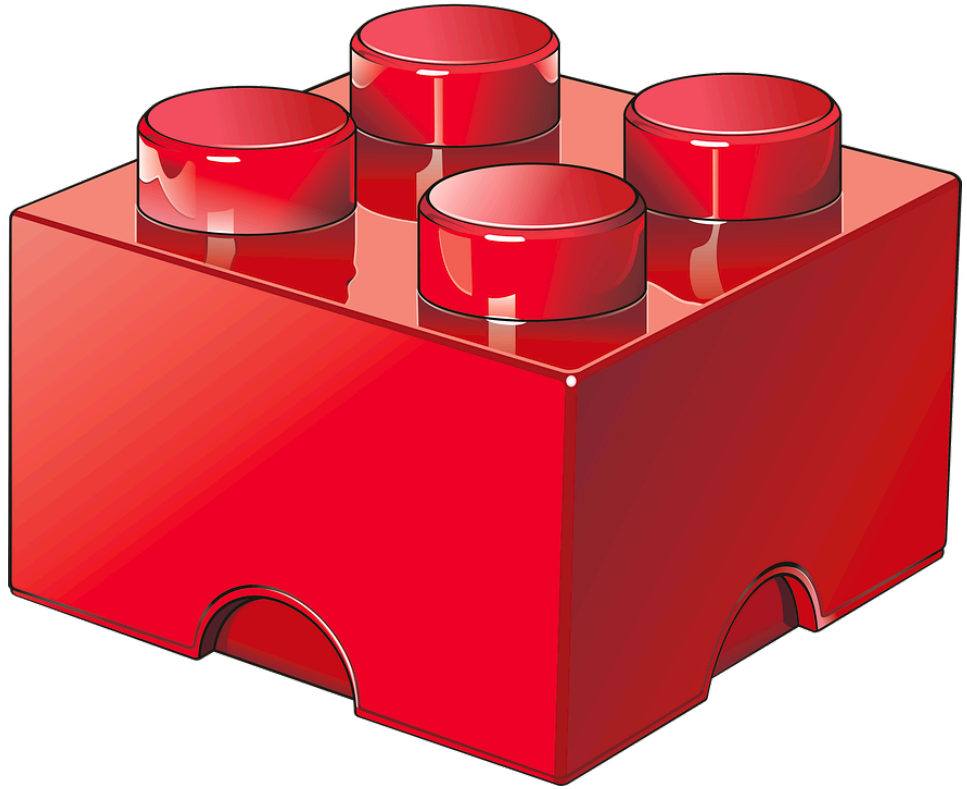
Software Development Process



Unit test:

- Each component (class, method, etc.)
- Functionality, inputs, behaviours
- Input partitioning
- Coverage criteria

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Software Development Process

Quick primer on how software development works:

1. Requirements analysis and specification
2. System and software design
3. Intermediate design
4. Detailed design
5. Implementation
6. Integration
7. System deployment
8. Operation and maintenance

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Software Development Process

Process(es):

1. “Waterfall”
2. Incremental
3. Spiral model
4. Agile

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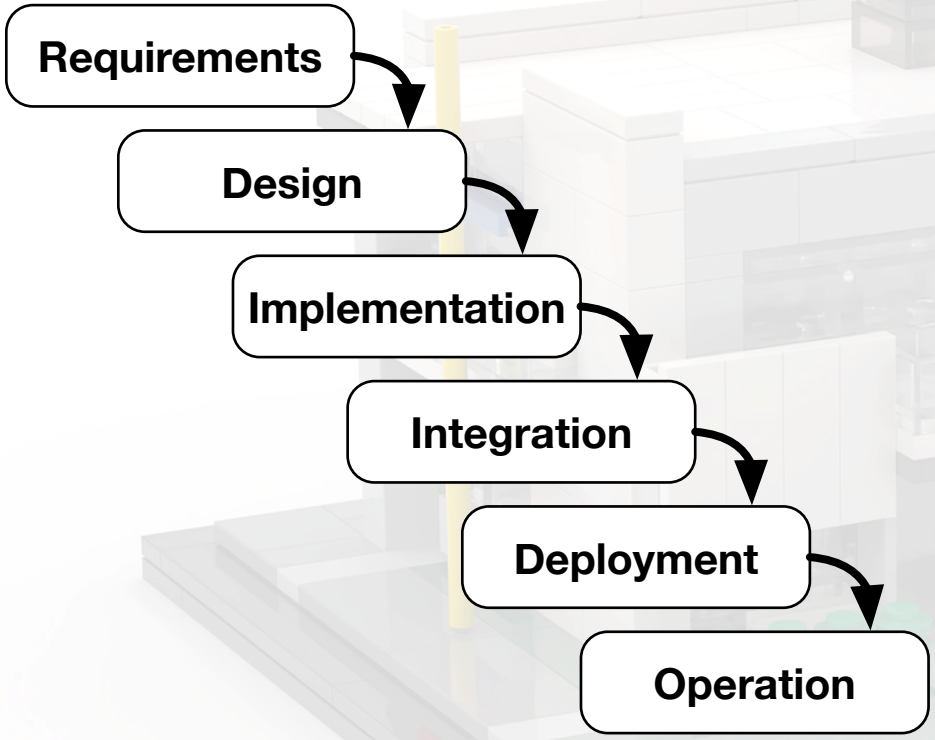
Software Development Process



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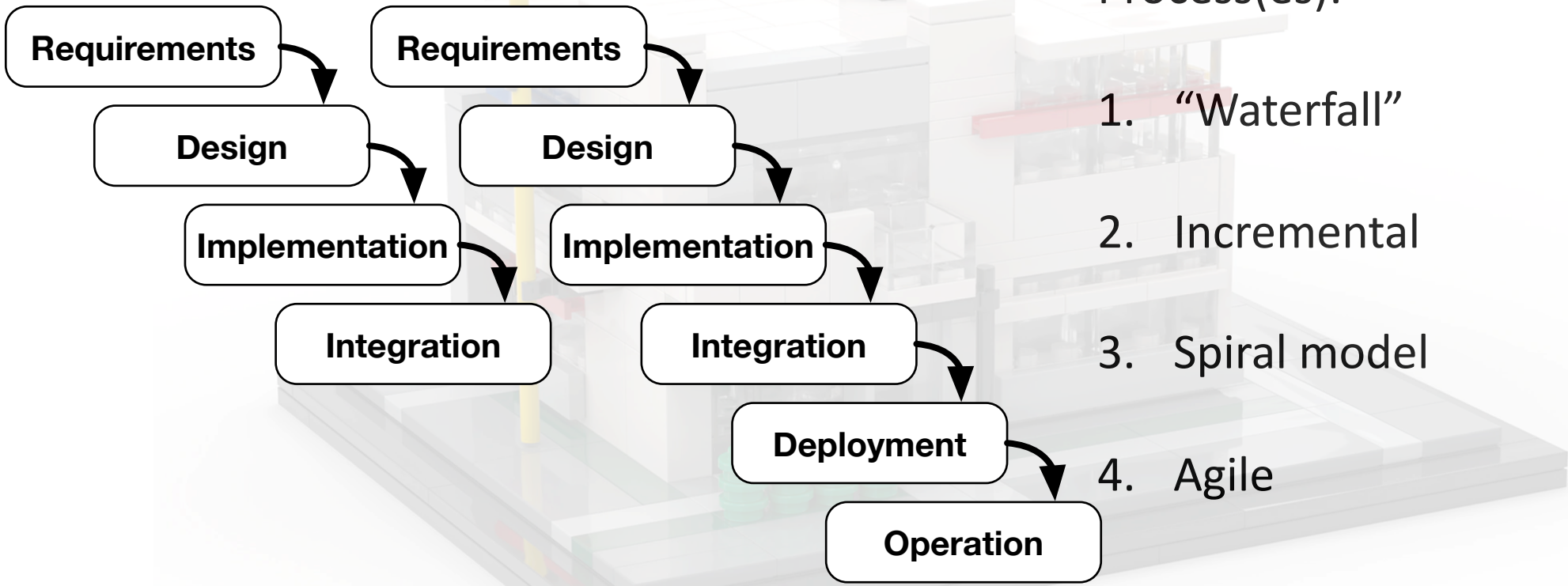
Software Development Process



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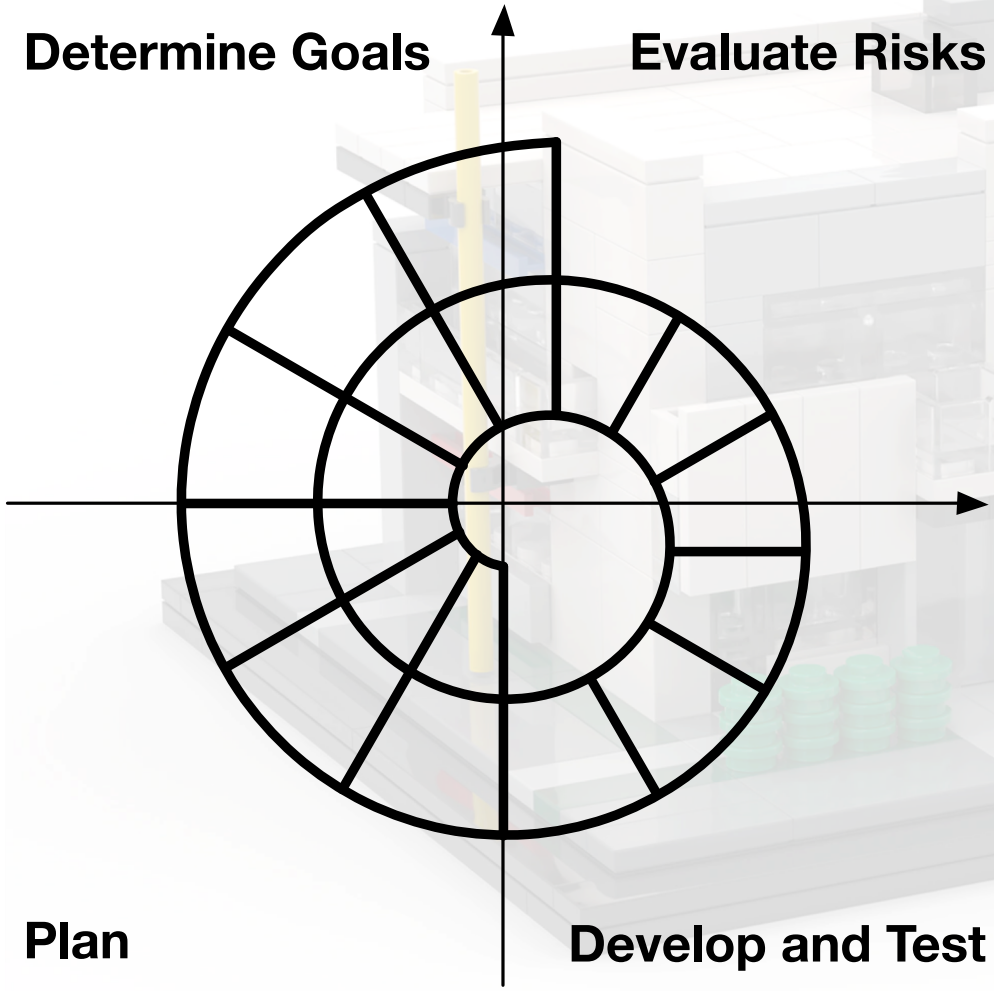
Software Development Process



Process(es):

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Testing a Growing Product

We’ve done right so far

Existing code works

But more functionality needs added (there’s always more stuff to add)

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Regression Testing

Re-test modified software

- Ensure new changes do not break existing functionality
- Automated
- Balance between more tests and manageable test suite size
- Evaluation Criteria: (wait… we know this, right?)

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Regression Testing

```java
package ex06;

public class Time {
    int hours;
    int minutes;
    int seconds;

    public Time(int hours, int minutes, int seconds){
        this.hours = hours;
        this.minutes = minutes;
        this.seconds = seconds;
    }

    public static Time convertSeconds(int seconds){
        int sec = seconds % 60;
        int hour = seconds / 60;
        int mins = hour % 60;

        hour = hour / 60;

        return new Time(hour, mins, sec);
    }
```

How can we improve this?

- Ensure that any data stored in it is usable
- Ensure that any data is accessible when appropriate (and only when appropriate)
- Add additional functionality

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Regression Testing

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        int hour = seconds / 60;
        int mins = hour % 60;

        hour = hour / 60;

        return new Time(hour, mins, sec);
    }
```

Private!

Example:
Make constructor private!

In groups (self-assigned)

Take 5 minutes and discuss:

Benefits?
Drawbacks?
What tests would you add?
What tests should be removed?

Pick a representative and share your findings!

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Regression Testing

Changes can

- **Correct** known faults
- **Improve** existing functionality or performance
- **Adapt** existing structure and functionality
- **Prevent** future problems

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Software Development Process

So,

Nothing old broke,

Is what is new any good?

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Integration Testing

Assumptions:

Individual components are tested

Integration testing: ensuring that the combination of these components is also tested.

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Integration Testing

Check that the various components:

1. Connect!
2. Interact appropriately
3. Require any changes to be performed

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Integration Testing

```
1   package ex06;
2
3   public class Meeting {
4       Person owner;
5       Date date;
6       Time time;
7       int duration;
8
9   @   private Meeting(Person p, Date d, Time t){
10          this.owner = p;
11          this.date = d;
12          this.time = t;
13      }
14  }
```

The Person class is not ready yet!

- what inputs should it have?
- What methods should it have?
- Is currently designed behaviour appropriate?

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Integration Testing

```
1   package ex06;
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3   public class Meeting {
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```

The Person class is not ready yet!

- what inputs should it have?
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- Is currently designed behaviour appropriate?

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Integration Testing

Integration:

- Can be done on incomplete systems
- Some components can be replaced with Stubs (or Mock-ups in other contexts).
- Gives rise to a new problem: what is a good order to integrate components in.

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Questions so far?

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Test Process

Quality

- At all the levels presented there!

- At each step – there are activities that can improve quality, and support or enable better testing

- It’s not just code being assessed!

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Questions so far?

Exercise for the Seminar

Rooms:

-A3-01

-A4-01

-A4-03

-A5-18

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Exercise for the Seminar

RECAP!

- What tests do you have for the Time and Date classes?
- What coverage did you achieve?
- Explain your testing approach!

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Exercise for the Seminar

RECAP!

- Ensure that the Time and Date classes only contain valid info (have tests to show that)

- Change those classes where appropriate!

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Exercise for the Seminar

Write up tests that

- Fail before you update the Date and/or Time classes

- Pass after those classes are changed

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Exercise for the Seminar

If possible, use your implementation from the previous seminar/OOP.

Focus on writing the tests!

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