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 earlier phases
  - Easier to ensure changes do not introduce new bugs

• OO Maintenance
  - Easier to implement 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