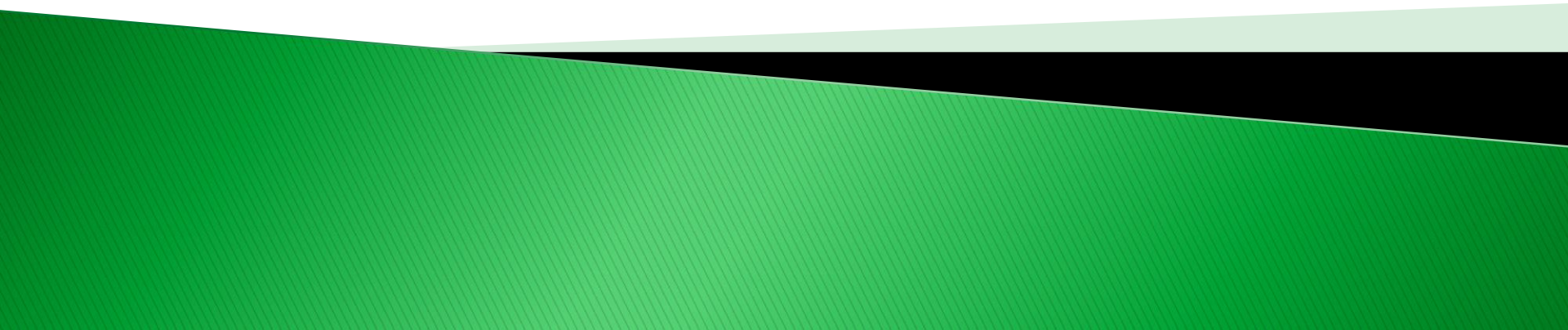


# **Module 2 (Part III)**

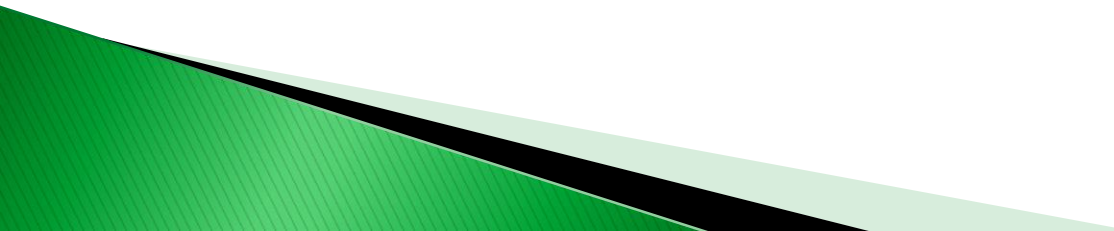
## **Software Quality**



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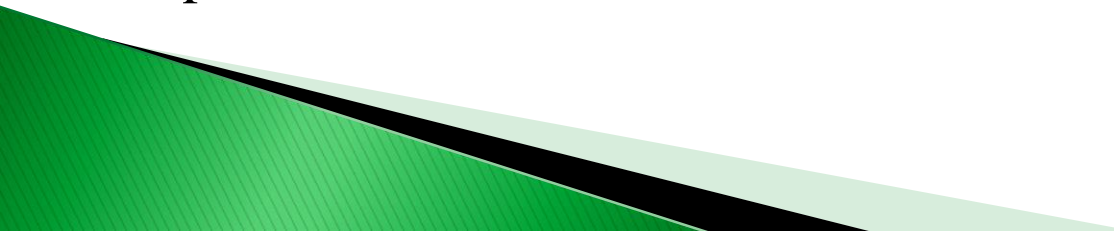
## ❖ WHAT IS QUALITY?


- ▶ To say that a certain product is a *quality product* implies that the product is of good quality
  - ▶ On the other hand, people certainly use the term *bad quality* to express their dissatisfaction with the products or services they use
  - ▶ Therefore, the adjective *good* is implicitly attached to the word *quality* in the minds of most people
  - ▶ Thus, the word *quality* connotes *good quality* to most people, including technical professionals
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- ▶ Before attempting a more elaborate definition of quality, let us consider the various connotations the word invokes, as it means different things in different sections of society:

- 1) For a **customer or end user** of a product, quality connotes defect-free functioning, reliability, ease of use
- 2) For a **producer of goods**, quality connotes conformance of the product to specifications
- 3) For a **provider of services**, quality connotes meeting deadlines and delivery of service that conforms to customer specifications and standards
- 4) For **government bodies**, quality connotes safety and protection of consumers from fraud
- 5) For an **industry association or standards body**, quality connotes safeguarding the industry's reputation, protecting the industry from fraud

- ▶ The International Organization for Standardization (ISO 9000, second edition, 2000) defines quality as the **degree** to which a set of inherent **characteristics** fulfills **requirements**
  - ▶ Quality can be used with such adjectives as poor, good, or excellent
  - ▶ This definition contains three key terms: **requirements, characteristics, and degree**
  - ▶ **Requirements** can be stated by a customer as product specifications
  - ▶ **Characteristics** refers to the capability of the deliverable
  - ▶ The word **degree** implies that quality is a continuum, beginning with zero and moving toward, perhaps, infinity
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- ▶ **Quality** is an attribute of a **product** or **service** provided to consumers that conforms the best of the **available specifications** for that product or service
  - ▶ It includes making **those specifications** available to the end user of the product or service
  - ▶ The specifications that form the basis of the product or service provided may have been defined by a government body, an industry association, or a standards body
  - ▶ Where such a definition is not available, the provider may define the specifications
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- ▶ The result of a product or service that meets the above definition of quality is that the customer is able to effectively use the product for the length of its life or enjoy the service fully
  - ▶ This result further mandates that the provider is responsible for providing any support that is required by the customer
  - ▶ Any product or service that meets the requirements of this definition is rated a “quality product/service”
  - ▶ Any product or service that does not meet the requirements of this definition is rated “poor quality”
  - ▶ **Reliability** of a product is its capability to function at the defined level of performance for the duration of its life
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# ❖ FOUR DIMENSIONS OF QUALITY


- ▶ Quality has four dimensions

- ❖ **Specification quality**

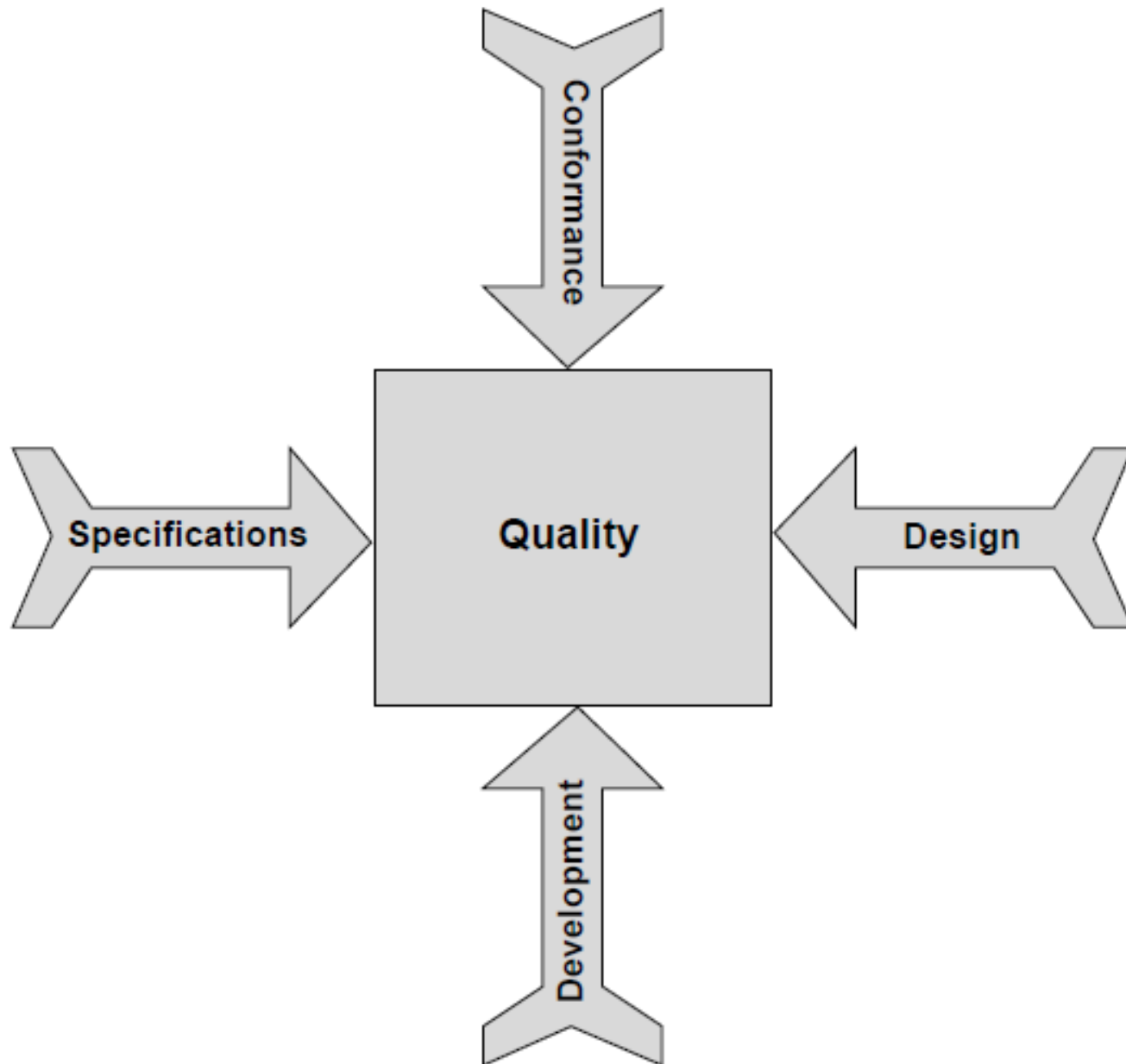
- ❖ **Design quality**

- ❖ **Development (software construction) quality**

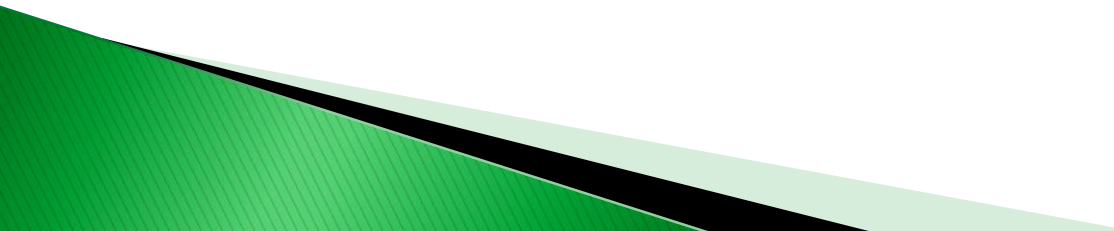
- ❖ **Conformance quality**

- ▶ Specifications are the starting point in the journey of providing a product or service, followed by design and then development
  - ▶ Conformance quality is ensuring how well that quality is built into the deliverable at every stage
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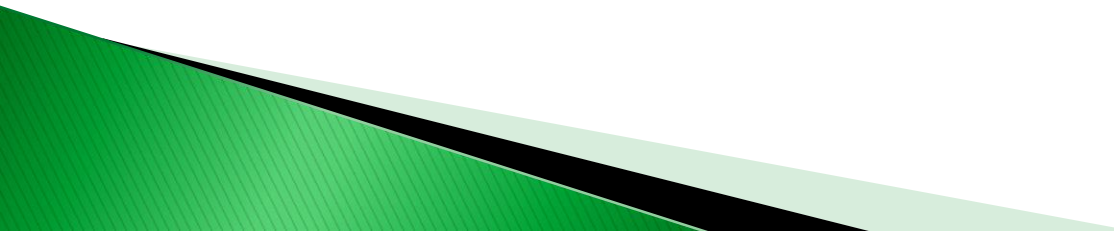
# 1) Specification Quality

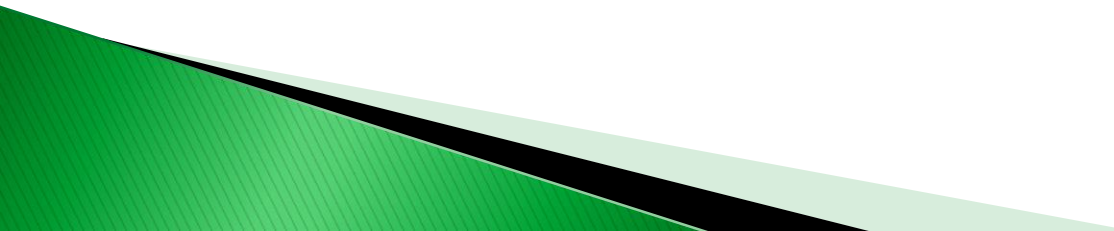
- ▶ Specification quality refers to **how well the specifications are defined** for the product or service being provided
  - ▶ Specifications have no predecessor activity, and all other activities succeed specifications
  - ▶ Thus, **if the specifications are weak, design will be weak**, resulting in the development and manufacture of an incorrect product, and the effort spent on ensuring that quality is built in will have been wasted
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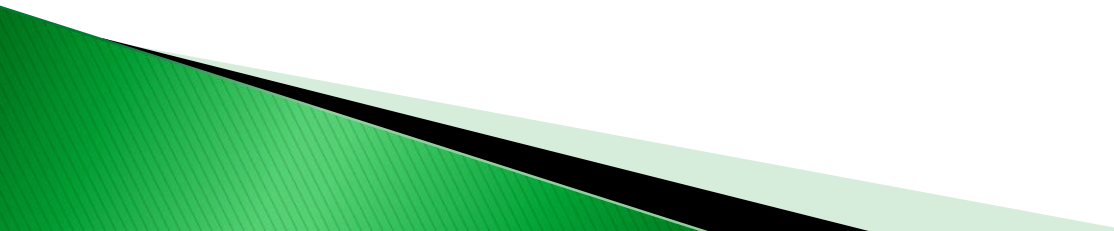
► Specifications normally should include the following six aspects:

- 1) **Functionality aspects** : Specify **what functions** are to be achieved by the product or service
  - 2) **Capacity aspects** : Specify the **load the product can carry** (such as 250 passengers on a plane or 100 concurrent users for a Web application)
  - 3) **Intended use aspects** : Specify the **need or needs the product or service** satisfies
  - 4) **Reliability aspects** : Specify **how long the product can be enjoyed** before it needs maintenance
  - 5) **Safety aspects** : Specify **the threshold levels for ensuring safety to persons** and property from use of the product or service
  - 6) **Security aspects** : Specify any **threats** for which the product or service needs to be prepared
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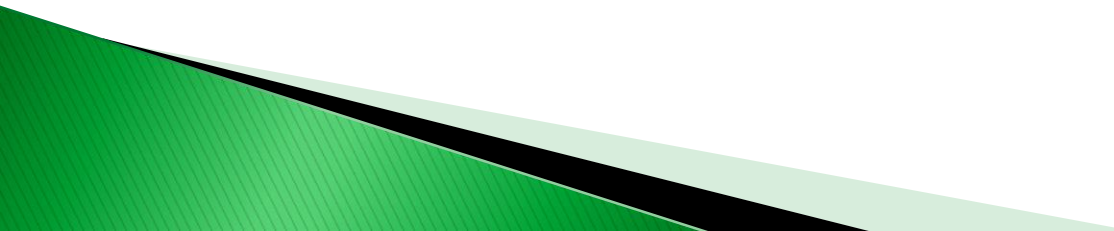
## ➤ Ensuring Quality in Specifications

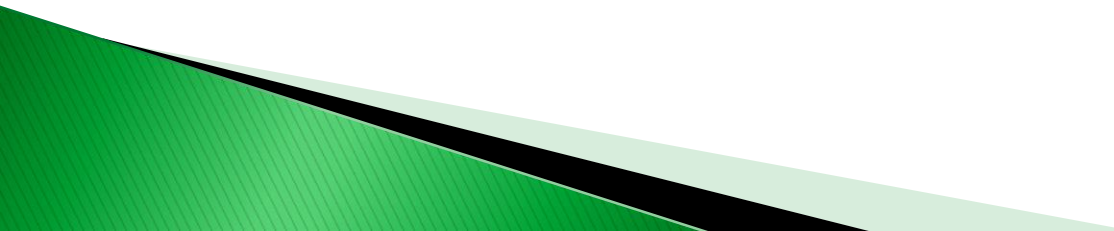
- ▶ In the software industry, specifications are referred to as **user requirements**
  - ▶ The following are possible scenarios for obtaining user requirements:
    - 1) A business analyst conducts a **feasibility study, writes up a report, and draws up the user requirements**. The analyst:
      - a) Meets with all the **end users** and notes their requirements and concerns
      - b) Meets with the **function heads** and notes their requirements and concerns
      - c) Meets with **management personnel** and notes their requirements and concerns
      - d) **Consolidates the requirements** and presents them to select end users, function heads, and management personnel and receives their feedback, if any
      - e) **Implements the feedback** and finalizes specifications
- 

- 2) A ready set of user requirements is presented as part of a request for proposal
  - 3) A request for proposal points to a similar product and requests replication with client-specific customization
  - ▶ Regardless of the scenario, once the specifications are ready, quality assurance steps in
  - ▶ The role of quality assurance in this area is to ensure that the specifications are exhaustive and cover all areas
  - ▶ Including functionality, capacity, reliability, safety, security, intended use, etc.
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- ▶ The tools for building quality into specifications are as follows:
    - ❖ **Process documentation** - Details the methodology for gathering, developing, analyzing, and finalizing the specifications
    - ❖ **Standards and guidelines, formats, and templates** - Specify the minimum set of specifications that needs to be built in
    - ❖ **Checklists** - Help analysts to ensure comprehensiveness of the specifications
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## 2) Design Quality

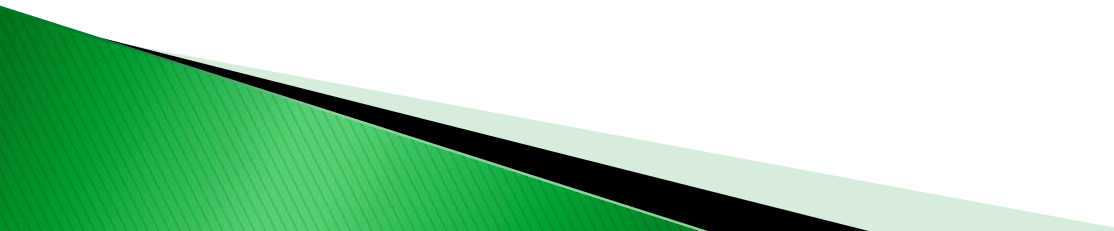
- ▶ Design quality refers to how well the product or service to be delivered is designed
  - ▶ The objectives for design are to fulfill the specifications defined for the product or service being provided
  - ▶ Design determines the shape and strengths of the product or service
  - ▶ Therefore, if the design is weak, the product or service will fail, even if the specifications are very well defined
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- ▶ Design can be split into two phases: **conceptual design and engineering**
  - ▶ *Conceptual design* selects the approach to a solution from the multiple approaches available
  - ▶ *Engineering* uses the approach selected and works out the details to realize the solution
  - ▶ Conceptual design is the creative part of the process, and engineering is the details part
  - ▶ In terms of software, conceptual design refers to **software architecture**, navigation, number of tiers, approaches to flexibility, portability, maintainability, and so on
  - ▶ Engineering design refers to **database design**, program specifications, screen design, report design, etc.
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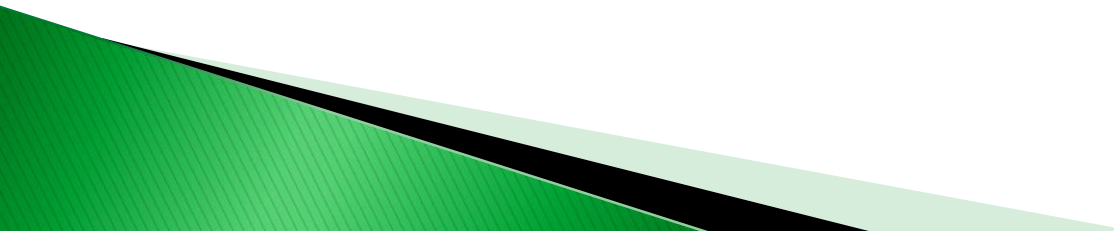
► Software design normally contains the following elements:

- 1) Functionality design
  - 2) Software architecture
  - 3) Navigation
  - 4) Database design
  - 5) Development platform
  - 6) Deployment platform
  - 7) User interface design
  - 8) Report design
  - 9) Security
  - 10) Fault tolerance
  - 11) Capacity
  - 12) Reliability
  - 13) Maintainability
  - 14) Efficiency and concurrence
  - 15) Coupling and cohesion
  - 16) Program specifications
  - 17) Test design
- 

- ▶ It is normal to conduct a *brainstorming session* at the beginning of a software design project, to select **one optimum design alternative** and to decide on the overall design aspects
  - ▶ Such as the number of tiers, technology platform, software coupling and cohesion, etc.
  - ▶ A brainstorming session helps designers arrive at the **best possible solution** for the project at hand
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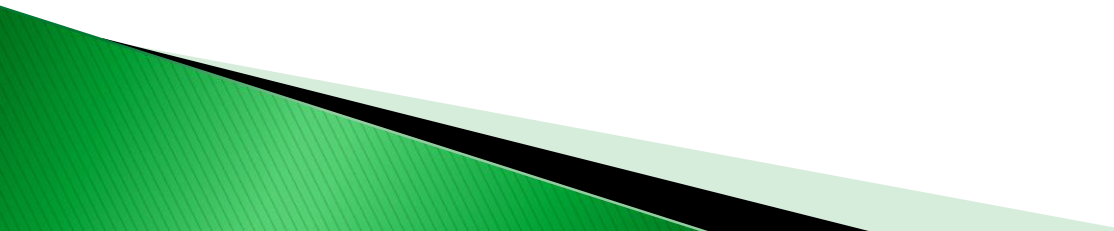
## ➤ Ensuring Quality in Design


- ▶ Normally, software design is a two-step process:
  - **Conceptual design** - Referred to as **high-level design**, functional design specification, software requirements specification, and software architecture design
  - **Engineering design** - Referred to as **low-level design**, detailed design specification, software design description, and software program design

- ▶ The tools for building quality into design include the following:
    - ❖ **Process documentation** - Details the methodology for **design alternatives** to be considered, **criteria** for selecting the alternative for the project, and finalizing the **conceptual design**
    - ❖ **Standards and guidelines, formats, and templates** - Specify the **possible software architectures** along with their attendant advantages and disadvantages and so on
    - ❖ **Checklists** - Help designers to ensure that **design** is carried out comprehensively and appropriately
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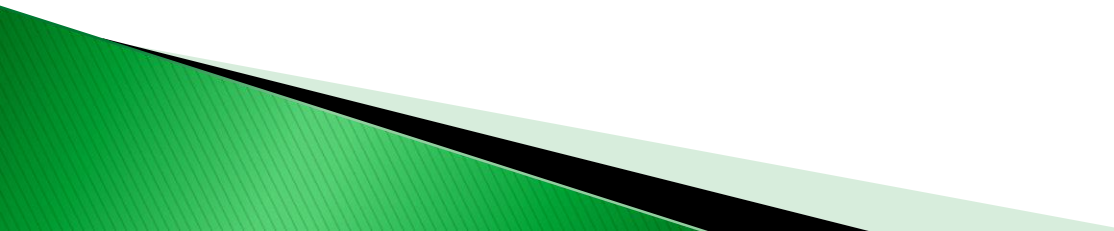
### 3) Development (software construction) Quality

The following activities form part of developing software:

- ☐ Create the database and table structures
  - ☐ Develop dynamically linked libraries for common routines
  - ☐ Develop screens
  - ☐ Develop reports
  - ☐ Develop unit test plans
  - ☐ Develop associated process routines for all other aspects, such as security, efficiency, fault tolerance, etc.
- 

- ▶ Good-quality construction is achieved by adhering to the ***coding guidelines*** of the programming language being used
  - ▶ Normally there is a separate coding guideline for every programming language used in an organization
  - ▶ Coding guidelines **contain naming conventions, code formatting** that help developers write reliable and defect-free code
  - ▶ Of course, it is very important to have **qualified people** trained in software development
  - ▶ Construction follows software design, and it should **always conform to the design document**
  - ▶ In this way, good quality in construction can be achieved
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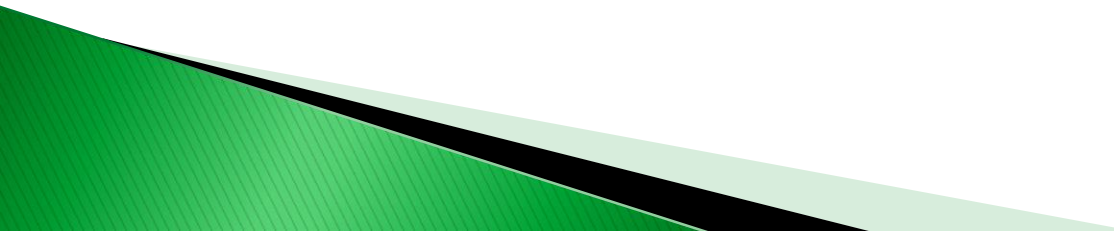
## ➤ Ensuring Quality in Development (Software Construction)

- ▶ Quality is built in by adhering to the **organizational standards** for code quality as well as the coding guidelines for the development language being used
  - ▶ Uncontrolled changes can wreak havoc with code quality
  - ▶ Therefore, change management and configuration management assume importance for ensuring code quality
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- ▶ There are two techniques to ensure that quality is built into a product:
  - Reviews (walkthroughs)
  - Testing

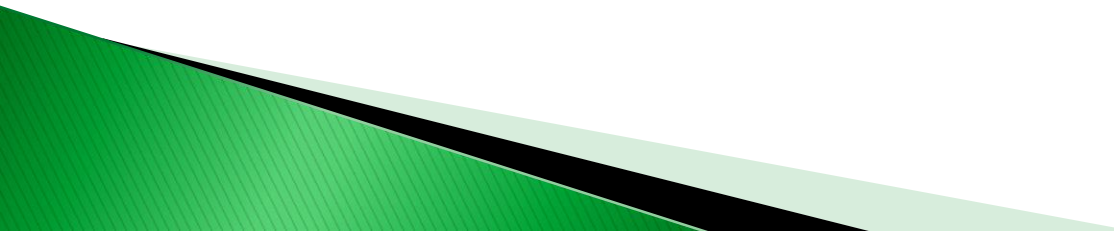


## 4) Conformance Quality

- ▶ Conformance quality deals with how well an organization ensures that quality is built into a product through the above three dimensions
  - ▶ It is one thing to do a quality job
  - ▶ But it is quite another to unearth any defects lurking in the work product and ensure that a good-quality product is indeed built
  - ▶ Essentially, conformance quality examines how well quality control is carried out in the organization
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## ➤ Ensuring Conformance Quality

- ▶ Ensuring that conformance quality is at desirable levels in the organization is achieved through :
  - Audits
  - Quality measurements
  - Metrics
  - Benchmarking
- ▶ Defect removal efficiency of verification and validation activities, defect injection rate, and defect density are all used for this purpose

- ▶ **Audits** also are conducted to ensure that projects conform to various applicable standards for building quality into all activities, including specifications and design
  - ▶ In addition, organizational data is **benchmarked** against industry benchmarks, and corrective or preventive actions are taken to ensure that organizational conformance is indeed on a par with the industry
  - ▶ Conformance quality is built in through **process definition** and **continuous improvement** for all software development activities as well as **quality assurance**
- 

<b>Quality dimension</b>	<b>How to build in quality</b>	<b>Techniques for ensuring quality</b>
<b>Quality of specifications</b>	Specification development process documentation; standards and guidelines, formats, and templates for defining specifications; and checklists	Expert reviews, peer reviews, and brainstorming
<b>Quality of design</b>	Software design process documentation; standards and guidelines, formats, and templates for software design; and checklists	Expert reviews, peer reviews, managerial reviews, and brainstorming
<b>Quality of development</b>	Coding guidelines, configuration management, and change management	Peer reviews and software testing
<b>Conformance quality</b>	Diligent application of all quality assurance activities in the organization, process definition, and improvement	Audits, measurement and metrics for quality assurance activities, and benchmarking of organizational metrics against industry metrics