COURSE NAME

SOFTWARE QUALITY AND TESTING

CSC 4133

(UNDERGRADUATE)

CHAPTER 2

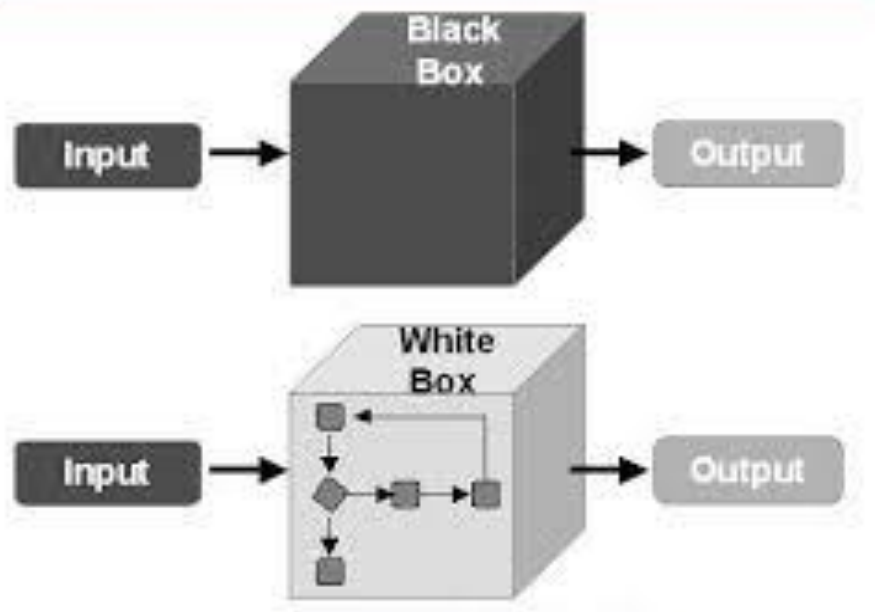
SOFTWARE QUALITY

QUALITY PERSPECTIVES

- ❑ Subject of SQAT: People's perspectives
  - External/Consumer: customers and users
  - Internal/Producer: developer, testers, and managers
  - Other: 3rd party, indirect users (email notification)

- ❑ Objects of SQAT:
  - Software products, systems, and services

Comparison among Black-Box & White-Box Tests



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- ❑ External View
  - mostly sees a software system as a black box, where one can observe its behavior but not see through inside
- ❑ Internal View
  - mostly sees a software system as a white box, or more appropriately a clear box, where one can see what is inside and how it works

VIEWS IN SOFTWARE QUALITY (KITCHENHAM AND PFLEEGER)

1. Mystical view (misconception)
   - Quality is something that can be recognized through experience, but not defined in some tractable form
   - A good quality object stands out, and it is easily recognized

User view – fitness for the purspose.

2. User view
   - Quality concerns the extent to which a product meets user needs and expectations
   - A product is of good quality if it satisfies a large number of users
   - It is useful to identify the product attributes which the users consider to be important
   - This view may encompass many subject elements, e.g. usability, reliability, efficiency, etc.

VIEWS IN SOFTWARE QUALITY

3. Manufacturing view

- Conformance to process standards/requirements
- Quality is seen as conforming to requirements leads to consistency in products
- Any deviation from the requirements is seen as reducing the quality of the product
- Products are manufactured "right the first time" so that the cost can be reduced (very low changing possibility and without re-work)
- Product quality can be incrementally improved by improving the process
- The CMM and ISO 9001 models are based on the manufacturing view

VIEWS IN SOFTWARE QUALITY

4. Product view

- If a product is manufactured with good internal properties, then it will have good external properties

5. Value-based view

- Customers' willingness to pay for a software
- Value-based view represents the merger of two concepts: excellence and worth
- Quality is a measure of excellence, and value is a measure of worth
- The value-based view makes a trade-off between cost and quality

WHY MEASURE QUALITY?

- ❑ Measurement allows us to have a quantitative view of the quality concept
- ❑ What are the reasons for developing a quantitative view of quality?
  - ▪ Baseline:
    - ○ Measurement allows us to establish baselines for qualities to achieve (Usability- extract all the information within 20 minutes from a website)
  - ▪ Quality improvement based on cost:
    - ○ Organizations make continuous improvements in their process models and an improvement has a cost associated with it. Measurement is key to process improvement
  - ▪ Know the present level for future planning:
    - ○ The needs for improvements can be investigated after performing measurements

SOFTWARE QUALITY FACTOR

- ❑ Software Quality in terms of quality factors and quality criteria
- ❑ McCall's Quality Factors and Criteria

Quality Factors

- A quality factor represents the behavioral characteristic of a system
- Examples
  - Correctness
  - Reliability
  - Efficiency
  - Performance

SOFTWARE QUALITY FACTOR

❑ EFFICIENCY

- The amount of computing resources and code required by program to perform a function (e.g. multi-tasking)
- *At least 25 percent of the processor capacity and RAM available to the application shall be unused at the planned peak load conditions.*

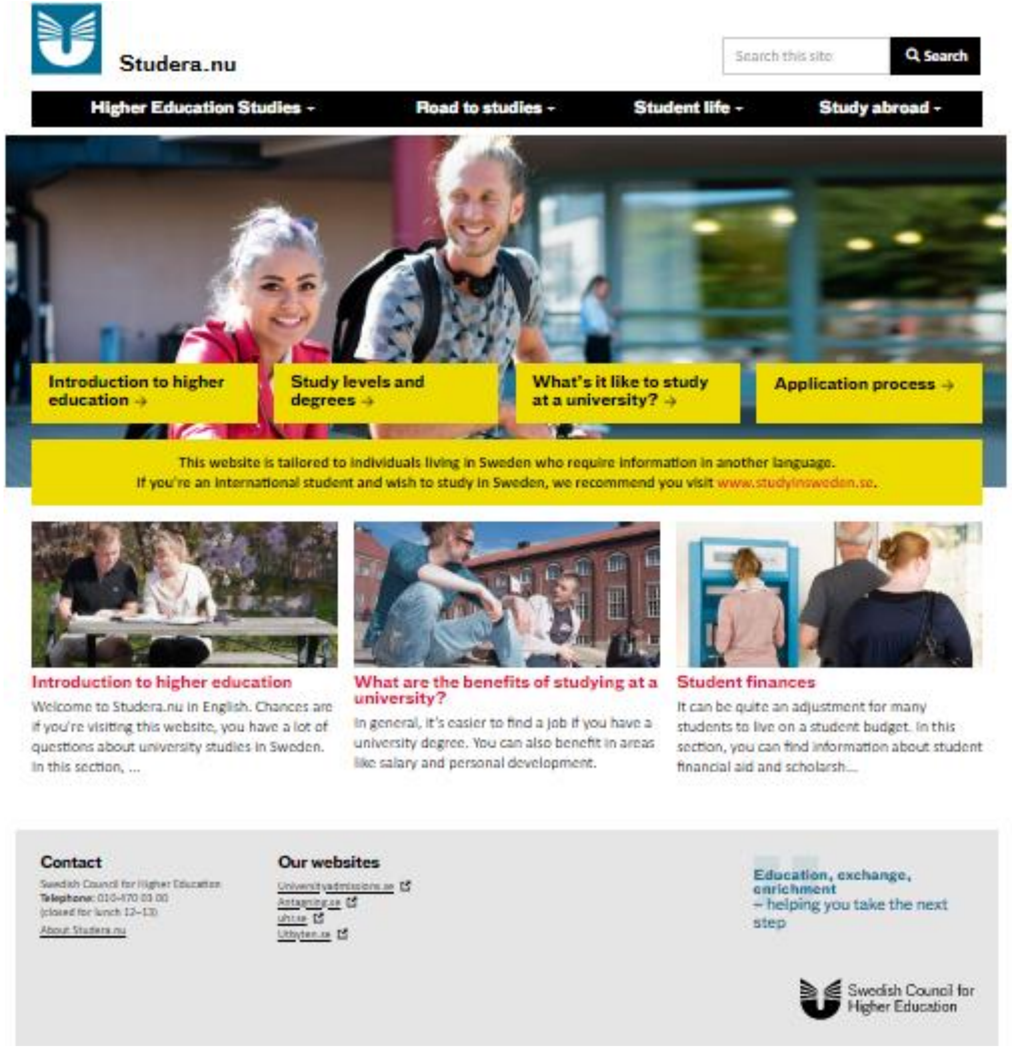
❑ INTEGRITY / SECURITY

- The extend to which access to a software or data by unauthorized persons can be controlled.
- CHOICE POINT security issue of unprotected data on a tape
- *Only users who have Auditor access privileges shall be able to view customer transaction histories.*

SOFTWARE QUALITY FACTOR

❑ USABILITY

- The effort required to learn, operate, prepare input, and interpret output of a program
- Time required (e.g. 30 minutes maximum) to extract information regarding higher studies application in Sweden from the website http://studera.nu
- *A trained user shall be able to submit a complete request for a chemical selected from a vendor catalog in an average of four and a maximum of six minutes.*



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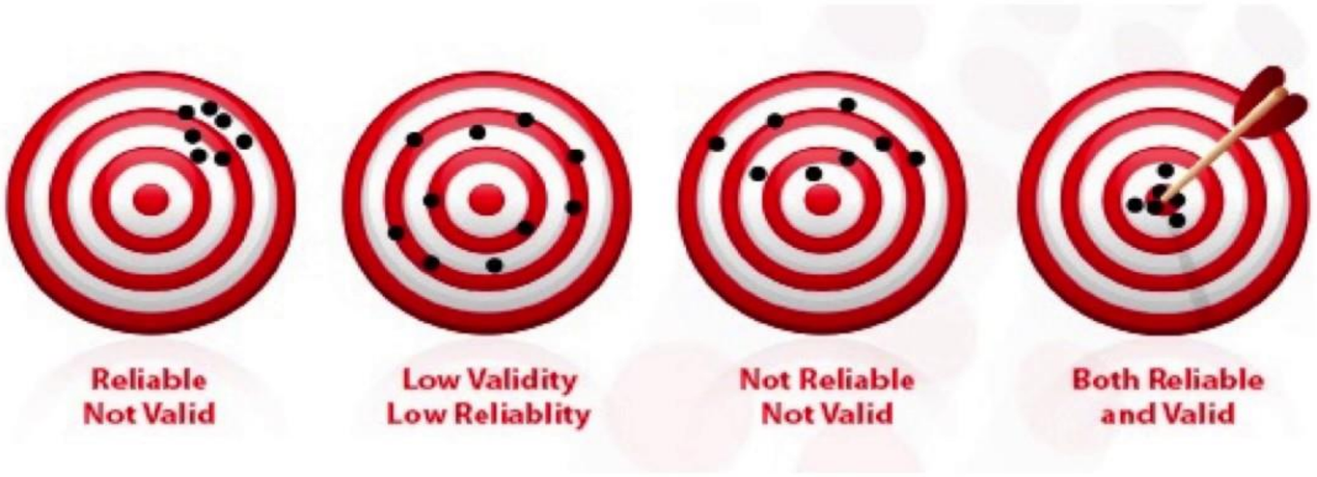
SOFTWARE QUALITY FACTOR

❑ RELIABILITY AND CORRECTNESS

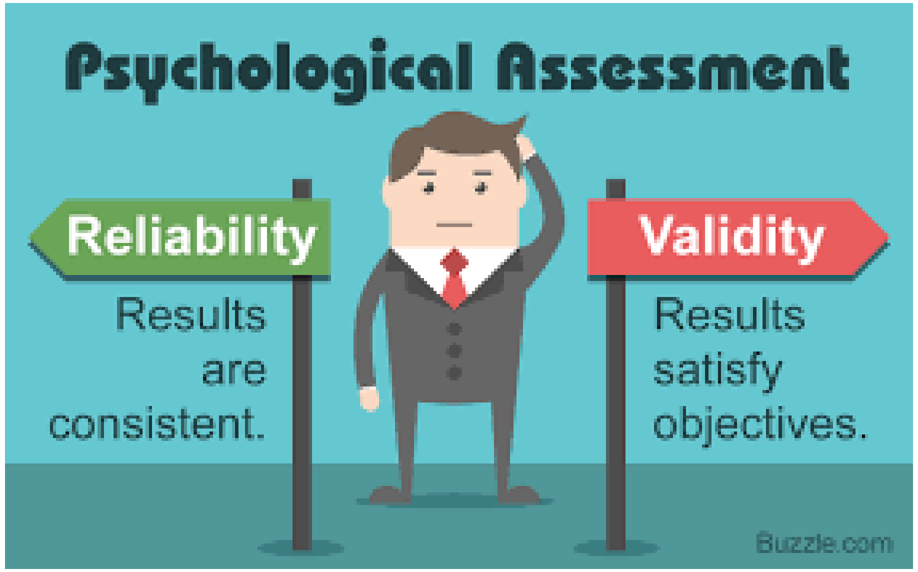
- The extend to which a program can be expected to perform its intendent functions with required precession (user's objectives/satisfaction).
- The probability of the software executing without failure for a specific period of time is known as reliability

Example: *No more than five experimental runs out of 1000 can be lost because of software failures*

Reliability & Validity



Evaluating the validity and reliability of research data



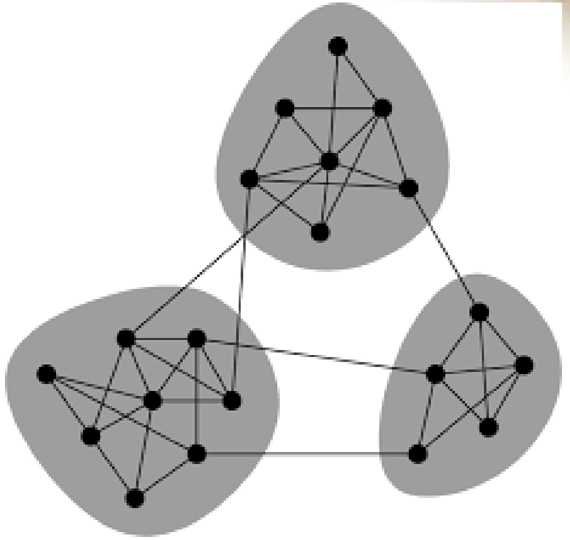
SOFTWARE QUALITY CRITERIA

Software Quality Criteria

- A quality criterion is an attribute of a quality factor that is related to software development
- Example: Modularity, testability, maintainability, reusability, etc.

❑ MODULARITY

- Modularity is an attribute of the architecture of a software system
- A highly modular software allows designers to put cohesive components in one module, thereby increasing the maintainability of the system
- Compatibility among the module integration



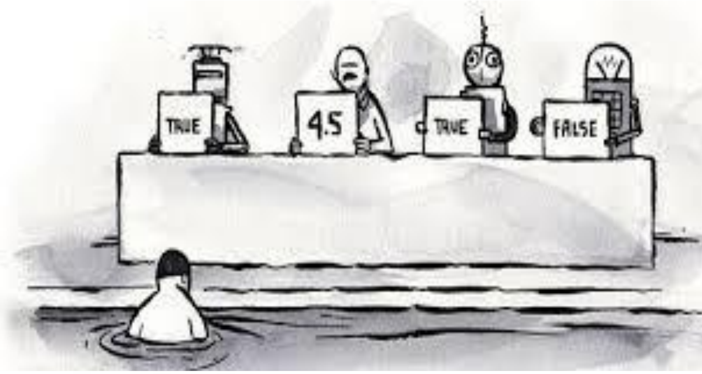
SOFTWARE QUALITY CRITERIA

MAINTAINABILITY

- The effort required to locate and fix a defect in an operational program
- *A maintenance programmer shall be able to modify existing reports to conform to revised chemical-reporting regulations from the federal government with 20 labor hours or less of development effort.*

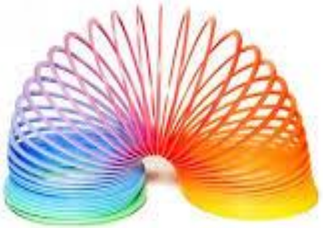
TESTABILITY

- The effort required to program to ensure that it performs its intendent functions.
- *The maximum cyclomatic complexity* of a module shall not exceed 20*



FLEXIBILITY

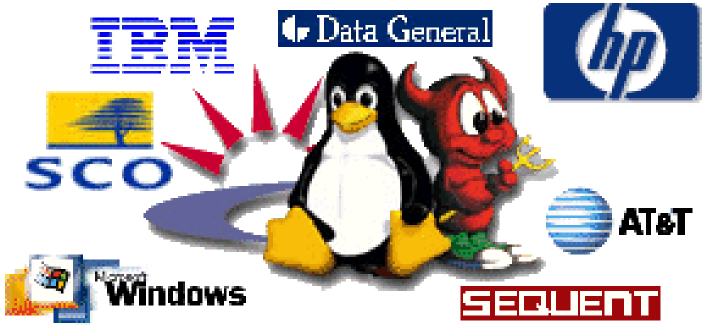
- The effort required to modify an operational program.
- *A maintenance programmer who has at least six months of experience supporting this product shall be able to make a new copy output available to the product, including code modifications and testing, with no more than one hour of labor.*



SOFTWARE QUALITY CRITERIA

❑ PORTABILITY

- The effort required to transfer a program from one hardware and/or software environment to another

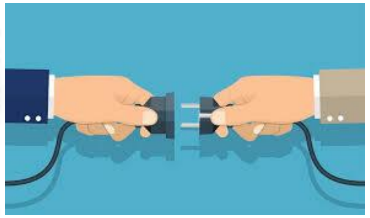


❑ REUSABILITY

- The extend to which parts of a software system can be reused in other application
- *The chemical structure input functions shall be designed to be reusable at the object code level in other applications that use the international standard chemical structure representations.*

❑ INTEROPERABILITY

- The effort required to couple one system with another (Biometric SIM registration, Blockchain)
- *The Chemical Tracking System shall be able to import any valid chemical structure from the ChemiDraw (version 2.3 or*



ISO-9126 QUALITY FRAMEWORK

- ISO (International Organization for Standardization)
- ISO-9126:
  - The mostly influential one in the software engineering community today
  - Provides a hierarchical framework for quality definition, organized into quality characteristics and sub-characteristics
  - Six top-level quality characteristics, each associated with its own exclusive (non-overlapping) sub-characteristics

Quality characteristics

- Functionality: what is needed
- Reliability: functions correctly
- Usability: effort to use
- Efficiency: resource needed
- Maintainability: correct/improve/adapt
- Portability: from one environment to another

QUALITY EXPECTATIONS

- External/Consumer expectations
  - "good enough" for the PRICE
    - Fit-for-use: doing the "right things"
    - Conformance: doing the "things right"
- Expectations for different software
  - General: functionality & reliability
  - Usability: GUI/end-user/web/etc.
  - Safety: safety-critical systems (autopilot)

- Internal/Producer expectations
  - "good enough" for the COST
    - Mirror consumer side
    - Functionality & correctness via V&V
  - Service related: maintainability
  - Interfacing units: interoperability
  - 3rd party: modularity (outsource)

REFERENCES

- ❑ Software Testing And Quality Assurance – Theory and Practice - Kshirasagar Naik & Priyadarshi Tripathy
- ❑ Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement - Jeff Tian