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software engineering dependability

Software Quality Assurance Conclusions

- Necessary, minimum requirements of testing
- A simple practical testing strategy
- Generation of a testing strategy in practice
- Summary
- Literature

- Absolutely necessary according to all authoritative standards:
 - Function-oriented test planning for all test phases
- Reproducibility of test results → automatic regression test after software modification
- Large consensus:
 - Supplementary structure-oriented coverage (minimum: branch coverage test)
 - In critical application areas – e.g., avionics – more thorough structure-oriented tests are explicitly required by the standards
 - Execution preferably during the first test phase after finishing the code (module test)
 - Additional performance and stress testing, especially in technical application areas

- Module Test
 - Function-oriented module test using a branch coverage testing tool
 - Function-oriented test case generation (e.g. generation of functional equivalence classes)
 - Preparation – viz. instrumentation – of the modules to be tested for controlling the branch coverage achieved
 - Complete execution of the function-oriented testing
 - Controlling of the branch coverage achieved in this way (according to experience, approx. 70% - 80%)
 - Structure-oriented module test using the branch coverage testing tool
 - Cause analysis for the non-execution of branches
 - Generation of test cases for the branches not yet executed
- Integration and System Test
 - Function-oriented test

- Software is nowadays often used in application areas in which quantitative statements are common or necessary:
 - Contract design: “We stipulate that the system’s minimum availability shall be 99.8%!”
 - Safety proof of a railway system at the Federal Railway Authority: “How high is the remaining risk posed by software failures?”
 - Is the expected number of the remaining failures sufficiently low for the release?
 - Is the probability adequately small that software failures in control units will cause malfunctions of our luxury sedans?
 - We need a failure-free mission time of 4 weeks. Can this be attained?
- Many enterprises have installed defined processes: The next step is to quantitatively control these.

- First steps in measurement:
 - Measurement of the test coverage → integrated into dynamic test tools
 - Measurement of code features → separate measurement tools

- Using tools in support of ...
 - ... regression tests
 - ... load and stress tests
 - ... GUI tests

- Prior to test execution:
 - Checking compliance with programming conventions → Tool
 - Data flow anomalies analysis → Tool / Compiler
 - Code Inspection / Review → WITHOUT Tool
- Dynamic test
 - As described
 - Beforehand: Switching on the assertions
 - At the same time:
 - Recording of the test cases (regression test) and
 - recording of the coverage
 - If applicable: load and stress tests / GUI test

- If applicable: measurement of the achieved reliability (evaluation of the test observations) → Tool
- If applicable: monitoring of special requirements from the standards: e.g., RTCA DO 178 B demands advanced dynamic tests (avionics)
- If applicable: early tool-supported safety analysis (FMECA, RBD, FT)

- Liggesmeyer P., Software-Qualität, 2. Aufl., Heidelberg: Spektrum Akademischer Verlag 2009