Unit Testing for Conventional Software

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Unit Testing

- Focuses testing on the function or software module
- Concentrates on the internal processing logic and data structures
- Is simplified when a module is designed with high cohesion
  - Reduces the number of test cases
  - Allows errors to be more easily predicted and uncovered
- Concentrates on critical modules and those with **high cyclomatic complexity** when testing resources are limited

Targets for Unit Test Cases

- Module interface
  - Ensure that information flows properly into and out of the module
- Local data structures
  - Ensure that data stored temporarily maintains its integrity during all steps in an algorithm execution
- Boundary conditions
  - Ensure that the module operates properly at boundary values established to limit or restrict processing
- Independent paths (basis paths)
  - Paths are exercised to ensure that all statements in a module have been executed at least once
- Error handling paths
  - Ensure that the algorithms respond correctly to specific error conditions

Common Computational Errors in Execution Paths

- Misunderstood or incorrect arithmetic precedence
- Mixed mode operations (e.g., int, float, char)
- Incorrect initialization of values
- Precision inaccuracy and round-off errors
- Incorrect symbolic representation of an expression (int vs. float)

Other Errors to Uncover

- Comparison of different data types
- Incorrect logical operators or precedence
- Expectation of equality when precision error makes equality unlikely (using == with float types)
- Incorrect comparison of variables
- Improper or nonexistent loop termination
- Failure to exit when divergent iteration is encountered
- Improperly modified loop variables
- Boundary value violations

Problems to uncover in Error Handling

- Error description is unintelligible or ambiguous
- Error noted does not correspond to error encountered
- Error condition causes operating system intervention prior to error handling
- Exception condition processing is incorrect
- Error description does not provide enough information to assist in the location of the cause of the error

Drivers and Stubs for Unit Testing

- Driver
  - A simple main program that accepts test case data, passes such data to the component being tested, and prints the returned results
- Stubs
  - Serve to replace modules that are subordinate to (called by) the component to be tested
  - It uses the module's exact interface, may do minimal data manipulation, provides verification of entry, and returns control to the module undergoing testing
- Drivers and stubs both represent overhead
  - Both must be written but don't constitute part of the installed software product