Unit Testing in Object Oriented Design vs Waterfall Software Life-Cycle Management

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Analysis Phase

- **WF Analysis**
- Problem description
- Functional and non-functional requirements
- Diagrams of the system
- Data Dictionary
- Prologue describing each major function
- Black box system validation test cases

- **OO Analysis**
- Problem description
- Functional and non-functional requirements
- Entity Relationship Diagrams
- Entity Dictionary
- Prologue describing each entity
- Black box entity validation test cases

Design Phase

•WF Design

•Decompose system into modules

•Determine data structures

•Develop algorithms

•Develop pseudo-code and/or flow-charts

•Develop cross-reference showing how reqs met by design

•Develop test strategies/classes for integration

•OO Design

•Develop object diagram

•Determine data structures

•Develop specifications for each object

•Develop pseudo-code for each operation

•Develop cross-reference mapping functions to objects

•Develop test strategies for class integration

Programming Phase

- **Structured Programming**
- Develop source in pascal, C
- Debug source code including any reused (library) code
- Clean compile of source

- **OO Programming**
- Develop source in object pascal, C++, Java
- Debug source code including any reused objects
- Clean compile of source

Testing Phase

•WF Testing

•Unit test each function

•Integration test

•Validation test

•Black-box system test

•Regression test as needed

•Log all tests

•OO Testing

•Unit test each class

•Integration test

•Validation test

•Black-box system test

•Regression test as needed

•Log all tests

Maintenance Phase

- **WF Maintenance**
  - Easier to Implement 4 earlier phases
  - Easier to ensure changes do not introduce new bugs
- **OO Maintenance**
  - Easier to Implement 4 earlier phases
  - Easier to ensure changes do not introduce new bugs

Unit Test in CS Curriculum

- University of Wisconsin
  - First Class start unit testing

Unit Test IDE Structure

- Eclipse Project
  - Code Project
  - Test Case Project

Comparison Project Results

- Graduate Tracking Application
  - WF – 119
  - OO – 597
- ATM Simulation
  - WF – 260
  - OO – 397
- Editor
  - WF – 451
  - OO – 242

Conclusions

- Unit testing should be integrated into all CS curriculum
- Object Oriented Life-Cycle is better in every case when combined with Unit Testing