

Software Engineering

Software Quality Assurance

❑ Quality

- Quality of design
 - Characteristics that designers specify for an item
 - Performance specifications
 - Encompasses requirements, specifications, design of the system
- Quality of conformance
 - Degree to which design specifications are followed during manufacturing
 - Focused primarily on implementation
- User satisfaction
 - Complaint product+
 - Good quality+
 - Delivery within budget+
 - Delivery within schedule

❑ Quality control

- Series of inspections, reviews, tests
- Automated, manual, combination

Software Quality Assurance

❑ Quality assurance

- Auditing and reporting functions of management
- Provide management with the data necessary to be informed about product quality
- Management's responsibility to address the problems and apply the necessary resources to resolve quality issues

❑ Cost of quality

- Includes all costs incurred in the pursuit of quality or in performing quality-related activities
- Prevention costs
 - Quality planning
 - Formal technical reviews
 - Test equipment
 - Training
- Appraisal costs
 - In-process and inter-process inspection
 - Equipment calibration and maintenance
 - Testing
- Failure costs
 - Disappear if no defects appear before shipping

Software Quality Assurance

❑ Cost of quality

- Failure costs
 - Internal failure costs
 - › Rework
 - › Repair
 - › Failure mode analysis
 - External failure costs
 - › Complaint resolution
 - › Product return and replacement
 - › Help line support
 - › Warranty work

❑ Software Quality Assurance (SQA) Activities

- Preparing an SQA plan for a project
 - Developed during project planning
 - Reviewed by all interested parties
 - Quality assurance activities performed by the software engineering team

Software Quality Assurance

❑ Software Quality Assurance (SQA) Activities

- Preparing an SQA plan for a project
 - Plan 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
- Participating in the development of the project's software process description
 - Software team selects a process
 - SQA group reviews the process description for compliance with organizational policy, internal software standards, externally imposed standards, other parts of software project plan
- Reviewing software engineering activities to verify compliance with the defined software process
 - SQA group identifies, documents, tracks deviations from the process
 - SQA group verifies that corrections have been made

Software Quality Assurance

❑ Software Quality Assurance (SQA) Activities

- Auditing designated software work products to verify compliance with those defined as part of the software process
 - SQA group reviews selected work products, identifies, documents, tracks deviations
 - SQA group verifies that corrections have been made
 - SQA group periodically reports the results of its work to the project manager
- Ensuring that deviations in software work and work products are documented and handled according to a documented procedure
- Recording any noncompliance and reporting to senior manager
 - Noncompliance items are tracked until they are resolved

❑ Software Reviews

- Pointing out the required improvements
- Confirm those parts where improvement is not needed
- Achieve a technical work with better quality and manageability
- Cost impact of software defects
 - Finding errors is the primary objective
 - Defects are costly
 - Early discovery of errors can be cost effective
 - Design activities introduce 50%-65% of all errors

Software Quality Assurance

❑ Software Reviews

- Cost impact of software defects
 - Reviews could be 75% effective in uncovering design flaws
 - Review helps reduce the cost of development and support phases
 - Error uncovered during design----- 1.0 monetary unit to correct
 - Same error discovered before starting testing----- 6.5 monetary unit to correct
 - That error found during testing-----15 monetary unit to correct
 - Same error uncovered after release-----60-100 monetary unit to correct
- Defect amplification and removal

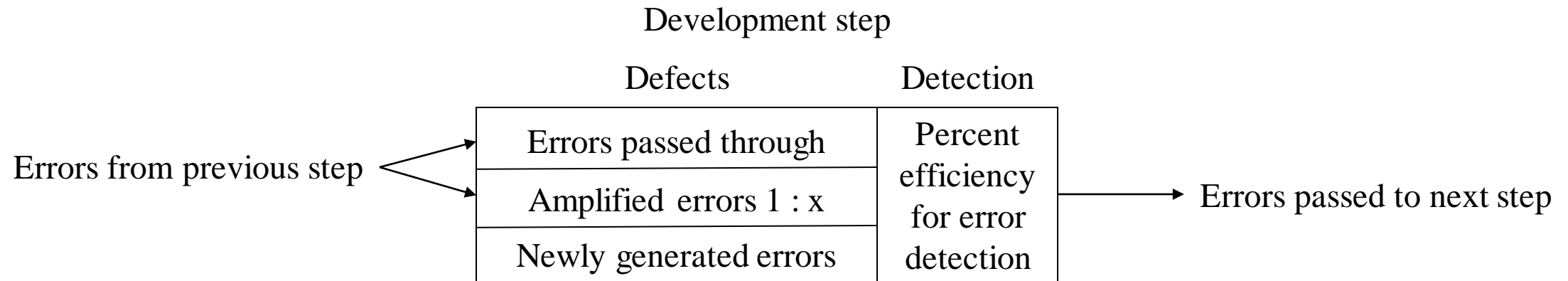


Figure 1: Defect amplification model

Software Quality Assurance

❑ Software Reviews

- Defect amplification and removal

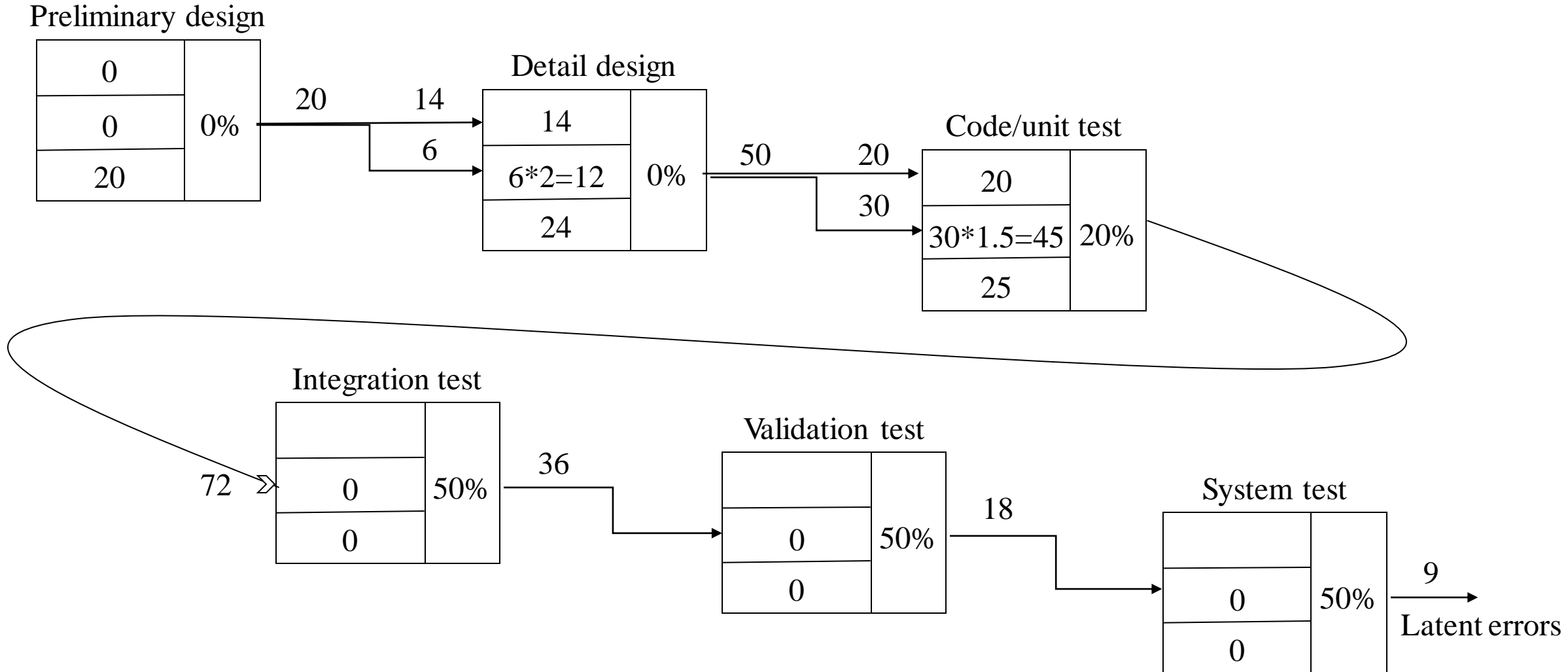


Figure 2: Defect amplification. No reviews

Software Quality Assurance

❑ Software Reviews

- Defect amplification and removal
 - Total cost for development and maintenance
 - › Errors discovered before testing: 18
 - › Errors discovered during testing: 63 (36+18+9)
 - › Errors discovered after release: 09
 - › $\text{Cost} = (6.5 * 18) + (15 * 63) + (70 * 9) = 1692$ monetary unit

Software Quality Assurance

❑ Software Reviews

- Defect amplification and removal

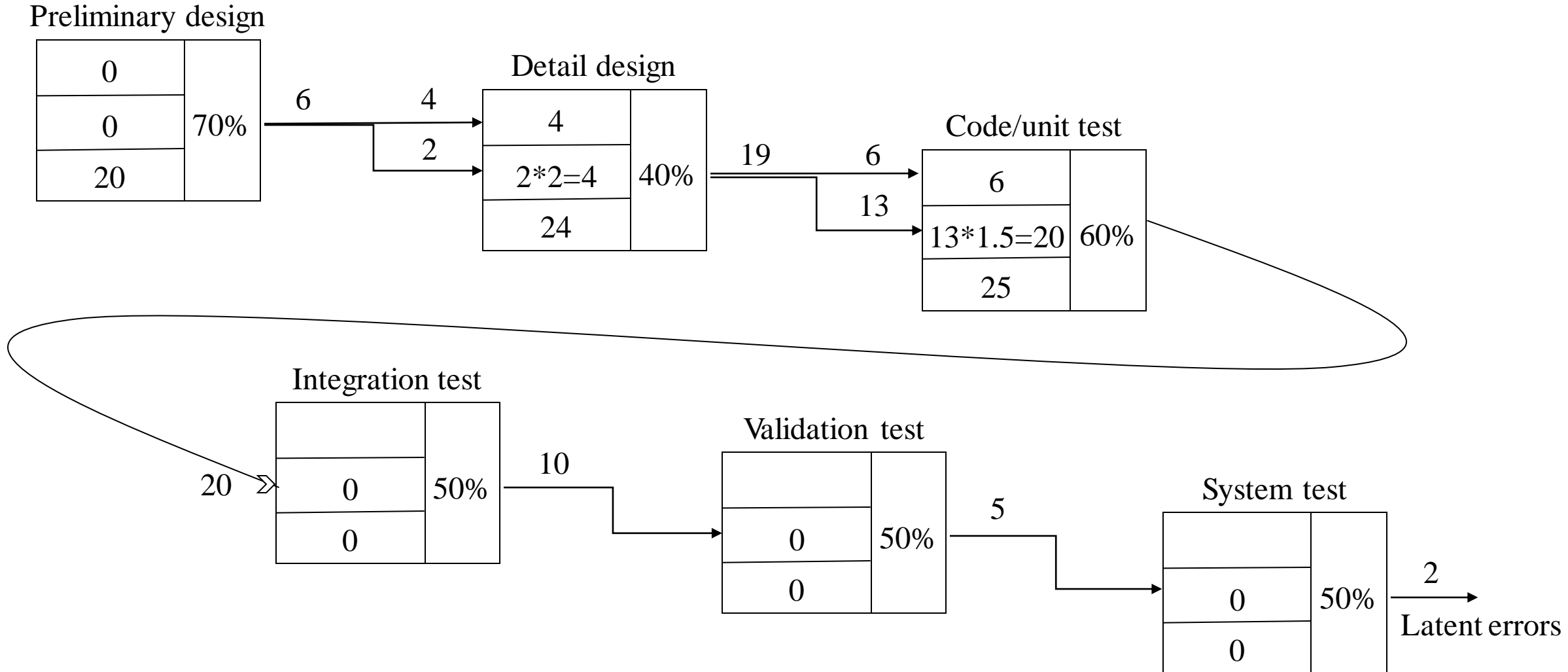


Figure 3: Defect amplification. Reviews conducted

Software Quality Assurance

❑ Software Reviews

- Defect amplification and removal
 - Total cost for development and maintenance
 - › Errors discovered during design: 27 (14+13)
 - › Errors discovered before testing: 31
 - › Errors discovered during testing: 18 (10+5+3)
 - › Errors discovered after release: 02
 - › $\text{Cost} = (1 \times 27) + (6.5 \times 31) + (15 \times 18) + (70 \times 2) = 639$ monetary unit

❑ Statistical SQA

- Information about software defects is collected and categorized
- An attempt is made to trace each defect to its underlying cause (non conformance to specifications, design error, violation of standards, poor communication with the customer)
- Using the Pareto principle (80 percent of the defects can be traced to 20 percent of all causes), isolate the 20 percent (the “vital few”)
- Once the vital few causes have been identified, move to correct the problems that have caused the defects