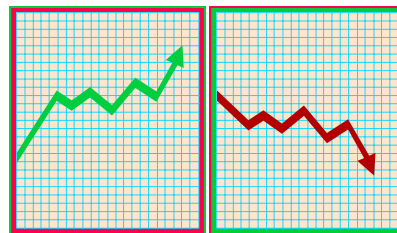


# Project Quality Management



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## Project Quality Management Processes

- ◆ **Quality planning:** identifying which quality standards are relevant to the project and how to satisfy them
- ◆ **Quality assurance:** evaluating overall project performance to ensure the project will satisfy the relevant quality standards
- ◆ **Quality control:** monitoring specific project results to ensure that they comply with the relevant quality standards while identifying ways to improve overall quality

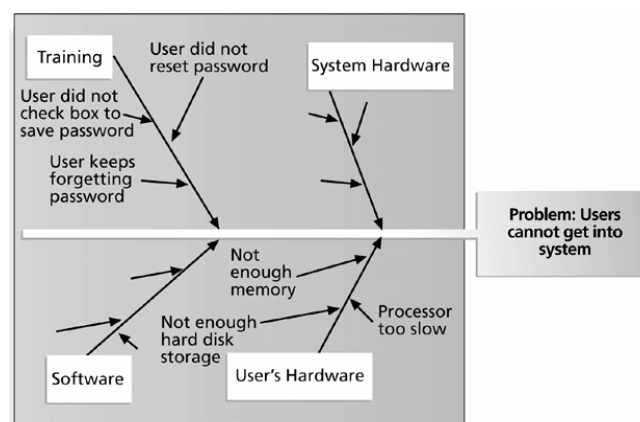
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## Modern Quality Management

- ◆ 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

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## Sample Fishbone or Ishikawa Diagram



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## Quality Planning

- ◆ It is important to design in quality and communicate important factors that directly contribute to meeting the customer's requirements
- ◆ Design of experiments helps identify which variable have the most influence on the overall outcome of a process

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## 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
- ◆ Benchmarking can be used to generate ideas for quality improvements
- ◆ Quality audits help identify lessons learned that can improve performance on current or future projects

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## Quality Control

- ◆ The main outputs of quality control are
  - acceptance decisions
  - rework
  - process adjustments
- ◆ Some tools and techniques include
  - pareto analysis
  - statistical sampling
  - quality control charts
  - testing

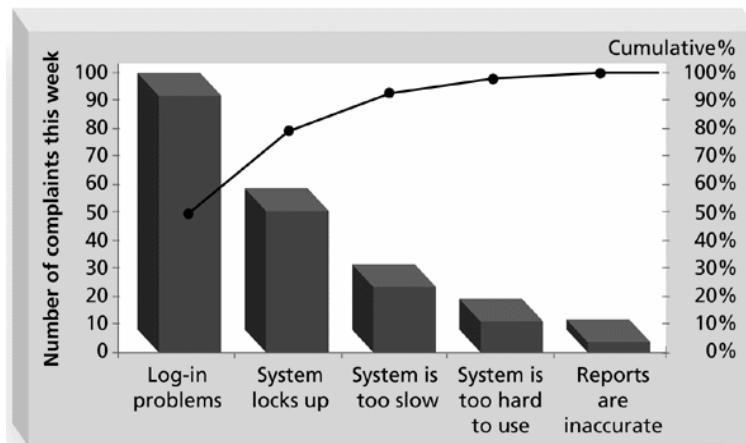
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## Pareto Analysis

- ◆ Pareto analysis involves identifying the vital few contributors that account for the most quality problems in a system
- ◆ Also called the **80-20 rule**, meaning that 80% of problems are often due to 20% of the causes
- ◆ Pareto diagrams are histograms that help identify and prioritize problem areas

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## Sample Pareto Diagram



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## Statistical Sampling and Standard Deviation

- ◆ 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:

$$\text{Sample size} = .25 \times (\text{certainty Factor/acceptable error})^2$$

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## Commonly Used Certainty Factors

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

95% certainty: Sample size =  $0.25 \times (1.960/.05)^2 = 384$

90% certainty: Sample size =  $0.25 \times (1.645/.10)^2 = 68$

80% certainty: Sample size =  $0.25 \times (1.281/.20)^2 = 10$

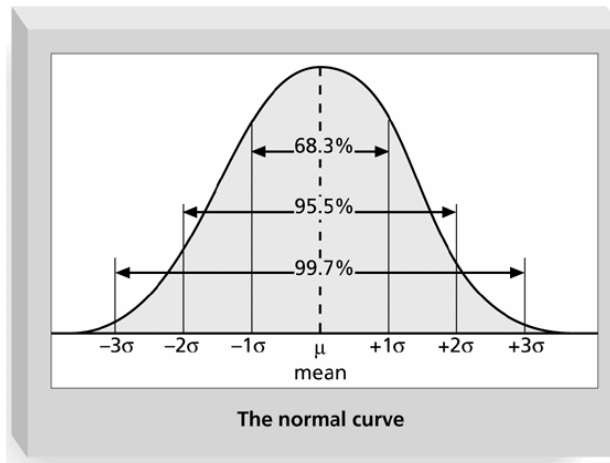
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## Standard Deviation

- ◆ Standard deviation measures how much variation exists in a distribution of data
- ◆ A small standard deviation means that data cluster closely around the middle of a distribution and there is little variability among the data
- ◆ A normal distribution is a bell-shaped curve that is symmetrical about the mean or average value of a population

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## Normal Distribution and Standard Deviation



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## 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

**Note: “Six sigma” often refers to +/-3 sigma, meaning 2.7 million defects per billion units produced, or 2.7 defects per million.**

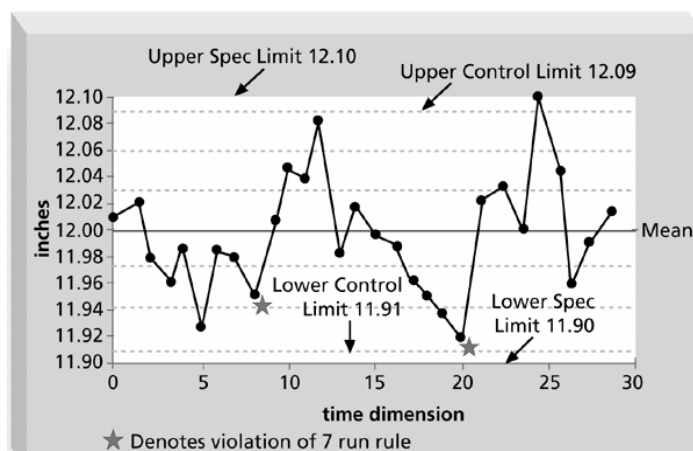
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## Quality Control Charts, Six Sigma, and the Seven Run Rule

- ◆ A control chart is a graphic display of data that illustrates the results of a process over time. It helps prevent defects and allows you to determine whether a process is in control or out of control
- ◆ Operating at a higher sigma value, like 6 sigma, means the product tolerance or control limits have less variability
- ◆ The seven run rule states that if seven data points in a row are all below the mean, above the mean, or increasing or decreasing, then the process needs to be examined for non-random problems

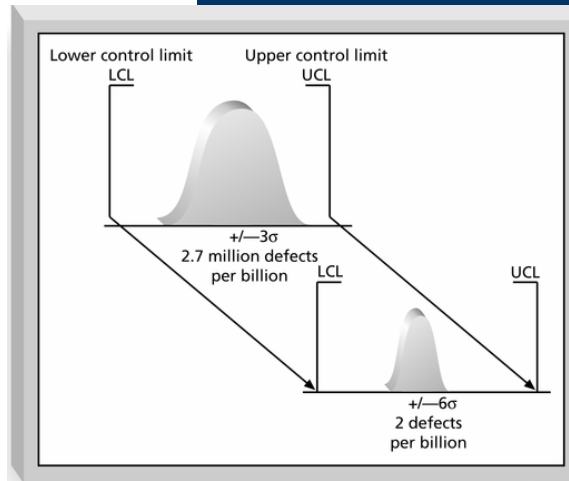
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## Sample Quality Control Chart



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## Reducing Defects with Six Sigma



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## The Cost of Quality

- ◆ The cost of quality is
  - the cost of conformance or delivering products that meet requirements and fitness for use
  - the cost of nonconformance or taking responsibility for failures or not meeting quality expectations

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## Costs Per Hour of Downtime Caused by Software Defects

Business	Cost per Hour Downtime
Automated teller machines (medium-sized bank)	\$14,500
Package shipping service	\$28,250
Telephone ticket sales	\$69,000
Catalog sales center	\$90,000
Airline reservation center (small airline)	\$89,500

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## Five Cost Categories Related to Quality

- ◆ **Prevention cost:** the cost of planning and executing a project so it is error-free or within an acceptable error range
- ◆ **Appraisal cost:** the 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

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