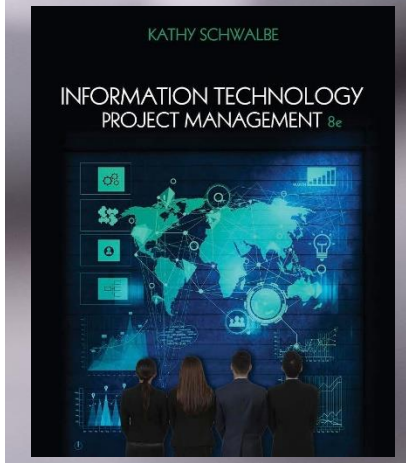
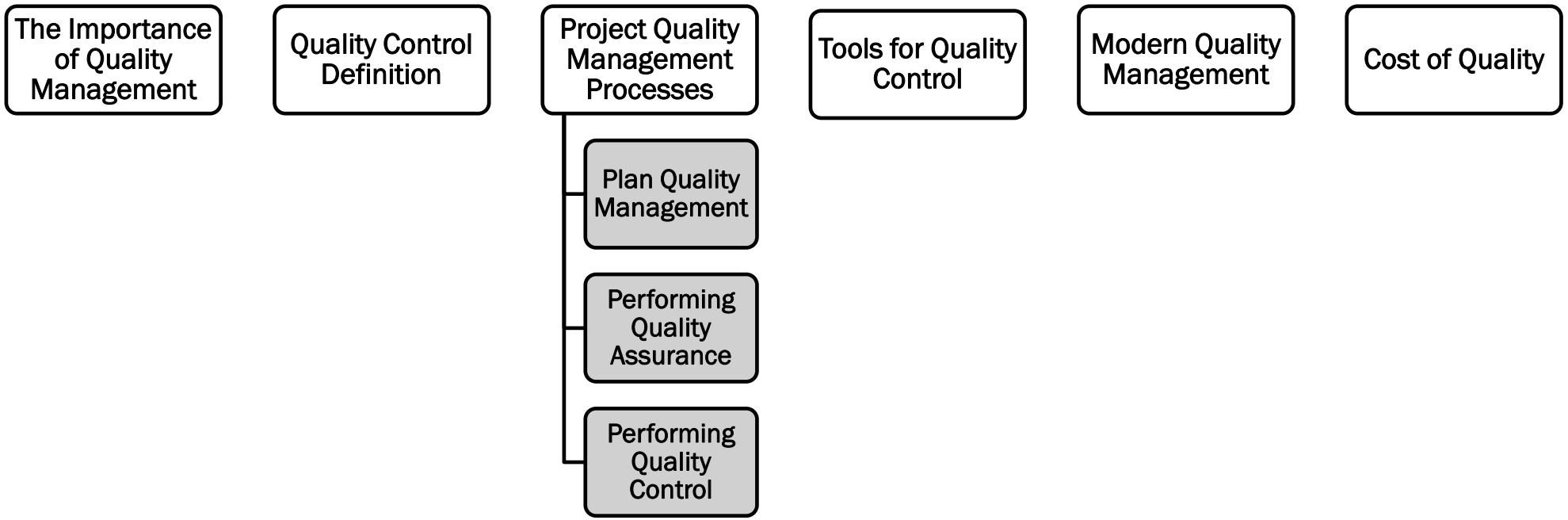
IT PROJECT MANAGEMENT

WEEK 9 : PROJECT QUALITY MANAGEMENT



Note:
Adapted from slide of the textbook: Schwalbe, Kathy. Managing Information Technology Project – Eight Edition. Boston, MA: Thomson Course Technology, 2016.
See the text itself for full citations.

MIND MAP


The Importance of Quality Management
Quality Control Definition
Project Quality Management Processes
Plan Quality Management
Performing Quality Assurance
Performing Quality Control
Tools for Quality Control
Modern Quality Management
Cost of Quality

LEARNING OBJECTIVES

Available in Video Material

a. Understand **the importance of project quality management** for information technology (IT) products and services
b. Define **project quality management** and understand how quality relates to various aspects of IT projects
c. Describe **quality management planning** and how quality and scope management are related
d. Discuss the importance of **quality assurance**
e. Explain the main outputs of the **quality control** process
f. Understand **the tools and techniques for quality control**, such as the Seven Basic Tools of Quality, statistical sampling, Six Sigma, and testing
g. Summarize the contributions of noteworthy quality experts to **modern quality management**
h. Describe how leadership, **the cost of quality**, organizational influences, expectations, cultural differences, and maturity models relate to improving quality in IT projects

A: THE IMPORTANCE OF QUALITY MANAGEMENT

THE IMPORTANCE OF PROJECT QUALITY MANAGEMENT

- Many people joke about the poor quality of IT products (see cars and computers joke)
- People seem to accept systems being down occasionally or needing to reboot their PCs
- But quality is very important in many IT projects

GENERAL MOTORS VS GATES JOKES

- Gates: **“If General Motors had kept up with technology like the computer industry has, we would all be driving $25 cars that got 1,000 miles to the gallon.”**
- General Motors issued a press release stating: “**If GM had developed technology like Microsoft, we would all be driving cars with the following characteristics:**
  - For no reason whatsoever your car would crash twice a day.
  - Every time they repainted the lines on the road, you would have to buy a new car.
  - Macintosh would make a car that was powered by the sun, reliable, five times as fast, and twice as easy to drive, but would run on only five percent of the roads.
  - New seats would force everyone to have the same size hips.
  - The airbag system would say ‘Are you sure?’ before going off.
  - Occasionally, for no reason whatsoever, your car would lock you out and refuse to let you in until you simultaneously lifted the door handle, turned the key, and grabbed hold of the radio antenna.

B: PROJECT QUALITY MANAGEMENT

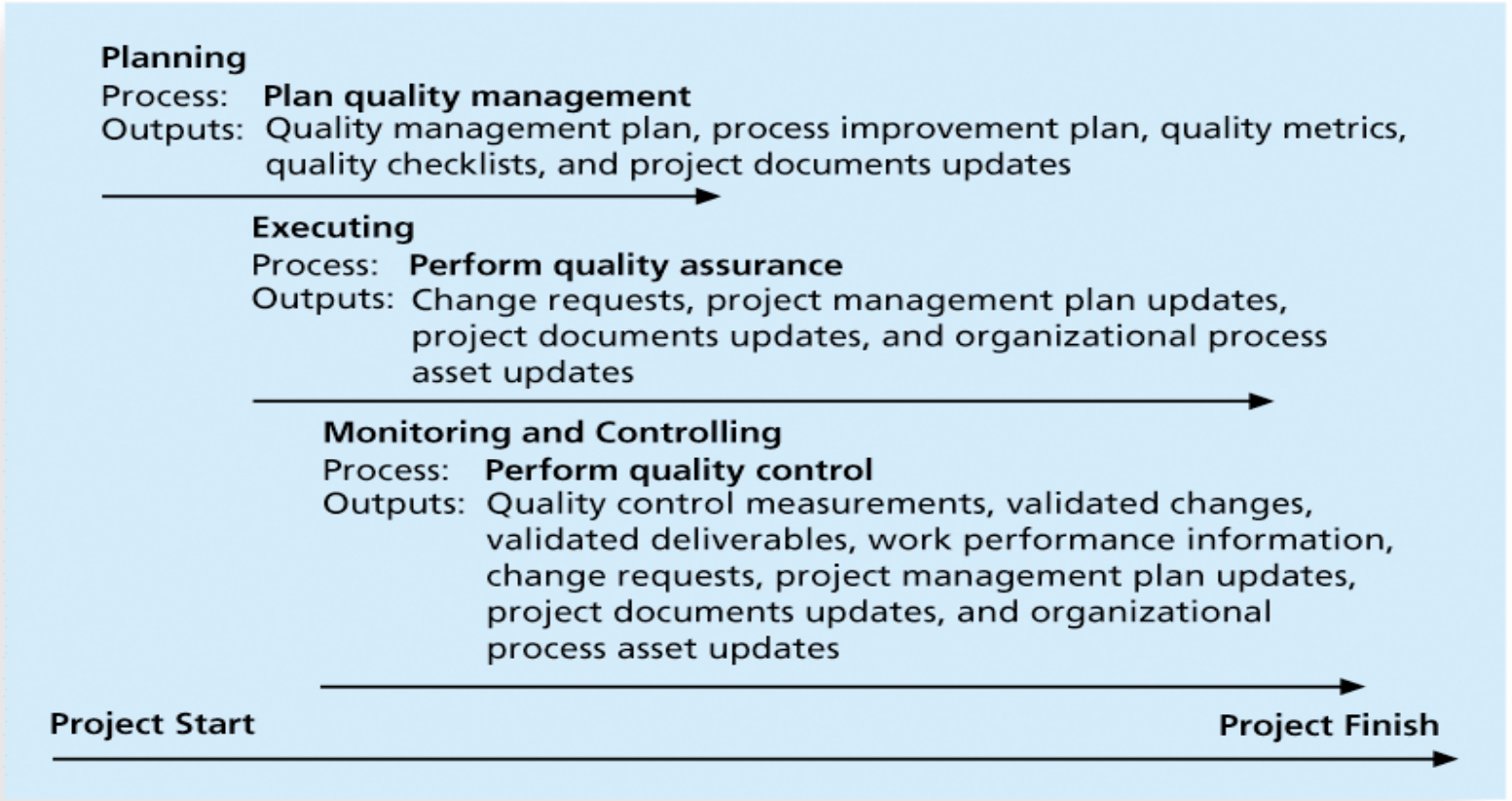
WHAT IS PROJECT QUALITY?

- The International Organization for Standardization (ISO) defines **quality** as “the degree to which a set of inherent characteristics fulfils requirements” (ISO9000:2000)
- Other experts define quality based on:
  - **Conformance to requirements:** The project’s processes and products meet written specifications
  - **Fitness for use:** A product can be used as it was intended

WHAT IS PROJECT QUALITY MANAGEMENT?

- **Project quality management** ensures that the project will satisfy the needs for which it was undertaken
- Processes include:
  - **Planning quality management:** Identifying which quality standards are relevant to the project and how to satisfy them; a **metric** is a standard of measurement
  - **Performing quality assurance:** Periodically evaluating overall project performance to ensure the project will satisfy the relevant quality standards
  - **Performing quality control:** Monitoring specific project results to ensure that they comply with the relevant quality standards

FIGURE 8-1. PROJECT QUALITY MANAGEMENT SUMMARY



C: PLANNING QUALITY MANAGEMENT

PLANNING QUALITY

- Implies the ability to anticipate situations and prepare actions to bring about the desired outcome
- Important to prevent defects by:
  - Selecting proper materials
  - Training and indoctrinating people in quality
  - Planning a process that ensures the appropriate outcome

SCOPE ASPECTS OF IT PROJECTS

- **Functionality** is the degree to which a system performs its intended function
- **Features** are the system's special characteristics that appeal to users
- **System outputs** are the screens and reports the system generates
- **Performance** addresses how well a product or service performs the customer's intended use
- **Reliability** is the ability of a product or service to perform as expected under normal conditions
- **Maintainability** addresses the ease of performing maintenance on a product

WHO'S RESPONSIBLE FOR THE QUALITY OF PROJECTS?

- Project managers are ultimately responsible for quality management on their projects
- Several organizations and references can help project managers and their teams understand quality
  - International Organization for Standardization (www.iso.org)
  - IEEE (www.ieee.org)

D: QUALITY ASSURANCE

PERFORMING QUALITY ASSURANCE

- **Quality assurance** includes all the activities related to satisfying the relevant quality standards for a project
- Another goal of quality assurance 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

E: QUALITY CONTROL

PERFORMING QUALITY CONTROL

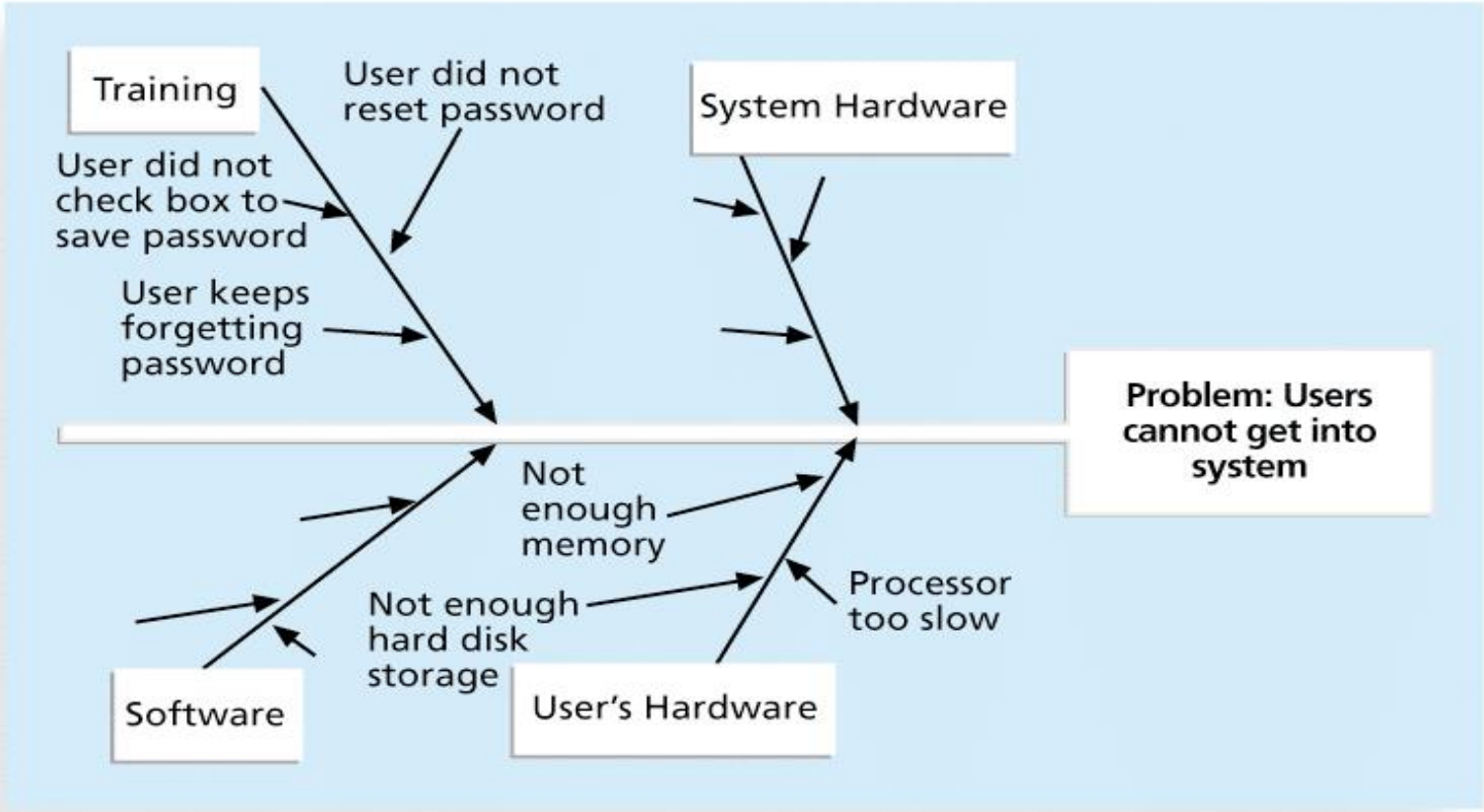
- The main outputs of quality control are:
  - Acceptance decisions
  - Rework
  - Process adjustments
- There are Seven Basic Tools of Quality that help in performing quality control

F: TOOLS & TECHNIQUES FOR QUALITY CONTROL

1. CAUSE-AND-EFFECT DIAGRAMS

- **Cause-and-effect diagrams** trace complaints about quality problems back to the responsible production operations
- They help you find the root cause of a problem
- Also known as **fishbone** or **Ishikawa diagrams**
- Can also use the **5 whys** technique where you repeated ask the question “Why” (five is a good rule of thumb) to peel away the layers of symptoms that can lead to the root cause

FIGURE 8-2. SAMPLE CAUSE-AND-EFFECT DIAGRAM

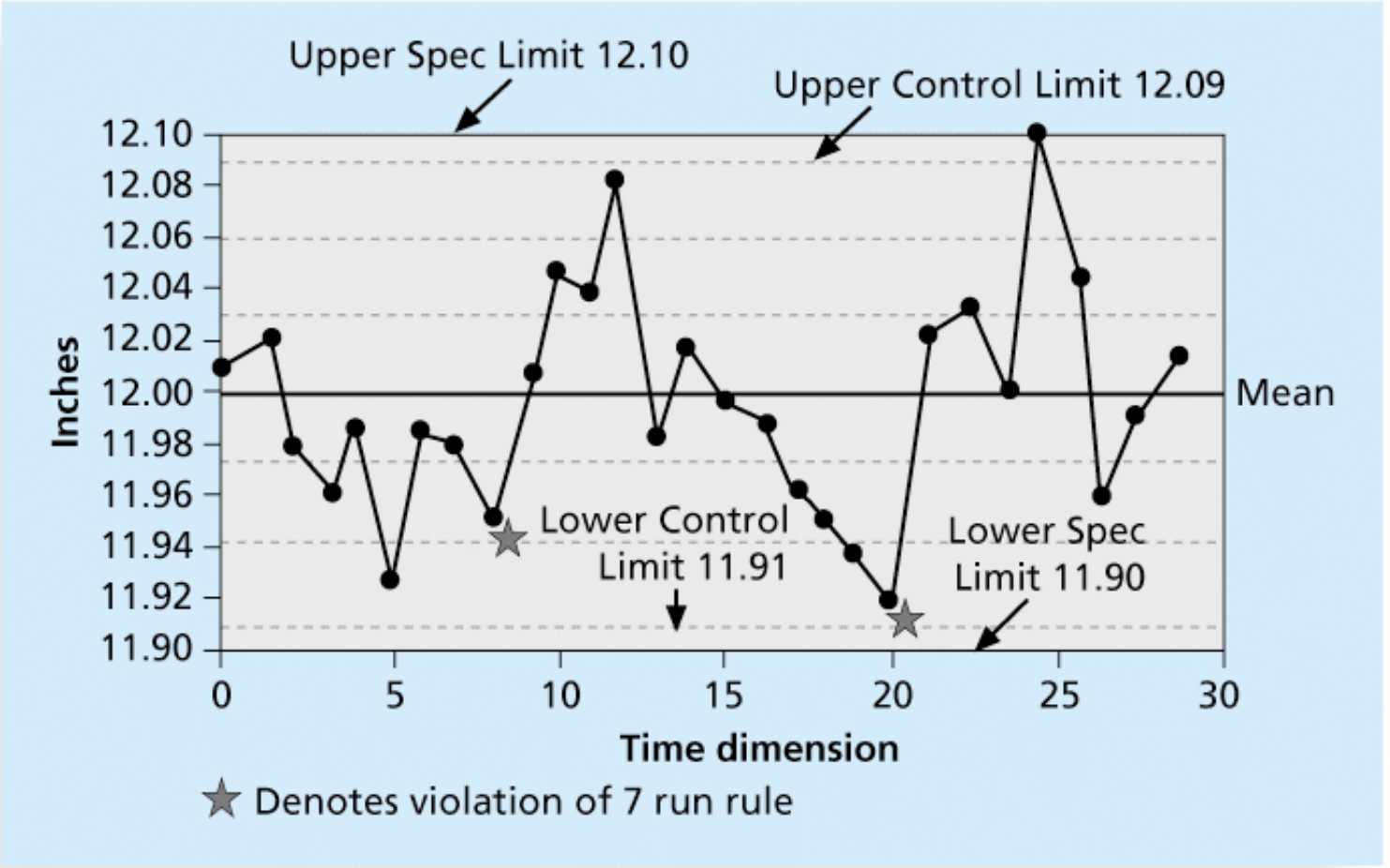


2. QUALITY CONTROL CHARTS

- A **control chart** is a graphic display of data that illustrates the results of a process over time
- The main use of control charts is to prevent defects, rather than to detect or reject them
- Quality control charts allow you to determine whether a process is in control or out of control
  - When a process is in control, any variations in the results of the process are created by random events; processes that are in control do not need to be adjusted
  - When a process is out of control, variations in the results of the process are caused by non-random events; you need to identify the causes of those non-random events and adjust the process to correct or eliminate them

THE SEVEN RUN RULE

- You can use quality control charts and the seven run rule to look for patterns in data
- The **seven run rule** states that if seven data points in a row are all below the mean, above the mean, or are all increasing or decreasing, then the proces needs to be examined for non-random problems



3. CHECKSHEET

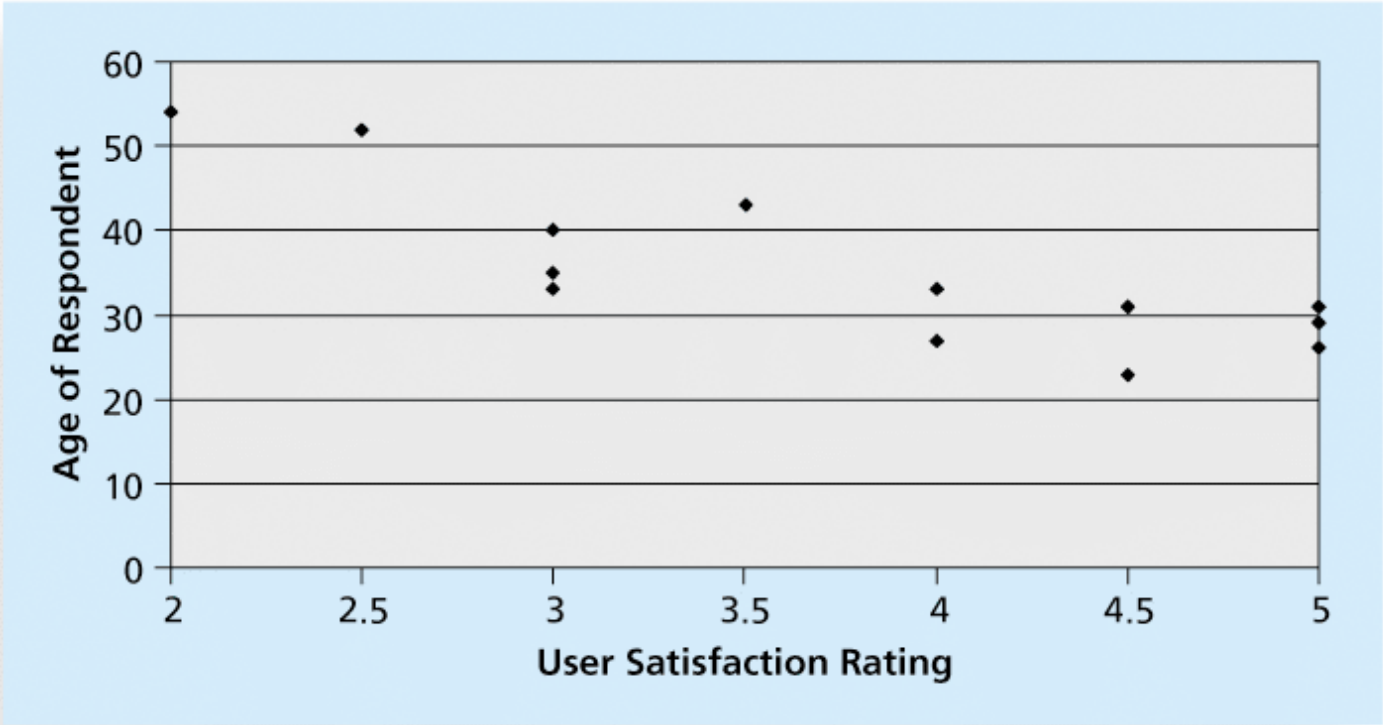
- A checksheet is used to collect and analyze data
- It is sometimes called a tally sheet or checklist, depending on its format
- In the example in Figure 8-4, most complaints arrive via text message, and there are more complaints on Monday and Tuesday than on other days of the week
- This information might be useful in improving the process for handling complaints

System Complaints

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

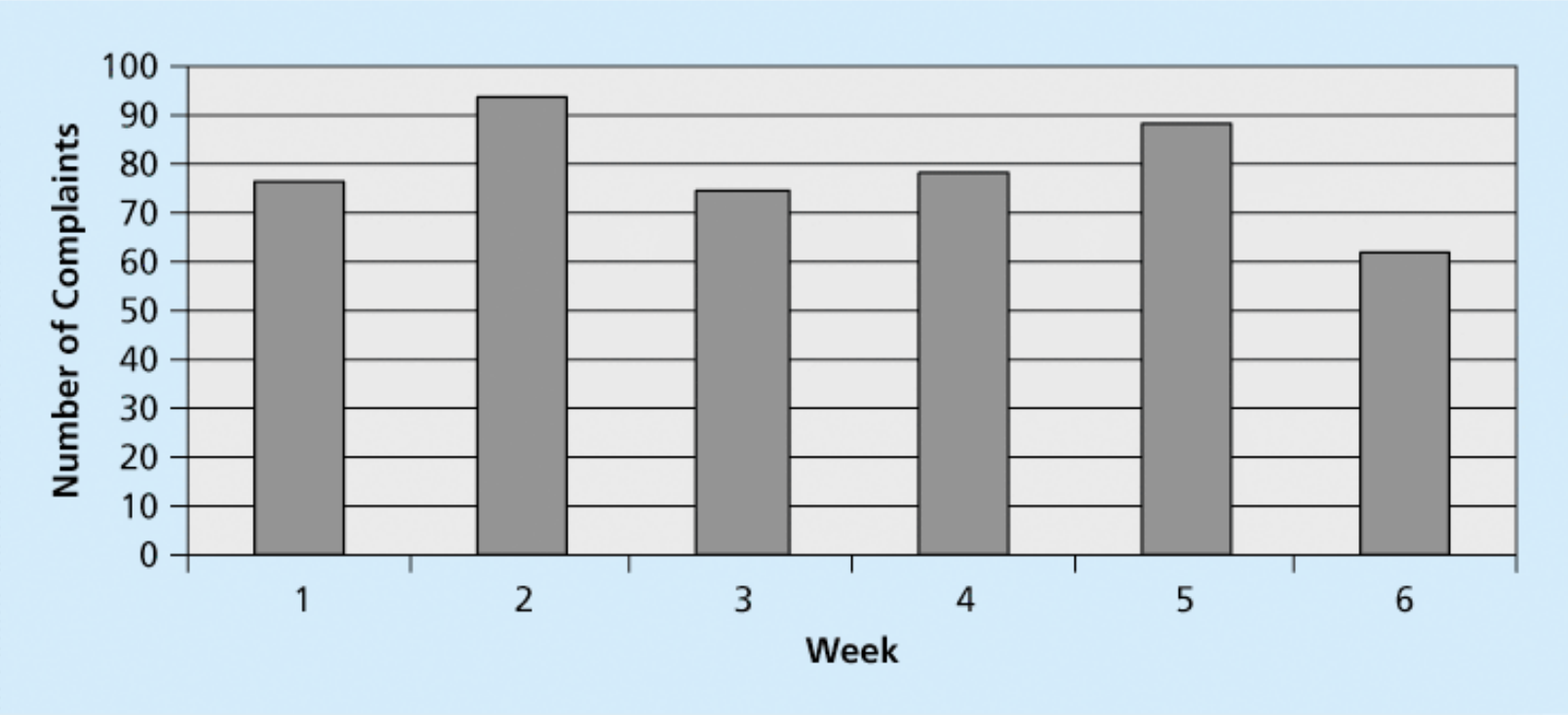
4. SCATTER DIAGRAM

- A **scatter diagram** helps to show if there is a relationship between two variables
- The closer data points are to a diagonal line, the more closely the two variables are related



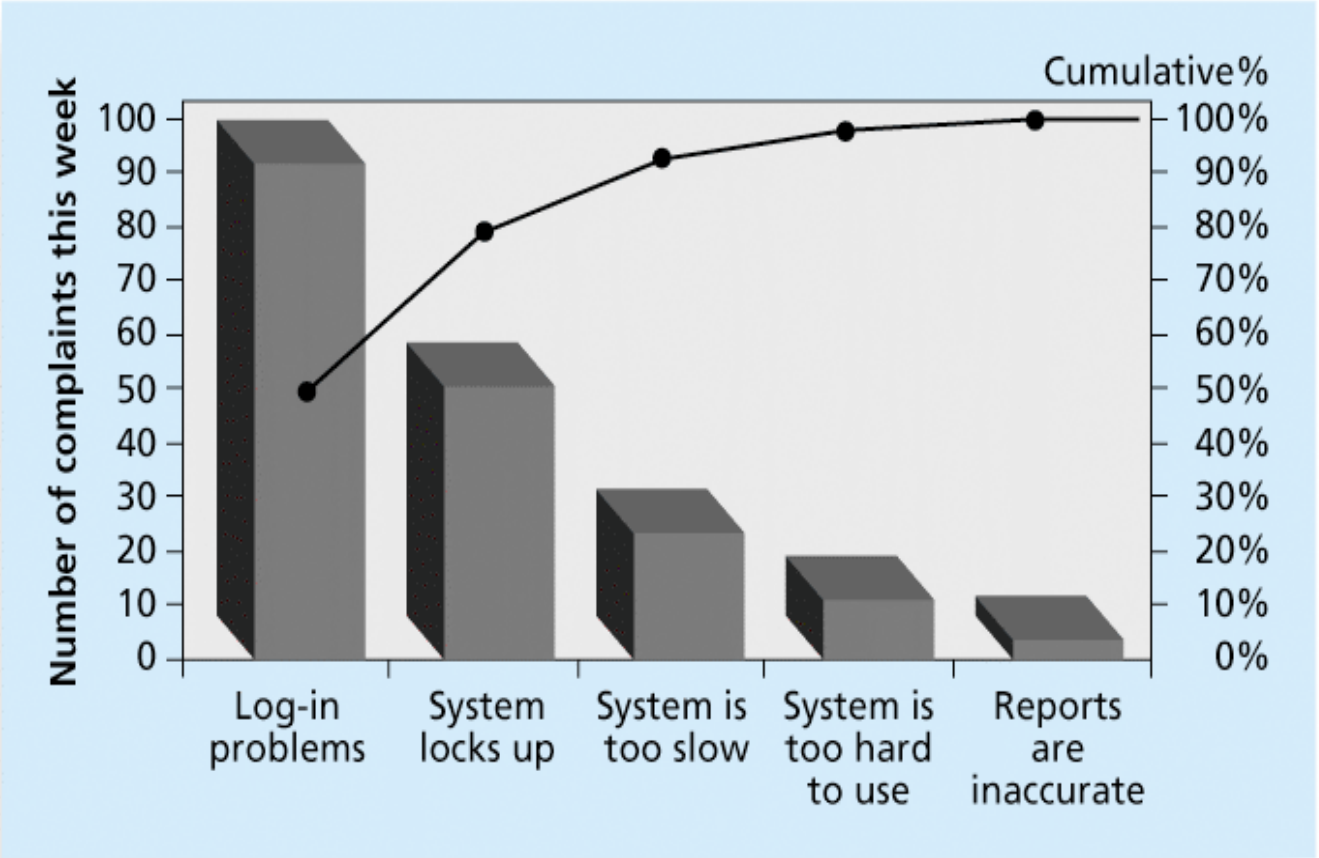
5. HISTOGRAMS

- A **histogram** is a bar graph of a distribution of variables
- Each bar represents an attribute or characteristic of a problem or situation, and the height of the bar represents its frequency



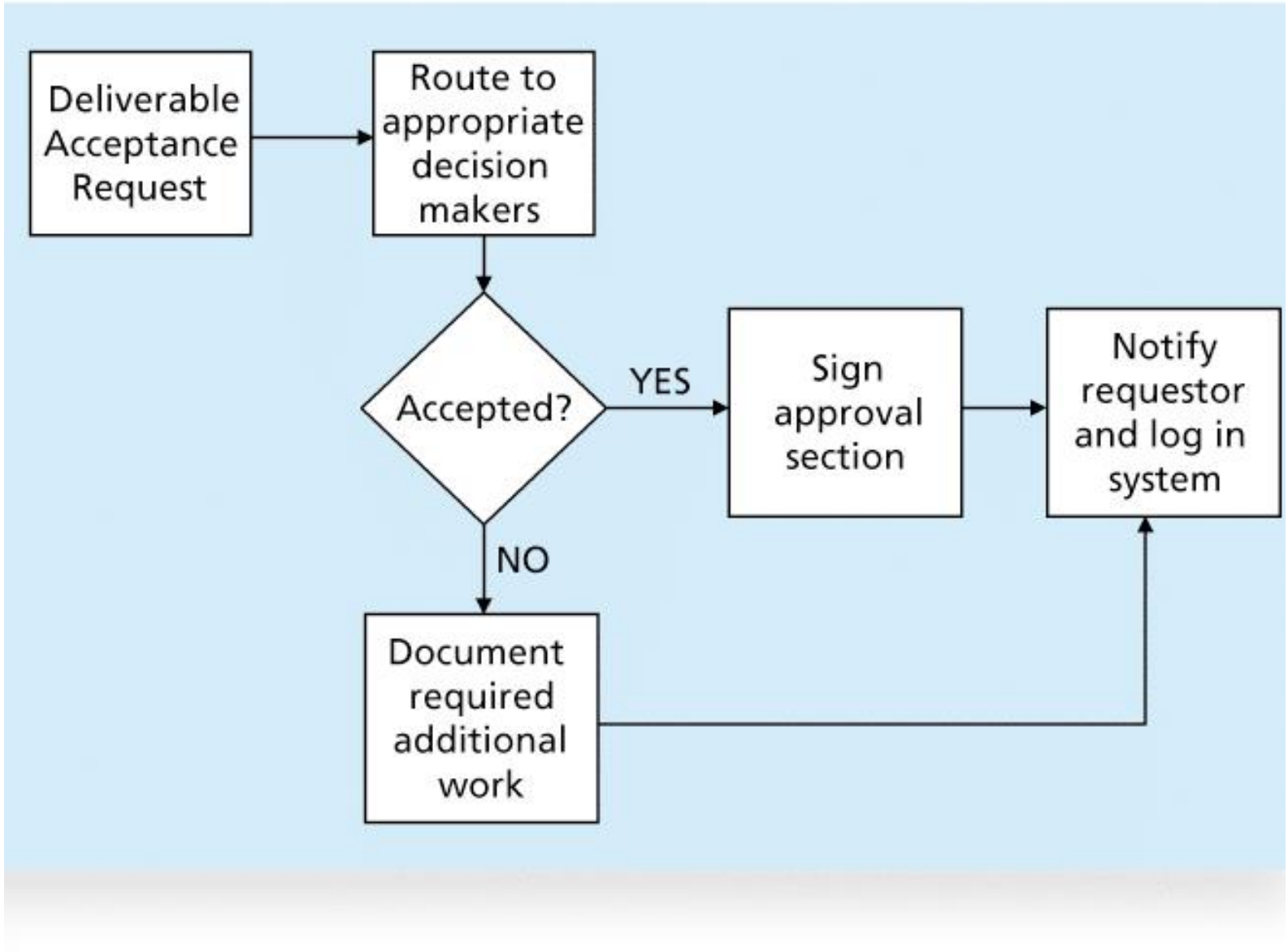
6. PARETO CHARTS

- A **Pareto chart** is a histogram that can help you identify and prioritize problem areas
- **Pareto analysis** is also called the 80-20 rule, meaning that 80 percent of problems are often due to 20 percent of the causes



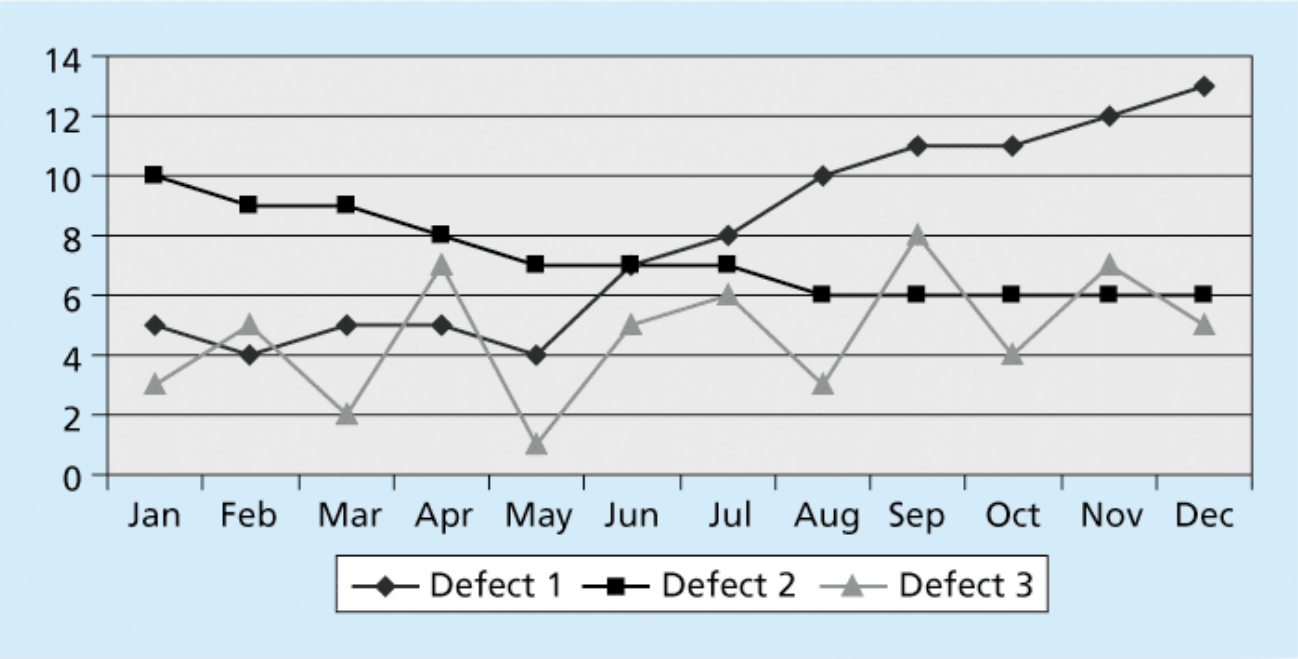
7. FLOWCHARTS

- Flowcharts are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved
- They show activities, decision points, and the order of how information is processed



RUN CHARTS

- In addition to flowcharts, run charts are also used for stratification, a technique that shows data from a variety of sources to see if a pattern emerges
- A **run chart** displays the history and pattern of variation of a process over time.
- You can use run charts to perform trend analysis and forecast future outcomes based on historical results



STATISTICAL SAMPLING

- **Statistical sampling** involves choosing part of a population of interest for inspection
- The 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
- Be sure to consult with an expert when using statistical analysis

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

SIX SIGMA

- **Six Sigma** is "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"*

- **Basic Information of Six Sigma**
  - The target for perfection is the achievement of no more than **3.4 defects per million opportunities**
  - The principles can apply to a wide variety of processes
  - Six Sigma projects normally follow a five-phase improvement process called DMAIC

*Pande, Peter S., Robert P. Neuman, and Roland R. Cavanagh, The Six Sigma Way, New York: McGraw-Hill, 2000, p. xi.

DMAIC

- **DMAIC** is a systematic, closed-loop process for continued improvement that is scientific and fact based
- DMAIC stands for:
  - **D**efine: Define the problem/opportunity, process, and customer requirements
  - **M**easure: Define measures, then collect, compile, and display data
  - **A**nalyze: Scrutinize process details to find improvement opportunities
  - **I**mprove: Generate solutions and ideas for improving the problem
  - **C**ontrol: Track and verify the stability of the improvements and the predictability of the solution

HOW IS SIX SIGMA QUALITY CONTROL UNIQUE?

- It requires an organization-wide commitment.
- Training follows the “Belt” system
- Six Sigma organizations have the ability and willingness to adopt contrary objectives, such as reducing errors and getting things done faster
- It is 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 PROJECTS USE PROJECT MANAGEMENT

- The training for Six Sigma includes many project management concepts, tools, and techniques
- For example, Six Sigma projects often use business cases, project charters, schedules, budgets, and so on
- Six Sigma projects are done in teams; the project manager is often called the team leader, and the sponsor is called the champion

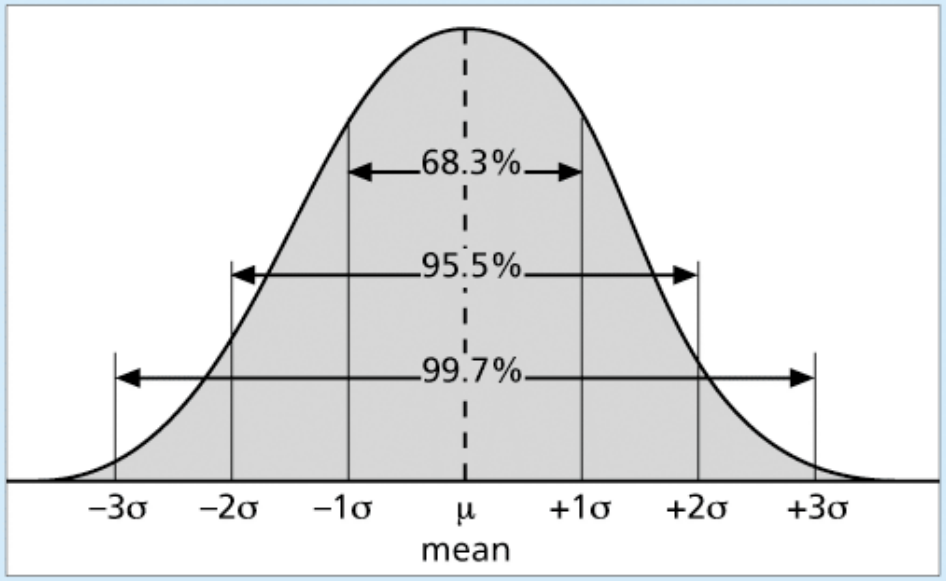
SIX SIGMA AND STATISTICS

- The term *sigma* means standard deviation
- **Standard deviation** measures how much variation exists in a distribution of data
- Standard deviation is 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, yet this number is confusing to many statisticians

SIX SIGMA USES A CONVERSION TABLE

- Using a normal curve, if a process is at six sigma, there would be no more than two defective units per billion produced
- Six Sigma uses a scoring system that accounts for time, an important factor in determining process variations
- **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

NORMAL CURVE, SIGMA AND DEFECTIVE UNITS



The normal curve

Specification Range (in plus or minus 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

TABLE 8-3: 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

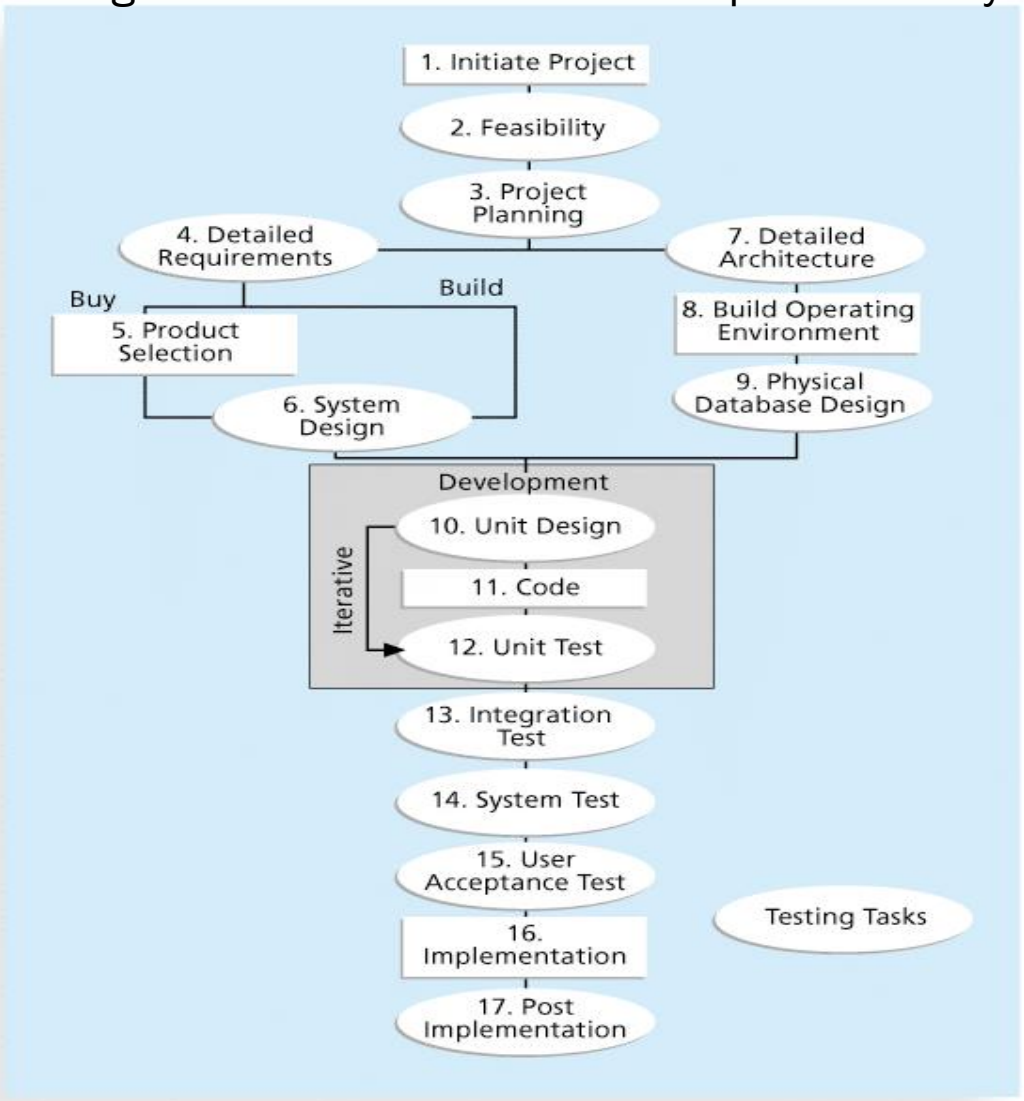
SIX 9S OF QUALITY

- **Six 9s of quality** is a measure of quality control equal to 1 fault in 1 million opportunities
- In the telecommunications industry, it means 99.9999 percent service availability or *30 seconds of down time a year*
- This level of quality has also been stated as the target goal for the number of errors in a communications circuit, system failures, or errors in lines of code

TESTING

- Many IT professionals think of testing as a stage th
- Testing should be done during almost every phase

Testing Tasks in the Software Development Life Cycle



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 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 because:
  - 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 error-free code at each stage of testing

G: MODERN QUALITY MANAGEMENT

MODERN QUALITY MANAGEMENT

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

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 fishbone diagrams
- Taguchi developed methods for optimizing the process of engineering experimentation
- Feigenbaum developed the concept of total quality control

MALCOLM BALDRIGE AWARD

- The **Malcolm Baldrige National Quality Award** originated in 1987 to recognize companies that have achieved a level of world-class competition through quality management
- Given by the President of the United States to U.S. businesses
- Three awards each year in different categories:
  - Manufacturing
  - Service
  - Small business
  - Education and health care

ISO STANDARDS

- ISO 9000 is a quality system standard that:
  - Is a three-part, continuous cycle of planning, controlling, and documenting quality in an organization
  - Provides minimum requirements needed for an organization to meet its quality certification standards
  - Helps organizations around the world reduce costs and improve customer satisfaction
- See www.iso.org for more information

GLOBAL ISSUES

- In 2015, 15 electric cars were introduced throughout the world
- Driverless cars are also being tested
- Google’s director of self-driving cars is striving to improve their quality to reduce accident rates

H: IMPROVING QUALITY, LEADRSHIP, COST QUALITY

IMPROVING INFORMATION TECHNOLOGY PROJECT QUALITY

- Several suggestions for improving quality for IT projects include:
  - Establish leadership that promotes quality
  - Understand the cost of quality
  - Focus on organizational influences and workplace factors that affect quality
  - Follow maturity models

LEADERSHIP

- As Joseph M. Juran said in 1945, “It is most important that top management be quality-minded. In the absence of sincere manifestation of interest at the top, little will happen below”*
- A large percentage of quality problems are associated with management, not technical issues.

*American Society for Quality (ASQ), *(www.asqc.org/about/history/juran.html*).

THE COST OF QUALITY

- The **cost of quality** is the 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
- A study reported that software bugs cost the U.S. economy $59.6 billion each year and that one third of the bugs could be eliminated by an improved testing infrastructure

FIVE 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

ORGANIZATIONAL INFLUENCES, WORKPLACE FACTORS, AND QUALITY

- Study by DeMarco and Lister showed that organizational issues had a much greater influence on programmer productivity than the technical environment or programming languages
- Programmer productivity varied by a factor of one to ten across organizations, but only by 21 percent within the same organization
- Study found no correlation between productivity and programming language, years of experience, or salary.
- A dedicated workspace and a quiet work environment were key factors to improving programmer productivity

EXPECTATIONS AND CULTURAL DIFFERENCES IN QUALITY

- Project managers must understand and manage stakeholder expectations.
- Expectations also vary by:
  - Organization's culture
  - Geographic regions

MATURITY MODELS

- **Maturity models** are frameworks for helping organizations improve their processes and systems
  - The **Software Quality Function Deployment Model** focuses on defining user requirements and planning software projects
  - The Software Engineering Institute's **Capability Maturity Model Integration** is a process improvement approach that provides organizations with the essential elements of effective processes

CMMI LEVELS

- CMMI levels, from lowest to highest, are:
  - Incomplete
  - Performed
  - Managed
  - Defined
  - Quantitatively Managed
  - Optimizing
- Companies may not get to bid on government projects unless they have a CMMI Level 3

PMI'S MATURITY MODEL

- 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

BEST PRACTICE

- OPM3 provides the following example to illustrate a best practice, capability, outcome, and key performance indicator:
  - Best practice: Establish internal project management communities
  - Capability: Facilitate project management activities
  - Outcome: Local initiatives, meaning the organization develops pockets of consensus around areas of special interest
  - Key performance indicator: Community addresses local issues

USING SOFTWARE TO ASSIST IN PROJECT QUALITY MANAGEMENT

- Spreadsheet and charting software helps create Pareto diagrams, fishbone diagrams, and so on
- Statistical software packages help perform statistical analysis
- Specialized software products help manage Six Sigma projects or create quality control charts
- Project management software helps create Gantt charts and other tools to help plan and track work related to quality management

CHAPTER SUMMARY

- Project quality management ensures that the project will satisfy the needs for which it was undertaken
- Main processes include:
  - Plan quality
  - Perform quality assurance
  - Perform quality control