



# SQA CONCEPT and DEFINITION



# What is software ?

- **Software – IEEE definition :**
  - computer programs, procedures,
  - possibly associated documentation
  - data pertaining to the operation of computer system.



# Software errors, faults and failures

- The origin of the software failures → software error → programmers
  - can be a grammatical error in one or more of the code lines,
  - a logical error in carrying out one or more of the client's req.
- Not all software errors become software fault.
- Software error can cause improper functioning of the software in general or in a specific application
- In the software failures that disrupt our use of the software.
- A software fault become a software failure only when it is “activated” - when the software user tries to apply the specific, faulty application.
- In many situation,
  - a software fault is never activated due to the user's lack of interest in the specific application
  - to the fact that the combination of conditions necessary to activated the fault never occurs



# Classification of the causes of software errors

1. Faulty definition of requirements
2. Client-developer communication failures
3. Deliberate deviations from software requirements
4. Logical design errors
5. Coding errors
6. Non-compliance with documentation and coding instructions
7. Shortcomings of the testing process
8. Procedure errors
9. Documentation errors




# Software Quality

- IEEE definition :

Software quality is the degree to which system, component, or process meets

1. specified requirements.
2. customer or user needs or expectations.



# Software Quality (2)

## ■ Pressman's definition :

Software quality is defined as :

Conformance to explicitly stated functional and performance requirements, explicitly documented development standards, and implicit characteristics that are expected of all professionally development software.



# Software Quality Assurance

- **IEEE definition -**

Software quality assurance is :

1. A planned and systematic pattern of **all actions** necessary to provide adequate confidence that an item or product conforms to established technical requirements.
2. A **set of activities designed** to evaluate the process by which the products are developed or manufactured. Contrast with quality control.



# Quality Control

- Quality control equals to variation control.
- Quality control is achieved through a series of inspections, reviews and tests applied throughout the development cycle, to ensure that the products meet their requirements with minimal variation.
- In software development, we look for:
  - variation (of the implementation) from the requirements.
  - variation in the software process (the goal is to have a repeatable process )





# Cost of Quality – an example

## Case study by IBM's Rochester development facility

### ■ With Inspection/Review With Inspection/Review

Total no. of codes	200,000 lines
No. of potential defects prevented	3112 defects
Time used for inspection	7053 hours
Programmer costs	US\$40/hour
<b>Total prevention cost</b>	<b>US\$282,120</b>
Prevention cost per error	US91

### ■ Without Inspection/Review

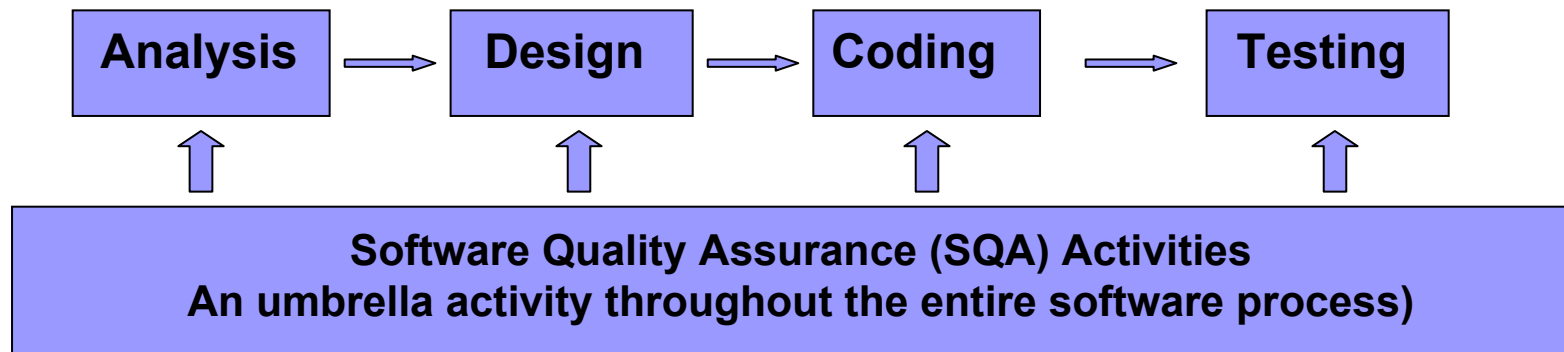
No. of defects per KLOC	1 per 1000 lines
No. of defects shipped	200
Estimated cost by IBM per "field fix"	US\$25,000
<b>Total cost to remove defects</b>	<b>US\$5 million</b>

“Prevention is better than cure. ”

# Software Quality Assurance (2)

- The goal of Software Engineering is to produce “high quality” software.
- SQA is an “Umbrella Activity” that is applied throughout the entire software process to achieve “high-quality” software.
- SQA reduces the amount of rework, results in lower costs, time and more importantly, time-to market.

## A typical Software Process





# Software Quality Assurance (3)

## SQA encompasses:

1. A quality management focus.
2. Effective use of software engineering methods and tools.
3. Formal technical review (FTR) throughout the entire software process.
4. A multi-tiered testing strategy (unit testing, integration testing, validation testing and system testing).
5. Change control and management.
6. Compliance with software development standards.
7. Measurement and reporting mechanism.

### ■ The work product:

A Software Quality Assurance Plan to define the software team's SQA strategy.



# SQA – expanded definition

- **Software quality assurance is :**

A systematic, planned set of actions necessary to provide adequate confidence that the software development process or the maintenance process of a software system product conforms to established functional technical requirements **as well as with the managerial requirements of keeping the schedule and operating within the budgetary confines.**



# The Objectives of SQA activities

## Software development (process-oriented) :

- Assuring an acceptable level of confidence that the software will conform to
  - functional technical requirements.
  - managerial scheduling and budgetary requirements.
- Initiating and managing of activities for the improvement and greater efficiency of software development and SQA activities.
  - ( improving the prospects that functional and managerial requirements will be achieved while reducing the costs of carrying out the software development and SQA activities )



# The Objectives of SQA activities


## Software maintenance (product-oriented) :

- Assuring an acceptable level of confidence that the software maintenance activities will conform to
  - functional technical requirements.
  - managerial scheduling and budgetary requirements.
- Initiating and managing of activities to improve and increase the efficiency of software maintenance and SQA activities.
  - ( This involves improving the prospects of achieving functional and managerial requirements while reducing the cost. )



# SQA Players

- SQA activities are carried out by two groups of people:
  - The software engineer group: who apply solid technical methods and measures to address quality, conduct formal technical reviews and perform planned software testing.
  - The SQA group: who are responsible for quality assurance, planning, oversight, keeping, analysis and report.



# Role of SQA Group

- The job is to assist the software team in achieving a high quality end products.
- The roles of the independent SQA group are:
  - Prepare a SQA plan for a product.
  - Participates in the development of the product's software process description.
  - Review software engineering activities to verify compliance with the defined software process.
  - Audit software work products to verify compliance with those defined as part of the software process.
  - Ensure that deviations in software work and work products are documented and handled according to a documentation documented procedure.
  - Records any noncompliance and reports to senior management.





# SQA and Software Engineering

- IEEE definition – software engineering is :
  1. The application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software; that is, the application of engineering the software.
  2. The study of approach as in (1).



# Summary

1. Define software, software quality and software quality assurance
2. Distinguish between software errors, software faults and software failures.
3. Identify the various causes of software errors.
4. Explain the objectives of software quality assurance activities.
5. Distinguish and explain the differences between software quality assurance and quality control.
6. Explain the relationship between software quality assurance and software engineering