Project Quality Management

Learning Objectives

- Develop a justification for project quality management and its importance in achieving project success for information technology (IT) products and services
- Define project quality management and understand how quality relates to various aspects of IT projects
- Describe quality management planning and how quality and scope management are related
- Discuss the importance of managing quality and quality assurance
- Explain the main outputs of the quality control process

Learning Objectives

- List and describe the tools and techniques for quality control, such as the Basic Tools of Quality, statistical sampling, Six Sigma, and testing
- Summarize the contributions of noteworthy quality experts to modern quality management
- Describe how leadership, the cost of quality, organizational influences, expectations, cultural differences, and maturity models relate to improving quality in IT projects
- Discuss how software can assist in project quality management
- Discuss considerations for agile/adaptive

What Is Project Quality Management?

- International Organization for Standardization (ISO) definition of quality
  - *"Totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs" (ISO8042:1994)*
  - "The degree to which a set of inherent characteristics fulfils requirements" (ISO9000:2000)
- Other definitions of quality
  - Conformance to requirements
    - Project's processes and products meet written specifications
  - Fitness for use

What Is Project Quality Management?

- Project quality management ensures the project will satisfy the needs for which it was undertaken
- Project quality management processes
  - ***Planning quality management***: identifying which quality standards are relevant to the project and how to satisfy them; a metric is a standard of measurement
  - ***Managing quality***: translating the quality management plan into executable quality activities
  - ***Controlling quality***: monitoring specific project results to ensure they comply with the

Planning Quality Management

- Implies the ability to anticipate situations and prepare actions to bring about the desired outcome
- Defect prevention methods
  - Selecting proper materials
  - Training and indoctrinating people in quality
  - Planning a process that ensures the appropriate outcome

Planning Quality Management

- Scope aspects of IT projects
  - ***Functionality***: degree to which a system performs its intended function
  - ***Features***: system's special characteristics that appeal to users
  - ***System outputs***: screens and reports the system generates
  - ***Performance:*** addresses how well a product or service performs the customer's intended use
  - ***Reliability***: ability of a product or service to perform as expected under normal conditions
  - ***Maintainability***: ease of performing maintenance on a product
- All project stakeholders must work together to balance the quality, scope, time, and cost dimensions of the project
  - Project managers are ultimately responsible for quality management on their projects

Managing Quality

- Quality assurance includes all the activities related to satisfying the relevant quality standards for a project
  - Another goal is continuous quality improvement
  - Kaizen is the Japanese word for improvement or change for the better
  - Lean involves evaluating processes to maximize customer value while minimizing waste
  - Benchmarking generates ideas for quality improvements by comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization
  - A quality audit is a structured review of specific quality management activities that help identify lessons learned that could improve performance on current or future projects

Controlling Quality

- Main outputs of quality control
  - Acceptance decisions
  - Rework
  - Process adjustments

Tools and Techniques for Quality Control

- Basic tools of quality that help in performing quality control
  - *Cause-and-effect diagrams*
  - *Control chart*
  - *Checksheet*
  - *Scatter diagram*
  - *Histogram*
  - *Pareto chart*
  - *Flowcharts/run charts*

Tools and Techniques for Quality Control

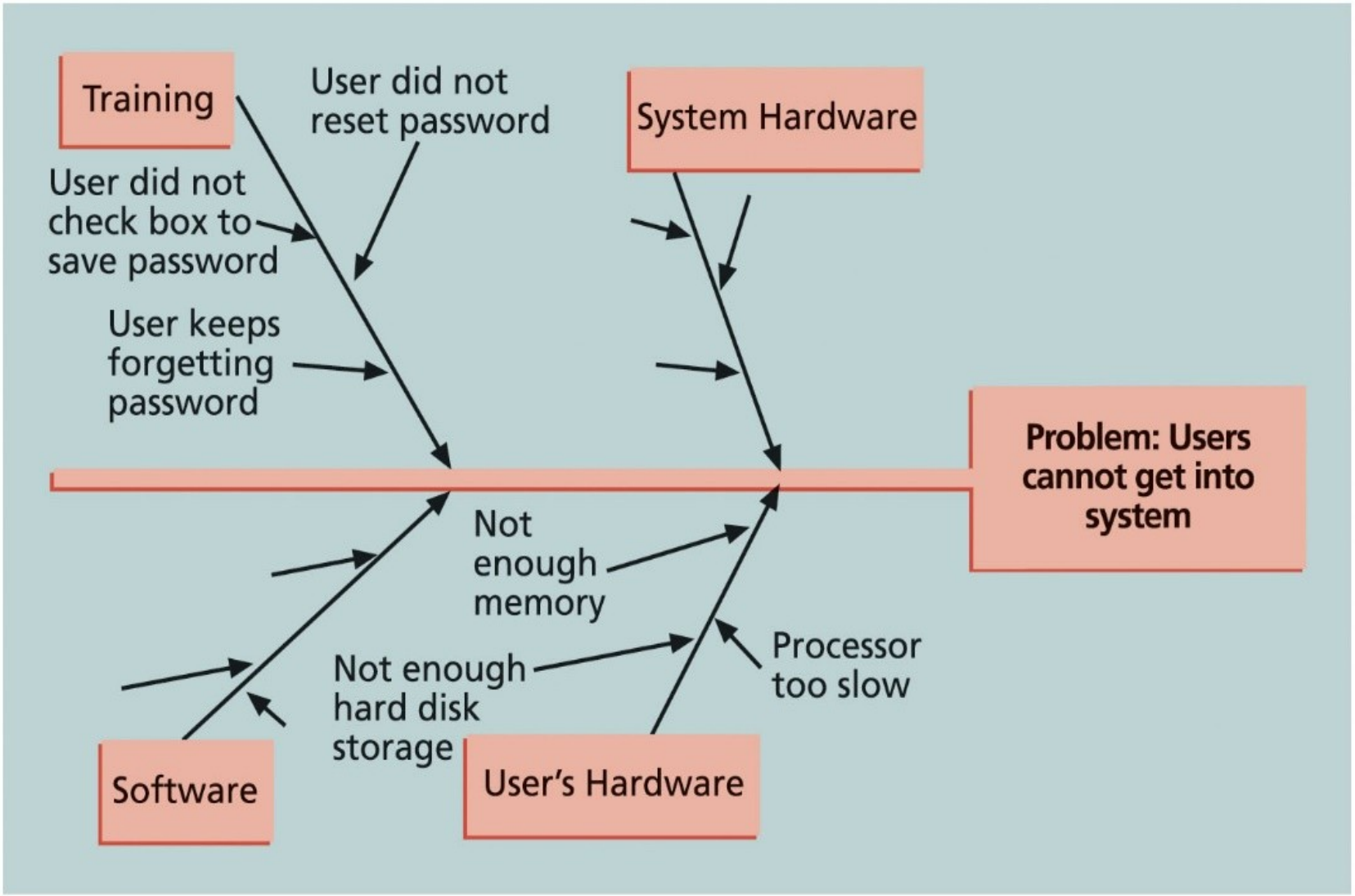


FIGURE 8-2 Sample cause-and-effect diagram

Tools and Techniques for Quality Control

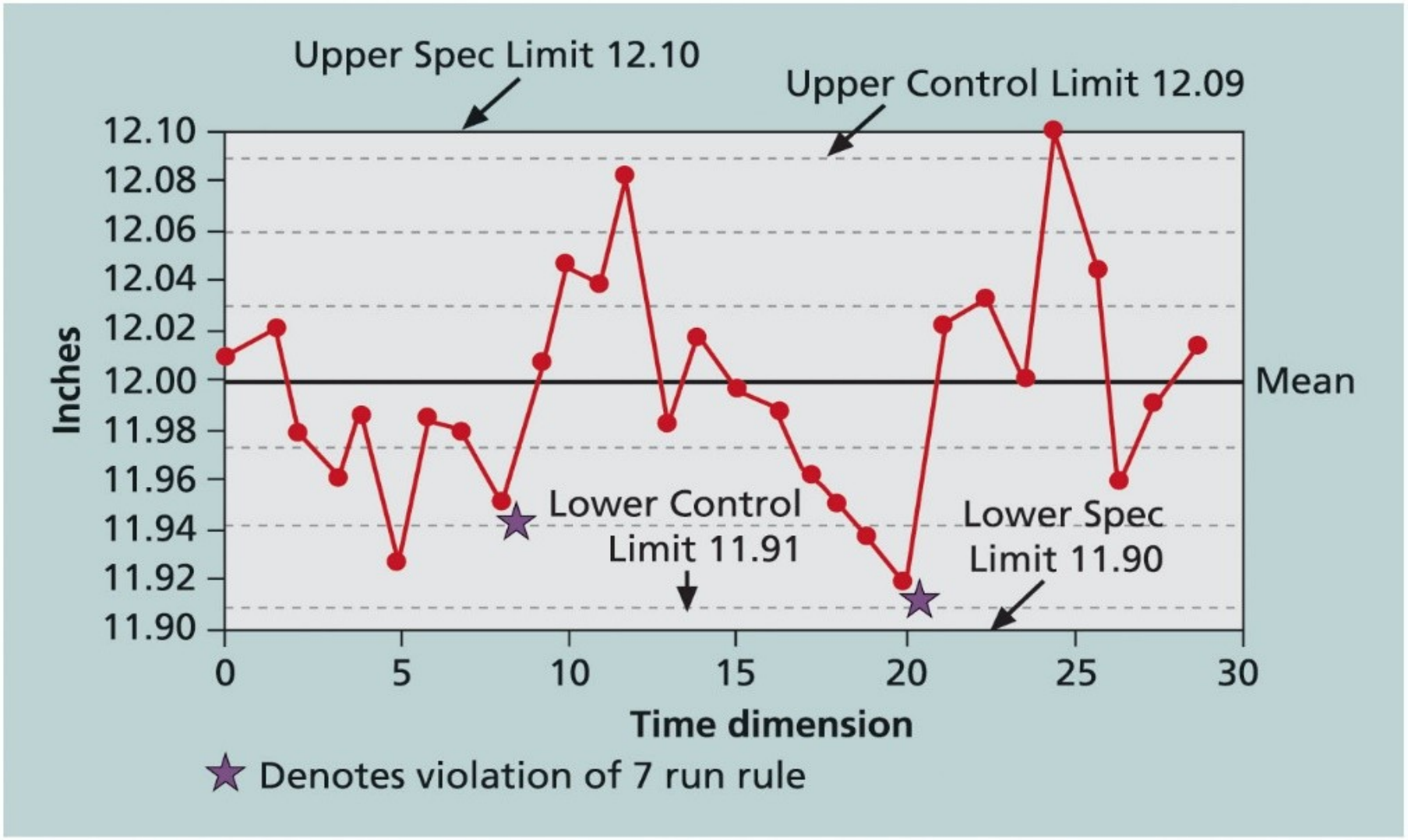


FIGURE 8-3 Sample control chart

Tools and Techniques for Quality Control

System Complaints

Source	Day							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
E-mail	𝍸	𝍸	𝍸	𝍸	𝍸		𝍸	12
Text	𝍸 𝍸	𝍸	𝍸 𝍸	𝍸	𝍸	𝍸	𝍸	29
Phone call	𝍸	𝍸	𝍸	𝍸	𝍸	𝍸		8
Total	11	10	8	6	7	3	4	49

FIGURE 8-4 Sample checksheet

Tools and Techniques for Quality Control

FIGURE 8-5 Sample scatter diagram

Tools and Techniques for Quality Control

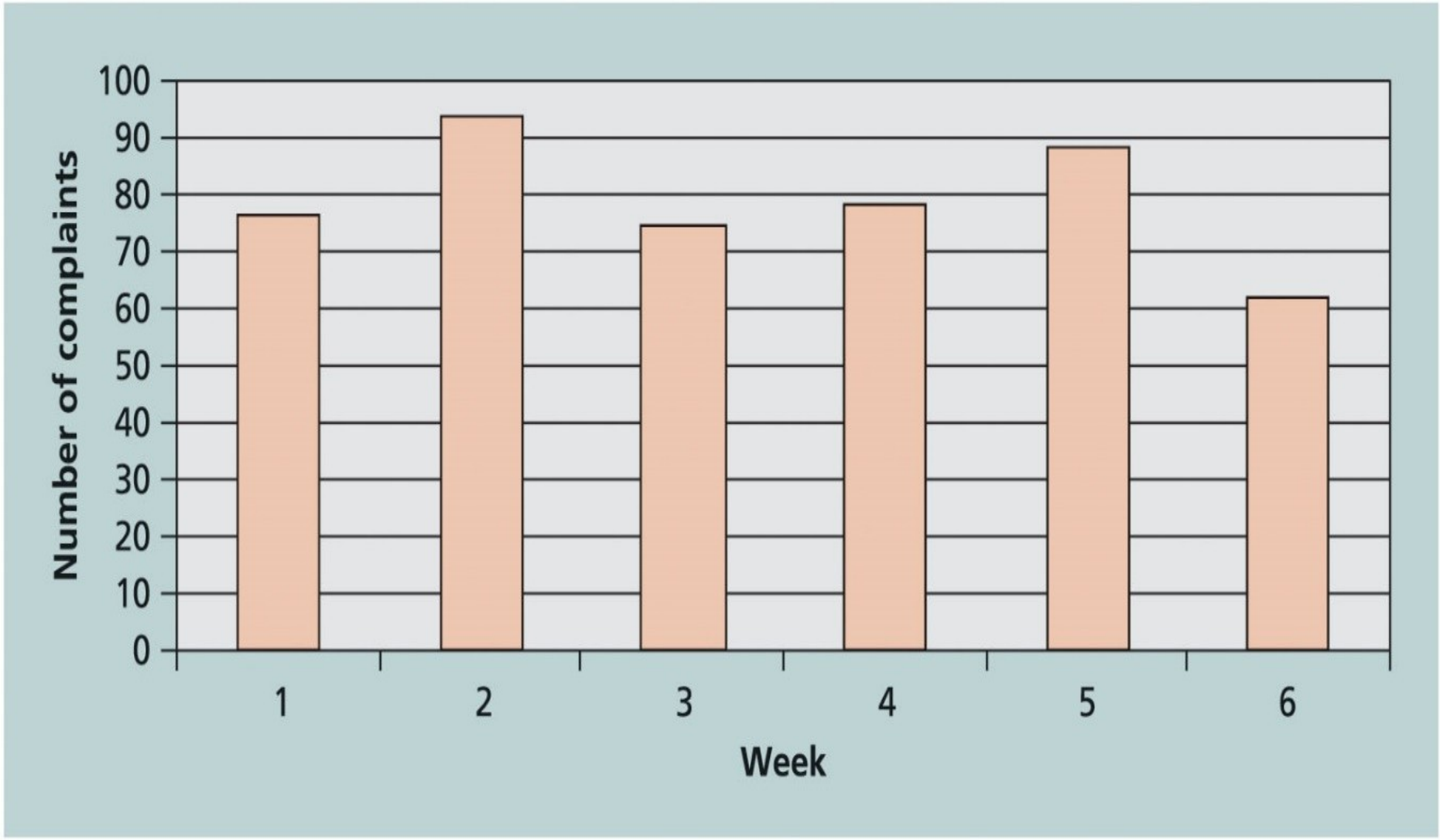


FIGURE 8-6 Sample histogram

Tools and Techniques for Quality Control

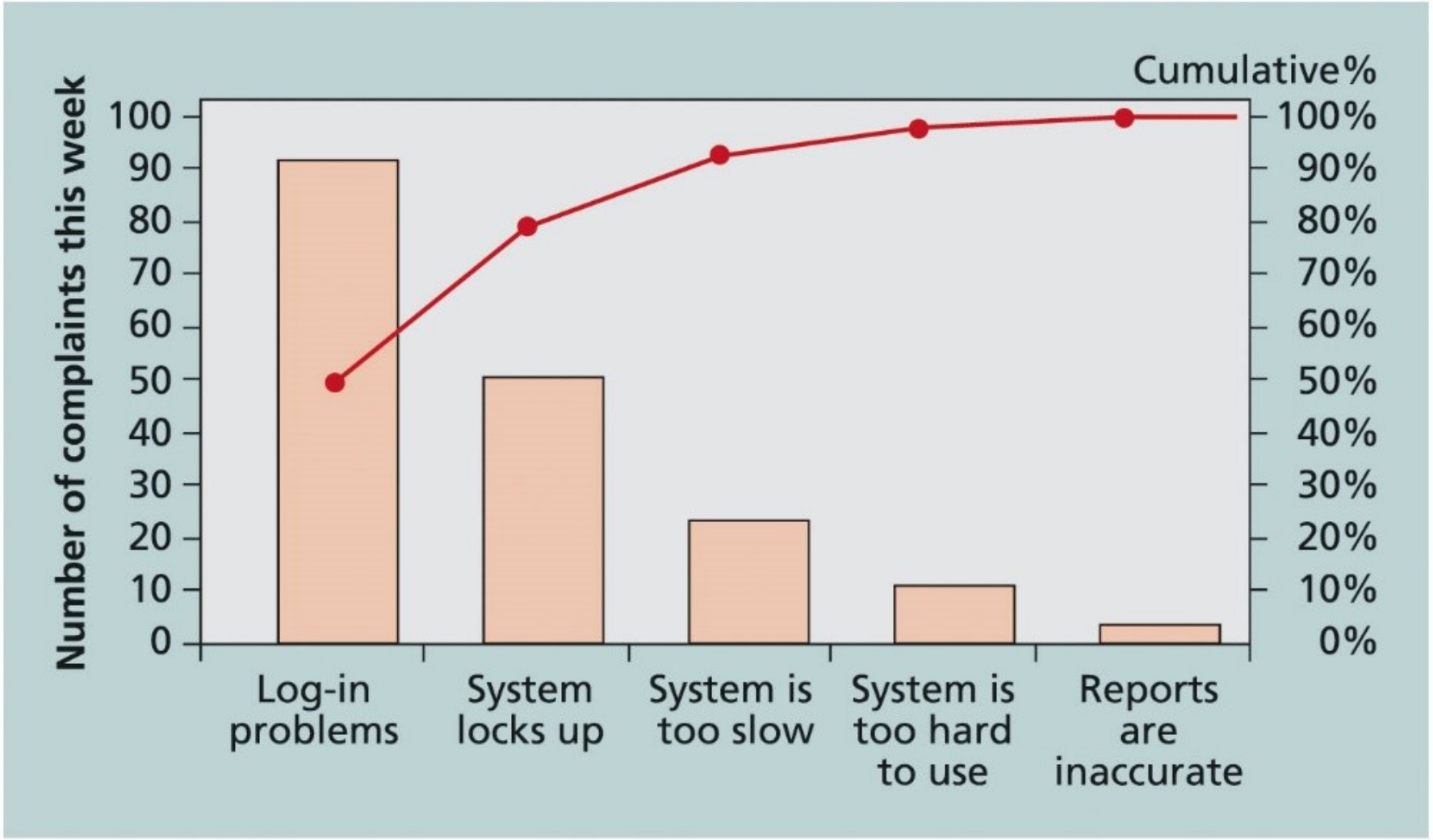


FIGURE 8-7 Sample Pareto chart

Tools and Techniques for Quality Control

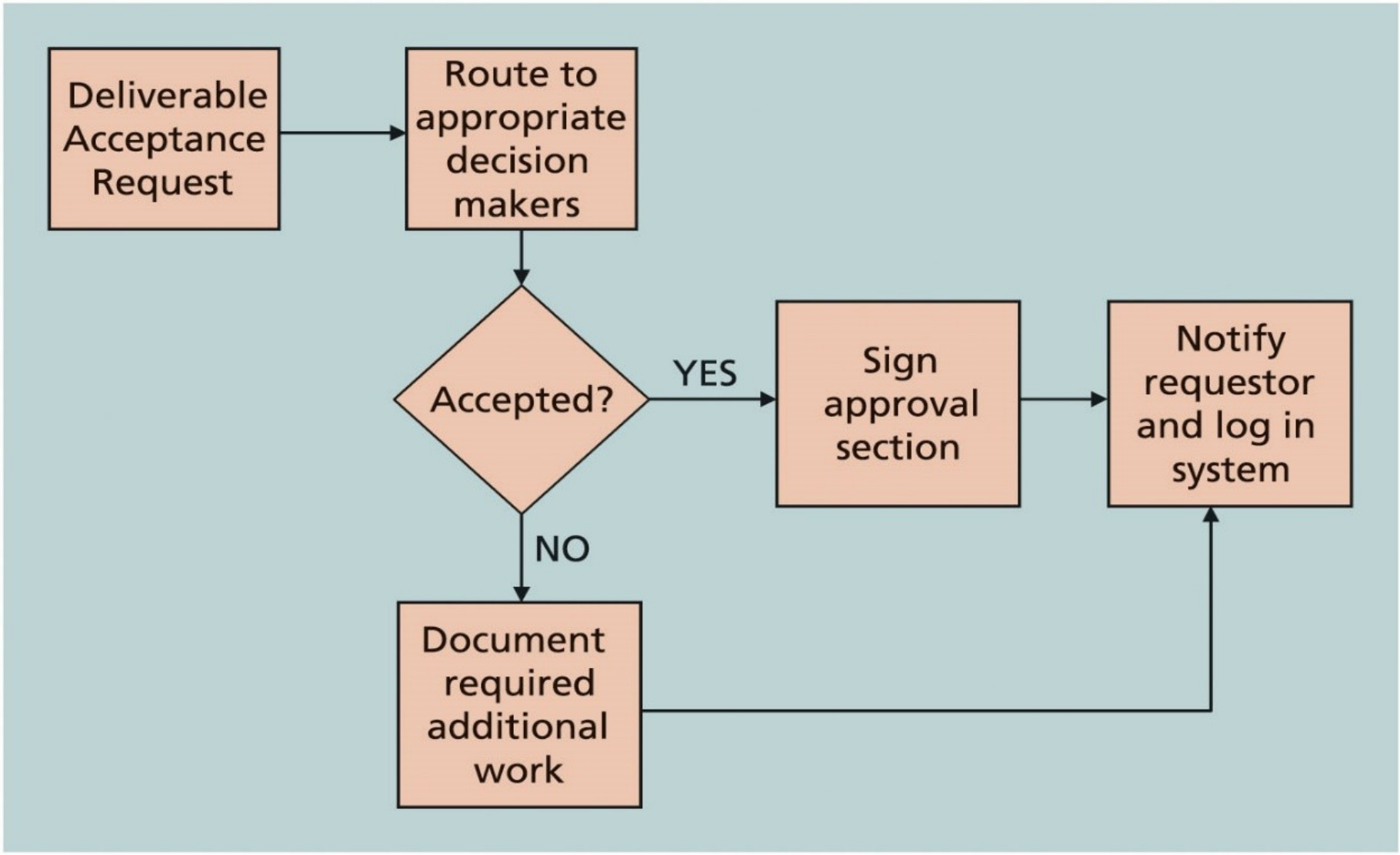


FIGURE 8-8 Sample flowchart

Tools and Techniques for Quality Control

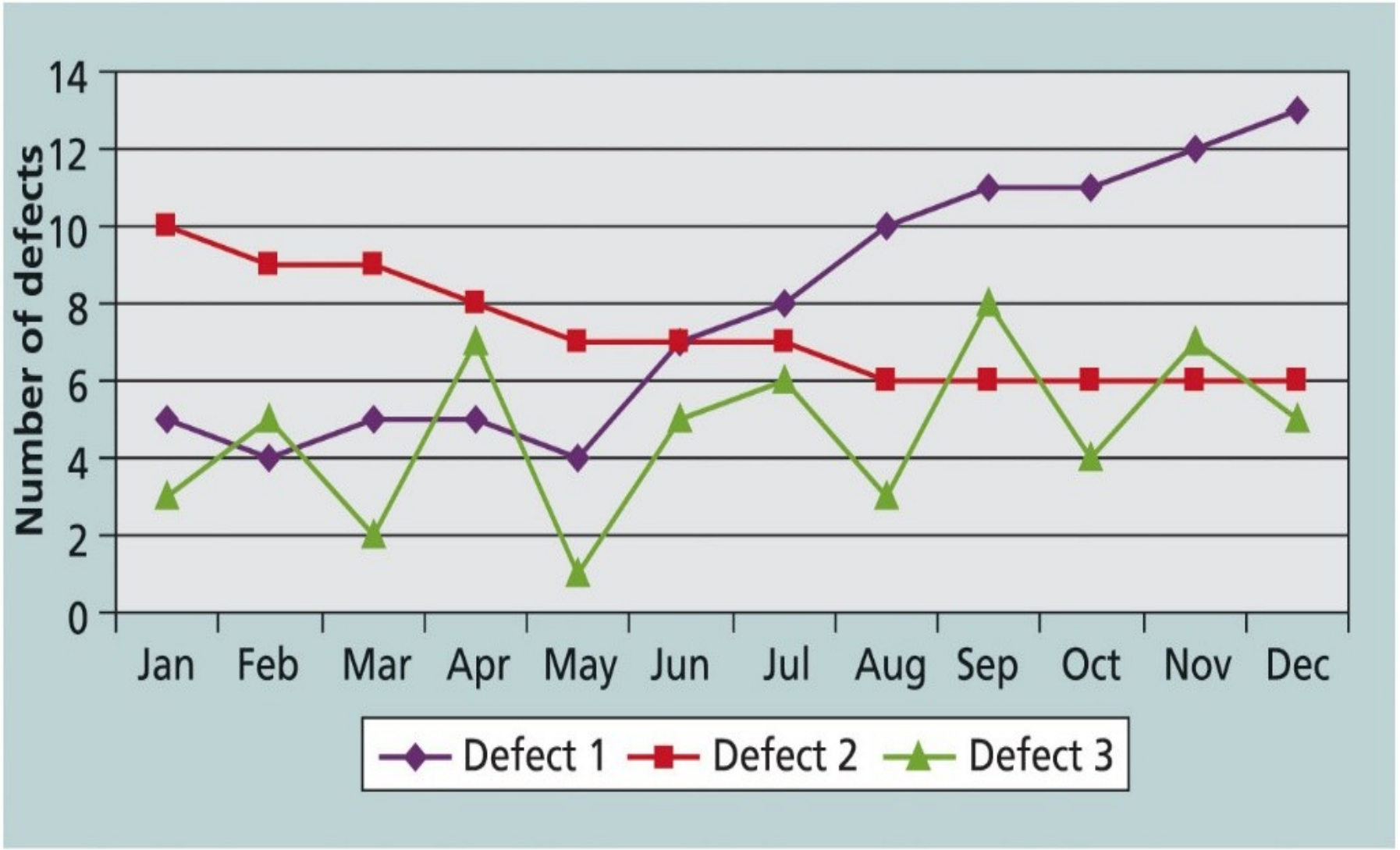


FIGURE 8-9 Sample run chart

Statistical Sampling

- Choosing part of a population of interest for inspection
  - Size of a sample depends on how representative you want the sample to be
  - Sample size formula
    - *Sample size = .25 x (certainty factor/acceptable error)^2*

Statistical Sampling

Desired Certainty	Certainty Factor
95%	1.960
90%	1.645
80%	1.281

Table 8-1 Commonly used certainty factors

Six Sigma

- The *Six Sigma Way* authors, Peter Pande, Robert Neuman, and Roland Cavanagh, define Six Sigma

  - *A comprehensive and flexible system for achieving, sustaining, and maximizing business success. Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data, and statistical analysis, and diligent attention to managing, improving, and reinventing business processes."*

Six Sigma

- DMAIC is a systematic, closed-loop process for continued improvement that is scientific and fact based
  - ***Define***: define the problem/opportunity, process, and customer requirements
  - ***Measure***: define measures, then collect, compile, and display data
  - ***Analyze***: scrutinize process details to find improvement opportunities
  - ***Improve***: generate solutions and ideas for improving the problem
  - ***Control***: track and verify the stability of the improvements and the predictability of the solution

How is Six Sigma Quality Control Unique?

- Six Sigma principles that help organizations improve their competitiveness and bottom-line results
  - Requires an organization-wide commitment
  - Training follows the “belt” system
  - Organizations have the ability and willingness to adopt contrary objectives, such as reducing errors and getting things done faster
  - An operating philosophy that is customer focused and strives to drive out waste, raise levels of quality, and improve financial performance at breakthrough levels

Six Sigma and Project Selection and Management

- What makes a project a potential Six Sigma project?
  - Must be a quality problem or gap between the current and desired performance
  - Project should not have a clearly understood problem
  - Solution should not be predetermined, and an optimal solution should not be apparent

Six Sigma and Statistics

- Sigma means standard deviation
  - Standard deviation measures how much variation exists in a distribution of data; a key factor in determining the acceptable number of defective units found in a population
  - Six Sigma projects strive for no more than 3.4 defects per million opportunities

Six Sigma and Statistics

- Six Sigma uses a conversion table
  - Yield represents the number of units handled correctly through the process steps
  - A defect is any instance where the product or service fails to meet customer requirements
    - There can be several opportunities to have a defect
- Six nines of quality is a measure of quality control equal to one fault in one million opportunities
  - In the telecommunications industry, it means 99.9999 percent service availability or *30 seconds of down time a year*

Six Sigma and Statistics

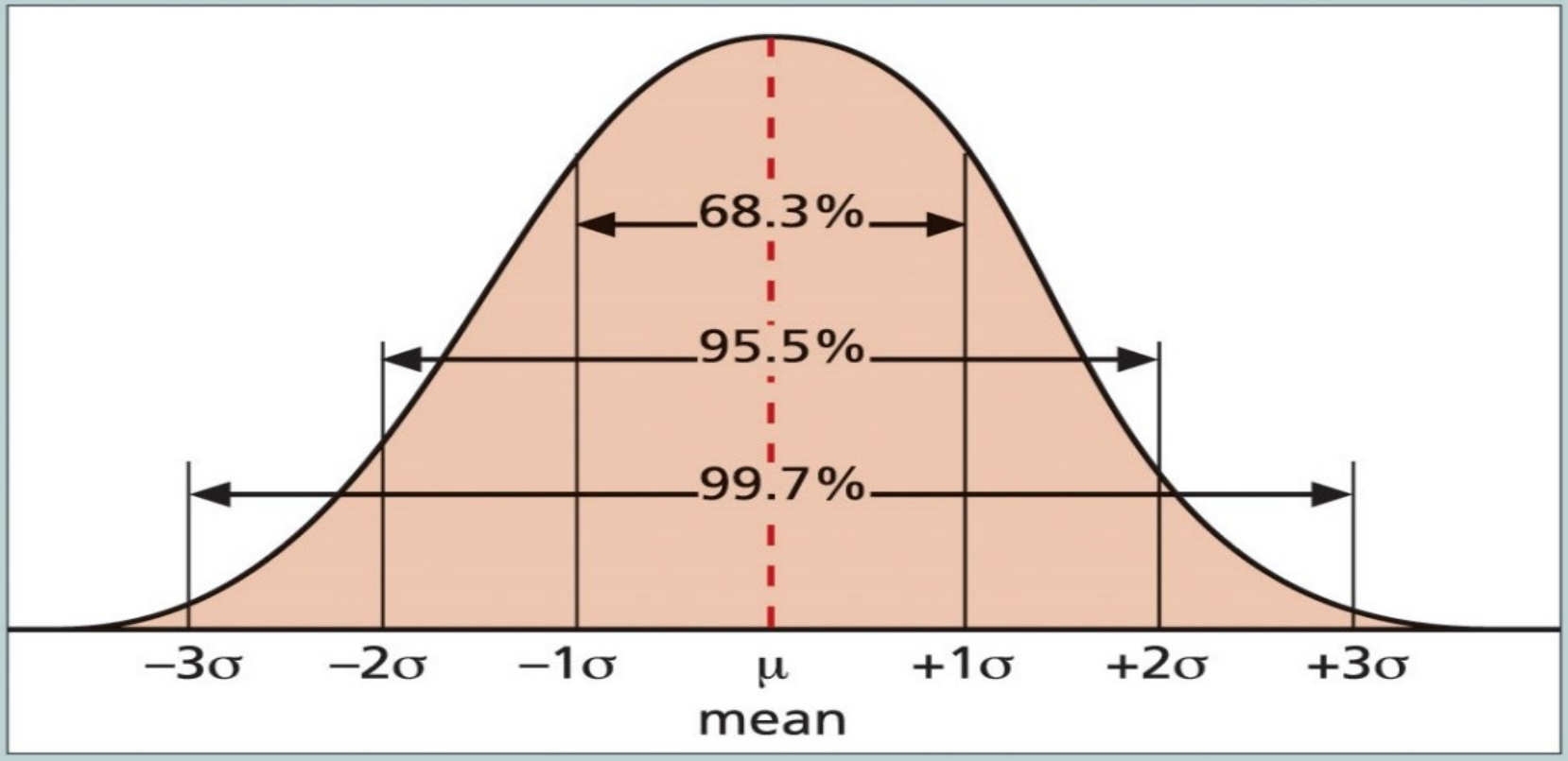


FIGURE 8-10 Normal distribution and standard deviation

Six Sigma and Statistics

Sigma and defective units

Specification Range (in ± Sigmas)	Percent of Population within Range	Defective Units per Billion
1	68.27	317,300,000
2	95.45	45,400,000
3	99.73	2,700,000
4	99.9937	63,000
5	99.999943	57
6	99.9999998	2

Six Sigma and Statistics

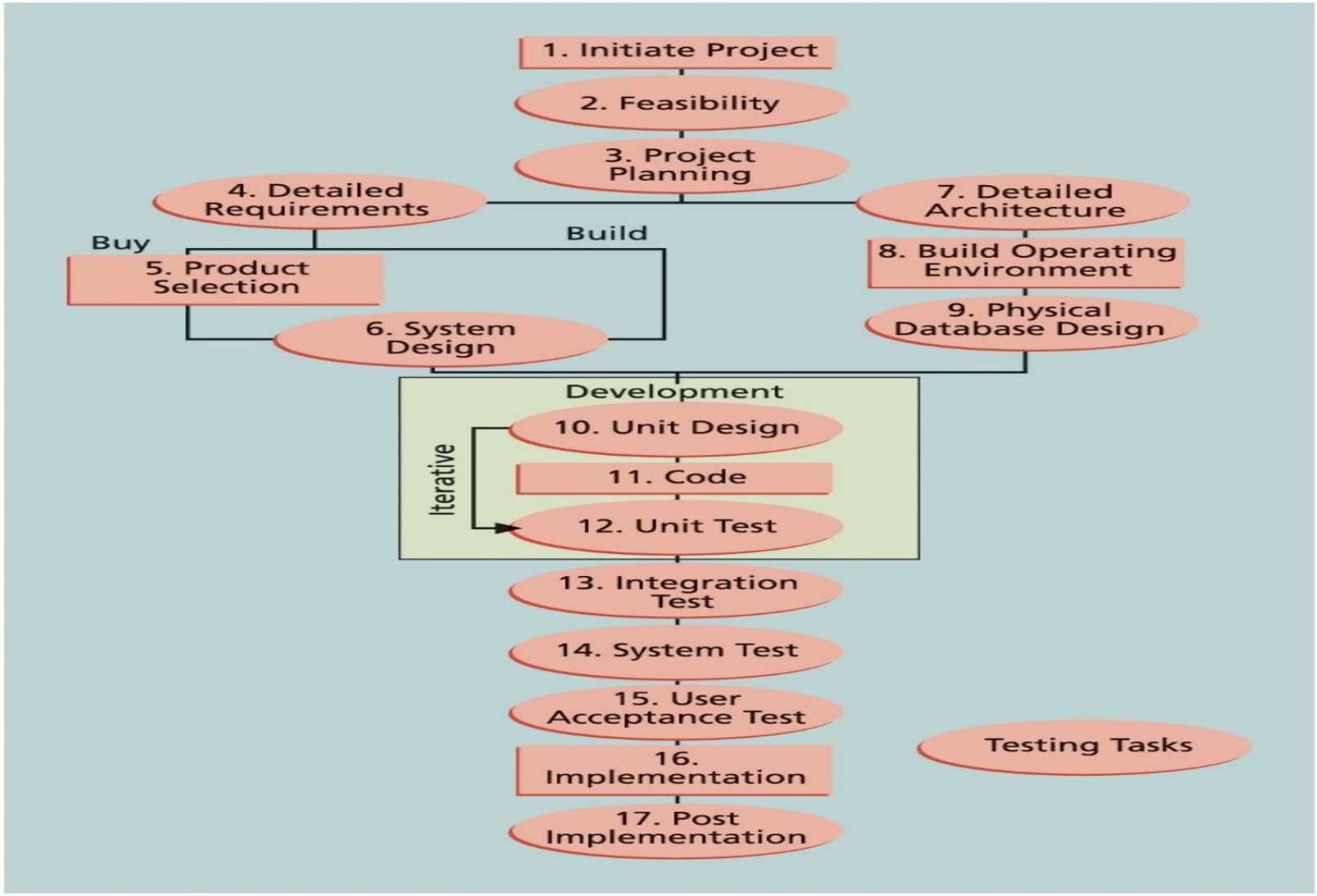
Six Sigma conversion table

Sigma	Yield	Defects per Million Opportunities (DPMO)
1	31.0%	690,000
2	69.2%	308,000
3	93.3%	66,800
4	99.4%	6,210
5	99.97%	230
6	99.99966%	3.4

Testing

- Many IT professionals think of testing as a stage that comes near the end of IT product development
  - Testing needs to be done during almost every phase of the systems development life cycle, not just before the organization ships or hands over a product to the customer

Testing



Source: Hollstadt & Associates, Inc.

FIGURE 8-11 Testing tasks in the software development life cycle

Testing

- Types of tests
  - Unit testing tests each individual component (often a program) to ensure it is as defect-free as possible
  - Integration testing occurs between unit and system testing to test functionally grouped components
  - System testing tests the entire system as one entity
  - User acceptance testing is an independent test performed by end users prior to accepting the delivered system

Testing

- Testing alone is not enough
  - Watts S. Humphrey, a renowned expert on software quality, defines a software defect as anything that must be changed before delivery of the program
- Testing does not sufficiently prevent software defects
  - The number of ways to test a complex system is huge
  - Users will continue to invent new ways to use a system that its developers never considered
- Humphrey suggests that people rethink the software development process to provide no potential defects when you enter system testing
  - Developers must be responsible for providing

Modern Quality Management

- Modern quality management:
  - Requires customer satisfaction
  - Prefers prevention to inspection
  - Recognizes management responsibility for quality
- Noteworthy quality experts:
  - Deming, Juran, Crosby, Ishikawa, Taguchi, and Feigenbaum

Modern Quality Management

- Quality experts
  - Deming was famous for his work in rebuilding Japan and his 14 Points for Management
  - Juran wrote the *Quality Control Handbook* and ten steps to quality improvement
  - Crosby wrote *Quality is Free* and suggested that organizations strive for zero defects
  - Ishikawa developed the concepts of quality circles and pioneered the use of cause-and-effect diagrams
  - Taguchi developed methods for optimizing the process of engineering experimentation
  - Feigenbaum developed the concept of total

Modern Quality Management

- ISO standards
  - ISO 9000: a three-part, continuous cycle of planning, controlling, and documenting quality in an organization
  - Provide minimum requirements needed for an organization to meet its quality certification standards
  - Help ensure that projects create products or services that meet customer needs and expectations

Improving IT Project Quality

- Suggestions for improving quality for IT projects
  - Establish leadership that promotes quality
  - Understand the cost of quality
  - Provide a good workplace to enhance quality
  - Work toward improving the organization’s overall maturity level in software development and project management

Leadership

- A large percentage of quality problems are associated with management, not technical issues
  - Top management must take responsibility for creating, supporting, and promoting quality programs
- Leadership provides an environment conducive to producing quality
  - When every employee insists on producing high-quality products, then top management has done a good job of promoting the importance of quality

The Cost of Quality

- Cost of conformance plus the cost of nonconformance
  - ***Conformance*** means delivering products that meet requirements and fitness for use
  - ***Cost of nonconformance*** means taking responsibility for failures or not meeting quality expectations

The Cost of Quality

- Cost categories related to quality
  - ***Prevention cost***: cost of planning and executing a project so it is error-free or within an acceptable error range
  - ***Appraisal cost:*** cost of evaluating processes and their outputs to ensure quality
  - ***Internal failure cost***: cost incurred to correct an identified defect before the customer receives the product
  - ***External failure cost***: cost that relates to all errors not detected and corrected before delivery to the customer
  - ***Measurement and test equipment costs***: capital cost of equipment used to perform prevention and appraisal activities

Maturity Models

- CMMI levels
  - Incomplete
  - Performed
  - Managed
  - Defined
  - Quantitatively Managed
  - Optimizing

Maturity Models

- PMI released the Organizational Project Management Maturity Model (OPM3) in December 2003
  - Model is based on market research surveys sent to more than 30,000 project management professionals and incorporates 180 best practices and more than 2,400 capabilities, outcomes, and key performance indicators
  - Addresses standards for excellence in project, program, and portfolio management best practices and explains the capabilities necessary to achieve those best practices

Considerations For Agile/Adaptive Environments

- Agile methods can be used on all types of projects, not just software development
  - Several projects use a hybrid approach where some deliverables are created using more traditional approaches
- Quality is a very broad topic, and it is only one of the ten project management knowledge areas
  - Project managers must focus on defining how quality relates to their specific projects and ensure that those projects satisfy the needs for which they were undertaken

Chapter Summary

- Quality is a serious issue
  - Project quality management includes planning quality management, performing quality assurance, and controlling quality
  - Many tools and techniques are related to project quality management
  - Many people made significant contributions to the development of modern quality management
  - There is much room for improvement in IT project quality
  - Several types of software are available to assist in project quality management