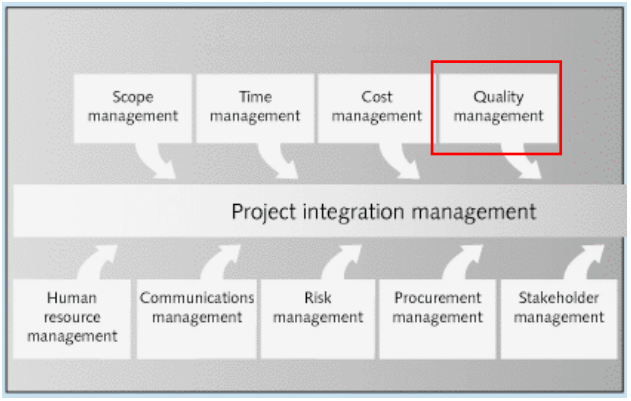
Project Quality Management



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The Importance of Project Quality Management

A fatal bug in software: Ariane 5

https://www.youtube.com/watch?v=kYUradUvEpI

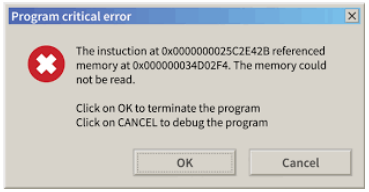
Cause: *a bug in its flight control software*

Assignment of a 64-bit double value to a 16-bit integer value representing horizontal bias caused an error, because the double value was too large to be converted to a 16-bit integer, leading to a crash 37 seconds after launch.

https://en.wikipedia.org/wiki/Ariane_5

The Importance of Project Quality Management

- In 1986, two hospital patients died after receiving fatal doses of radiation from a Therac 25 machine after a software problem caused the machine to ignore calibration data
- In one of the biggest software errors in banking history, Chemical Bank mistakenly deducted about $15 million from more than 100,000 customer accounts
- In 2015, the United States Department of Justice unsealed indictments in what was described as “the largest data break of names and e-mail addresses in the history of the internet”



What Is Project Quality?

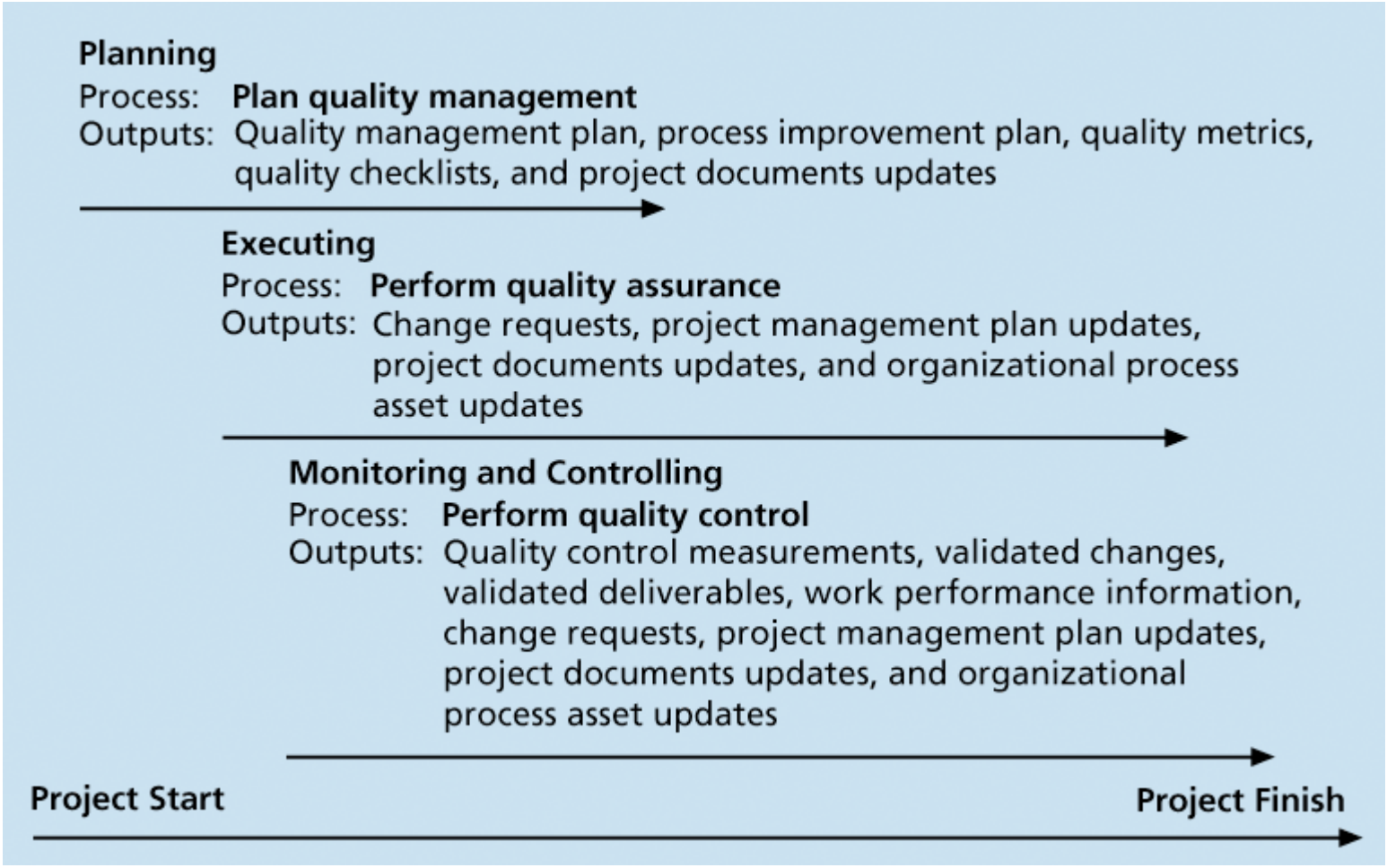
- The International Organization for Standardization (ISO) defines **quality** as “the degree to which a set of inherent characteristics fulfils requirements” (ISO9000:2000)
- Other experts define quality based on:
  - **Conformance to requirements**: The project’s processes and products meet written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

  Quality is affected by all three constraints.

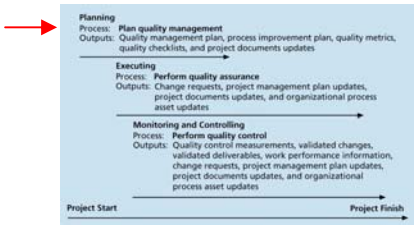
What Is Project Quality Management?

- Project managers are responsible for quality management
- Project quality management ensures that the project will satisfy the needs for which it was undertaken
- Processes include:
  - **Planning** : Identifying which quality standards are relevant to the project and how to satisfy them; a **metric** is a standard of measurement
  - **Quality Assurance**: all quality management procedures and documents focused on preventing mistakes and providing confidence that quality requirements will be met
  - **Control**: mostly the inspection aspect of quality management

Figure 8-1. Project Quality Management Summary



Quality Management Plan



- The first step is to define the process explaining how the project quality will be managed
- Quality Management Plan describes how quality will be managed throughout the lifecycle of the project. It defines quality standards, policies and procedures.
  - key project deliverables which are subject to quality review
  - quality standards that are the “measures” of successful deliverables
  - customer satisfaction criteria
  - quality standards that are the “measures” used to determine if the whole project management processes is followed
  - quality assurance and control processes

Characteristics associated with quality

- **Functionality** is the degree to which a system performs its intended function
- **Features** are the system's special characteristics that appeal to users
- **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

- **Robustness** is the ability of a product or service to perform as expected under abnormal conditions

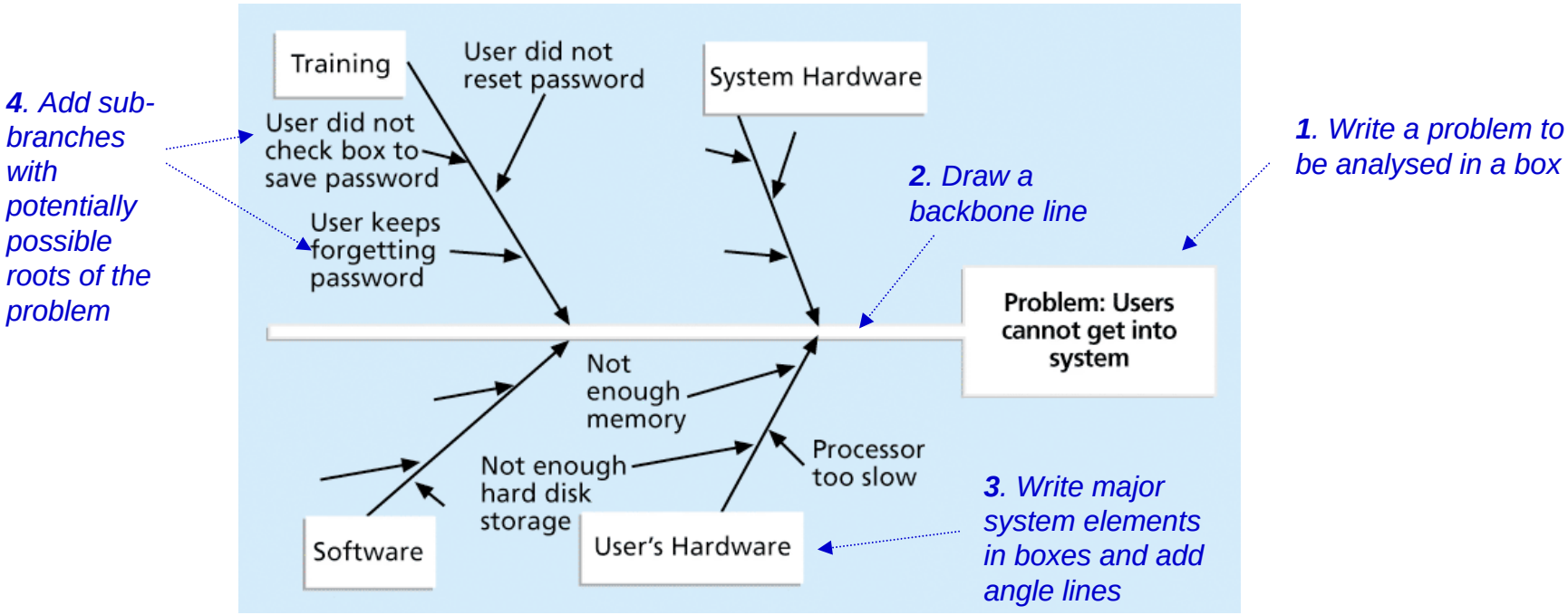
Quality Assurance

- Quality Assurance is a **proactive** approach to prevent mistakes
- Quality Assurance focuses on establishing and improving the project management **processes** to deliver quality products to the customer
  - Select a set of software system characteristics that will be subject to QA
  - Select a set of project documents and reports that will be subject to QA
  - Set checkpoints according to which QA audits will be carried out
  - Define how to confirm that the software product meets the requirements
  - Define how to verify that software has been implemented according to the specified standards (programming language, architecture, corrections,…)
  - Define a procedure to evaluate impact on quality caused by project changes
  - In some cases, benchmarking process may need to be defined to compare new product against competing products available on the market
  - Define the technology transfer procedure

Controlling Quality

- Quality Control is a process used to ensure the product meets the specifications and requirements of the customer.
- QC does not define processes, it follows relevant QA processes to examine the product quality
- Quality Control is a **reactive** approach to identify and correct mistakes using processes defined for testing, inspection and correction
- Possible actions:
  - Rework to bring an item into compliance with product requirements and specifications
  - Accept or reject a deliverable
  - Improve a relevant QA process
- There are several commonly used Quality Control tools

Cause-and-Effect Diagrams

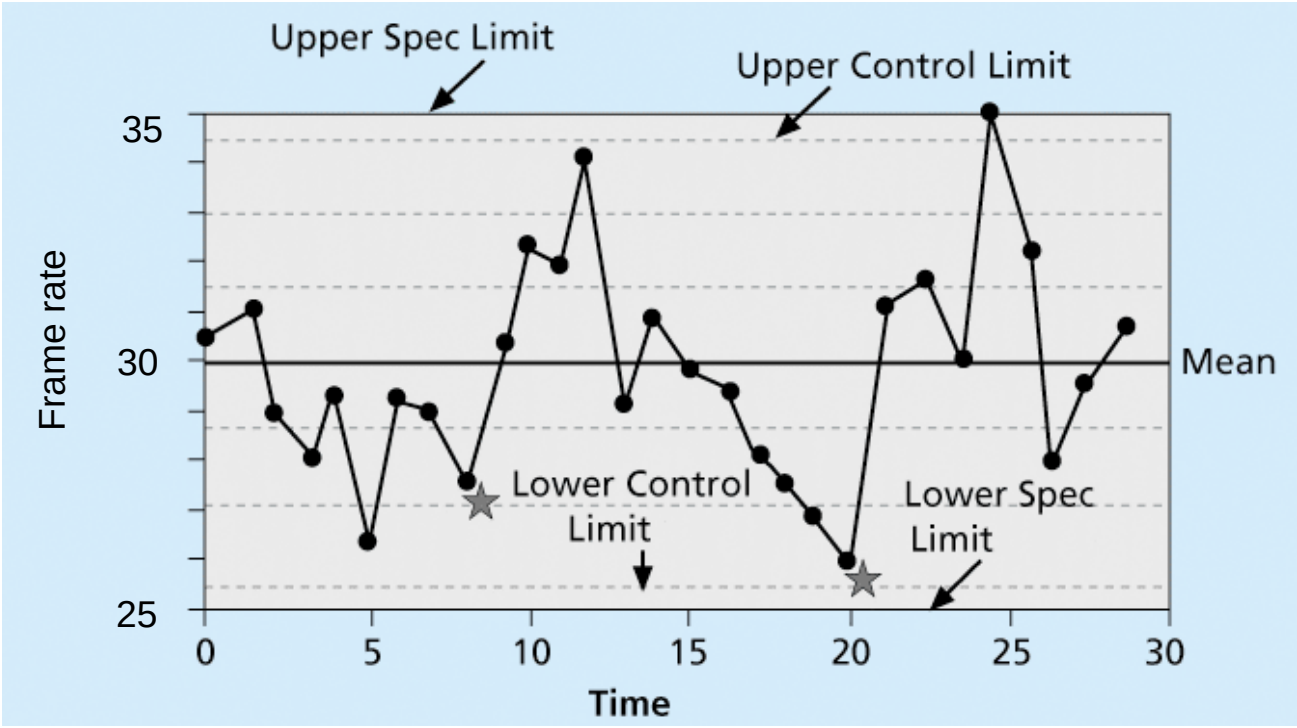


- Diagrams help to identify what caused a problem and reflect relationships between all contributing factors
- All industries have commonly used templates of cause-and-effect diagrams
- Analysis requires good understanding of the system architecture and interaction between system components

Quality Control Charts

To meet quality requirements, a video game was developed with the goal of hitting a frame rate of 30 fps but anywhere between 25 fps to 35 fps is considered acceptable.

Do the results of testing indicate a hidden problem?



- Control Charts display how system properties change around the expected value (or the mean) over time
- The system is rated as out of control if
  - a single point gets outside the control limits
  - seven data points in a row are all below the mean, or above the mean

Checksheet

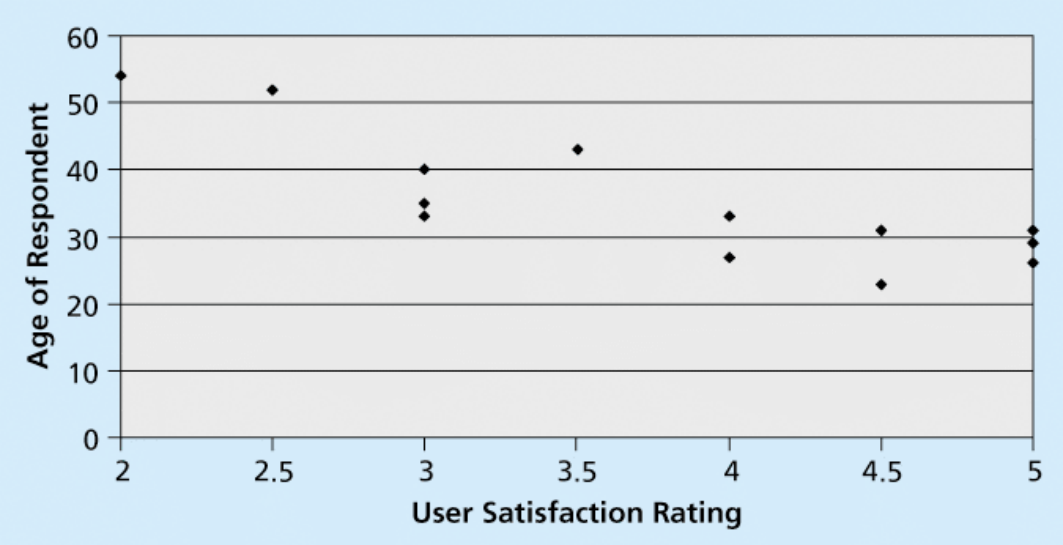
- Checksheets are used to identify and analyze trends
- In the example, most complaints arrive via text message, and there are more complaints on Monday and Tuesday than on other days of the week
- This information might be useful in improving the process for handling complaints

System Complaints

Source	Day							
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
Email	𝍸	𝍸	𝍸	𝍸	𝍸		𝍸	12
Text	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

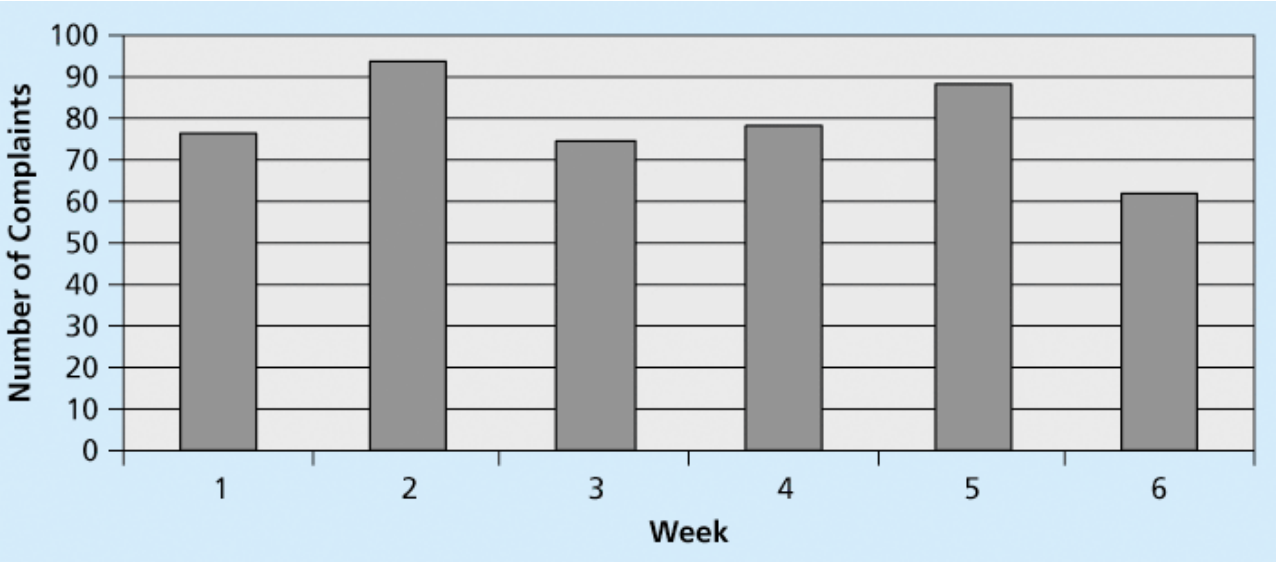
Scatter diagram

- Scatter Diagrams help to reveal if there is a relationship between two variables
- The closer data points are scattered around a line, the more closely the two variables are statistically related



Histograms

- Histograms are bar graphs that show distribution of collected data
- Each bar represents an attribute of a problem and the height of the bar represents its frequency

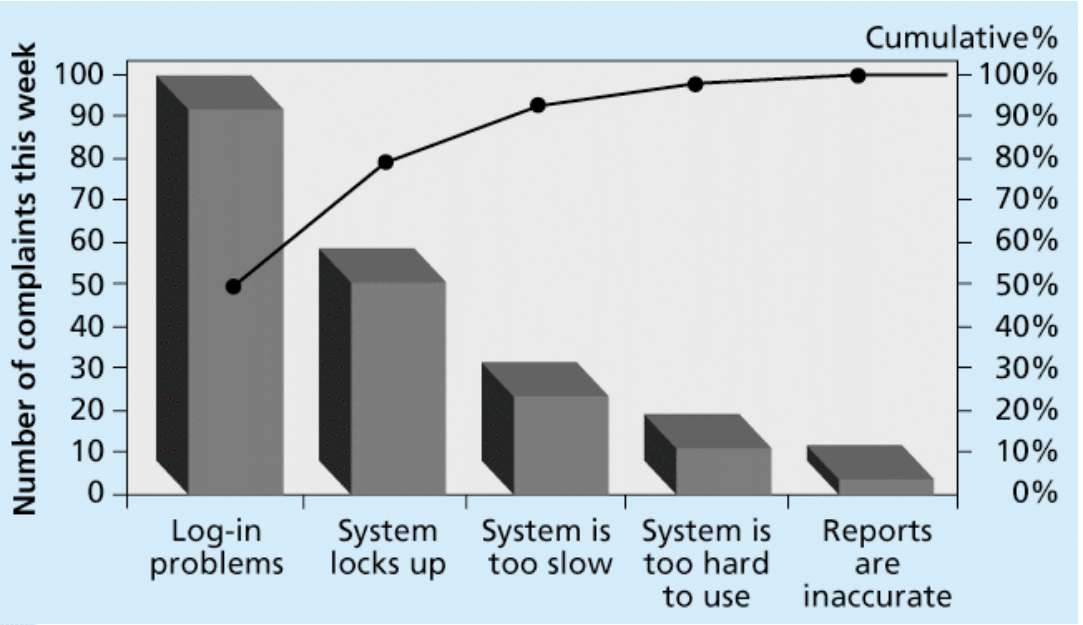


Pareto Charts

- Pareto Chart are histograms that can help you to prioritize what problems need to be solved first
- Pareto Analysis is commonly called the ‘80-20’ rule

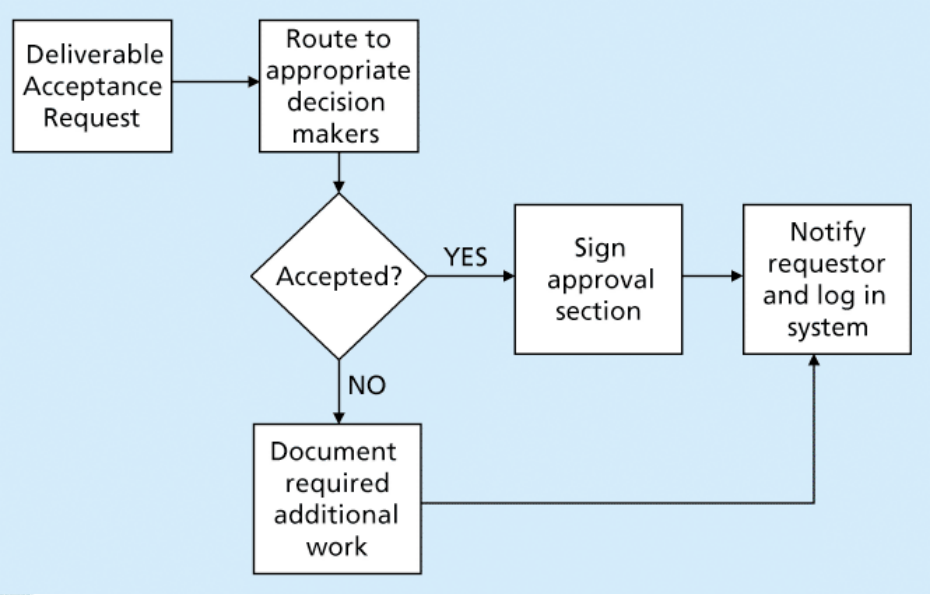
“20% of causes lead to 80% of problems ”

“doing 20% of the work you can fix 80% of problems”

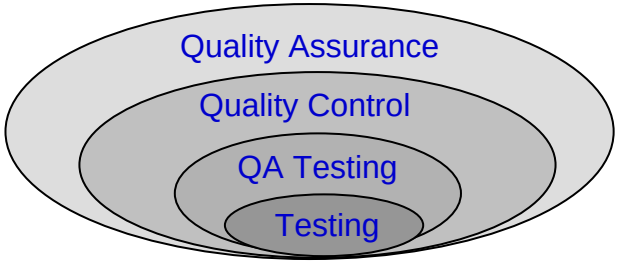


Flowcharts

- Flowcharts are graphic displays of the logic and flow of processes that help you analyze how problems occur and how processes can be improved
- Flowcharts in well documented IT systems can facilitate testing and debugging



Testing



- Software Testing involves executing a software system (or its part) to identify errors, bugs, and defects

  Focus on technical issues. It can be conducted by programmers.

- QA Testing and Software Testing address different issues. QA Testing for software is centred on delivering the best possible end-user experience and high quality products

  - Not limited to technical issues. Requires understanding of what the end-user "quality experience" should be.
  - Should be conducted by testers

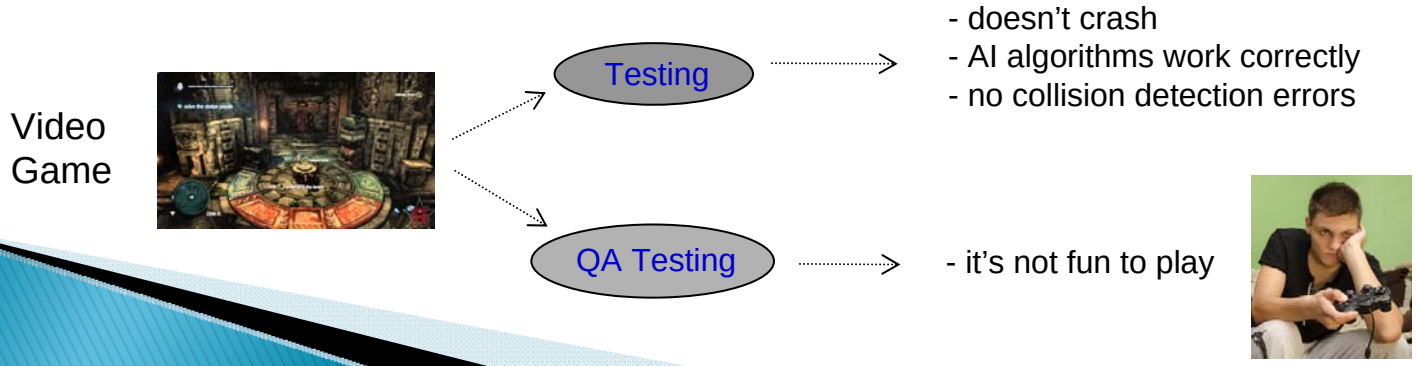
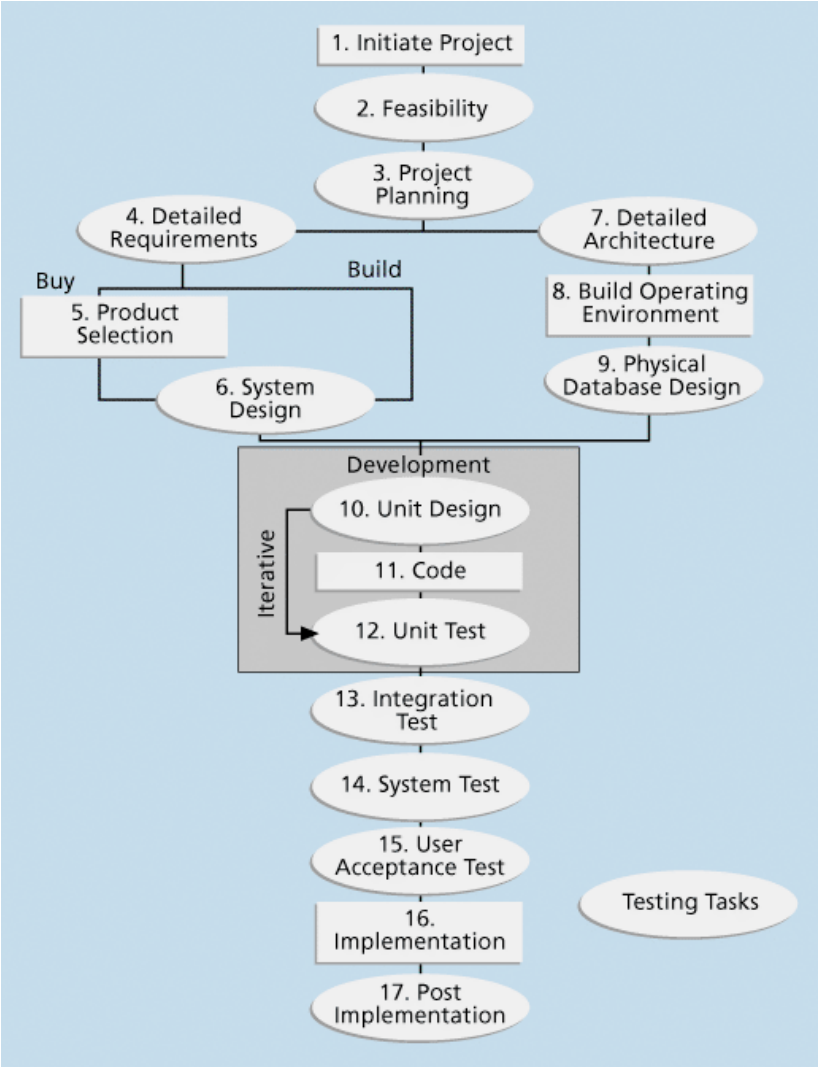


Figure 8-11. Testing Tasks in the Software Development Life Cycle

- **Unit testing** tests each individual component of a program to ensure it passes all test cases prepared according to the test plan
- **Integration testing** occurs after unit and before 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



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

- A large percentage of quality problems are associated with management commitment to quality rather than to technical issues.
- 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”*

*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 product requirements and user's quality criteria
  - **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 reported bugs could be eliminated by improved software testing and QA processes
- It's very important to find an optimal balance between quality requirements and project profitability

  - very high quality standards should not be set for low end products

Five Cost Categories Related to Quality

- **Prevention cost**: Cost of planning and executing a project according to QA procedures
- **Appraisal cost**: Cost of evaluating processes and their outputs to ensure quality
- **Internal failure cost**: Cost incurred to correct an identified defect before the product is transferred to customers
- **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 quality of work done by programmers 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 the number of bugs in code and programming language, years of experience, or salary.
- A dedicated workspace and a quiet work environment were key factors to improving programmer productivity

Using Software to Assist in Project Quality Management

- Spreadsheet and charting software can help to create relevant charts
- Statistical software packages help perform statistical analysis
- 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