Chapter 17: Software Quality Assurance

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- Elements of SQA - Software Quality Assurance
  - Standards
  - Reviews and Audits
  - Testing
  - Error/defect collection and analysis
  - Change management
  - Education
  - Vendor management
  - Security management
  - Safety
  - Risk management
- Tasks of the SQA Group
  - Prepares an SQA plan for a project that identifies
    - Evaluations to be performed
    - Audits and reviews to be performed
    - Standards that are applicable to the project
    - Procedures for error reporting and tracking
    - Documents to be produced by the SQA group
    - Amount of feedback provided to the software project team
  - Develops the project's software process description
    - The SQA group reviews the process description for compliance with organizational policy, internal software standards, externally imposed standards, and other parts of the software project plans
  - Verifies compliance with the defined software process
    - Identifies, documents, and tracks deviations from the process and verifies that corrections have been made
    - Periodically reports the results of its work to the project manager
    - Ensures that deviations is documented and handled according to procedure
    - Records and noncompliance and reports to senior management
- SQA Goals
  - ★ Requirements Quality
    - The correctness, completeness, and consistency of the requirements model will have a strong influence on the quality of all work products that follow
    - Traceability - the number of requirements not traceable to code
    - Model Clarity
  - ★ Design Quality
    - Every element of the design model should be assessed by the software team to ensure that it exhibits high quality and conforms to requirements
    - Architectural integrity
    - Interface complexity
  - ★ Code Quality
    - Source code and related work products must conform to standards and exhibit maintainability
    - Complexity
  - ★ Quality control effectiveness - QC effectiveness
    - Apply limited resources in the most effective way possible
    - Resource allocation - staff hour percentage per activity

- Formal SQA
  - Assumes that a rigorous syntax and semantics can be defined for every programming language
  - Allows the use of a rigorous approach to the specification of the requirements
  - Applies mathematical proofs to demonstrate that the program conforms to specifications
- Statistical SQA
  - Errors and defects are collected and categorized
  - Try to trace each error and defect's origin
  - ★ Pareto principle - 80% of defects can be traced to 20% of all possible causes
  - Move to correct the vital few 20% of problems
- ★ Six Sigma 6σ - (standard of deviation) for Software Engineering
  - Six standard deviations - 3.4 defects per million occurrences - implying an extremely high quality standard
  - Defines three core steps and two follow-up steps:
    - ★ Define customer requirements and deliverables
    - ★ Measure the existing process and its output to determine quality performance
    - ★ Analyze defect metrics and determine the vital few causes
  - For the same process:
    - ★ Improve the process by eliminating root causes
    - ★ Control the process to ensure future work does not reintroduce the causes
  - For a new process being developed:
    - ★ Design the process to avoid root causes and meet customer requirements
    - ★ Verify that the process will avoid defects and meet customer requirements
- Software Reliability - probability of failure-free operation over a period of time
  - MTBF - Mean-time-between-failure
  - MTTF - Mean-time-to-failure
  - MTTR - Mean-time-to-repair
  - ★ MTBF = MTTF + MTTR
- Software Availability - probability of requirements being met over a period of time
  - ★ Availability = [MTTF/(MTTF + MTTR)] x 100%
- AI and Reliability Models - AI always requires statistics
  - ★ Bayesian inference uses Bayes' theorem to update the probability for a hypothesis as more evidence becomes available
  - Bayesian inference can be used to estimate probabilistic quantities using incomplete historic data
  - ★ Regression model - used to estimate where and what type of defects might occur in future prototypes
  - Genetic algorithms - used to grow reliability models based on historic data
- Software Safety - finds potential hazards that would cause an entire system failure
- ISO 9001:2008 Standard - contains 20 requirements
- SQA Plan Contents
  - Purpose of the plan
  - Description of all products inside the purview of SQA
  - Applicable standards
  - Where SQA tasks are placed throughout the software process
  - Tools for SQA tasks
  - Configuration procedures
  - Safety of SQA records
  - Organize responsibilities