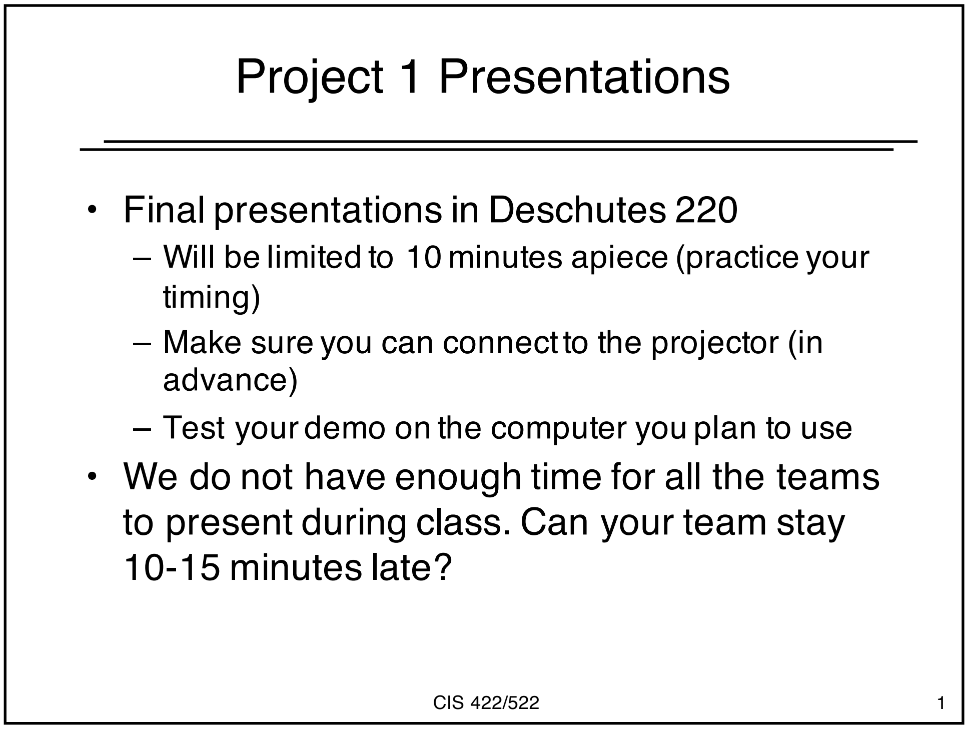
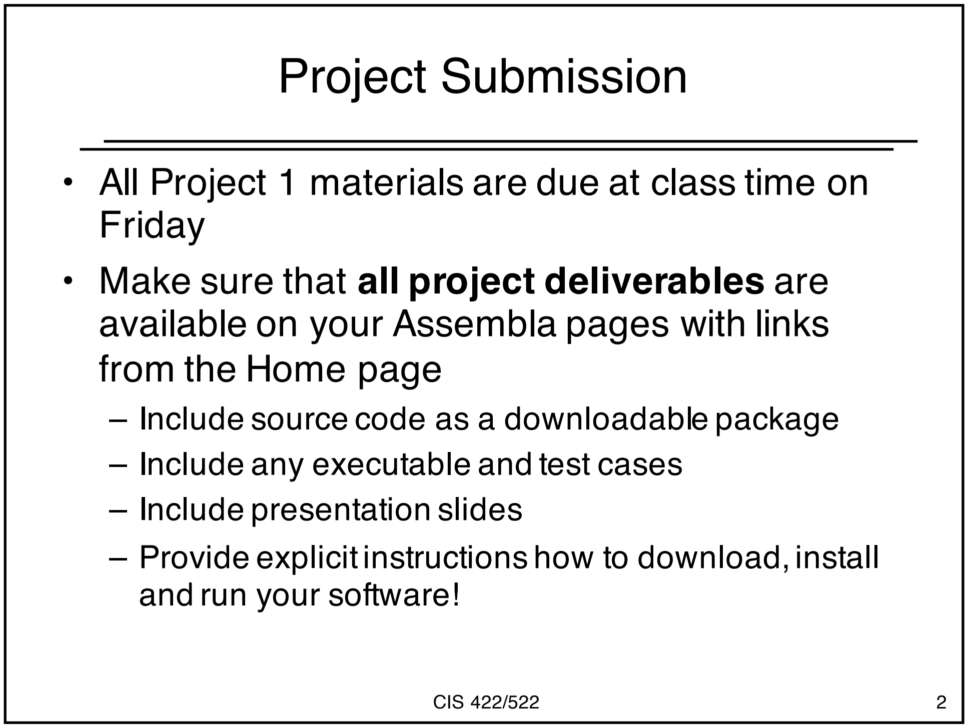


## Project 1 Presentations

- Final presentations in Deschutes 220
  - Will be limited to 10 minutes apiece (practice your timing)
  - Make sure you can connect to the projector (in advance)
  - Test your demo on the computer you plan to use
- We do not have enough time for all the teams to present during class. Can your team stay 10-15 minutes late?



## Project Submission

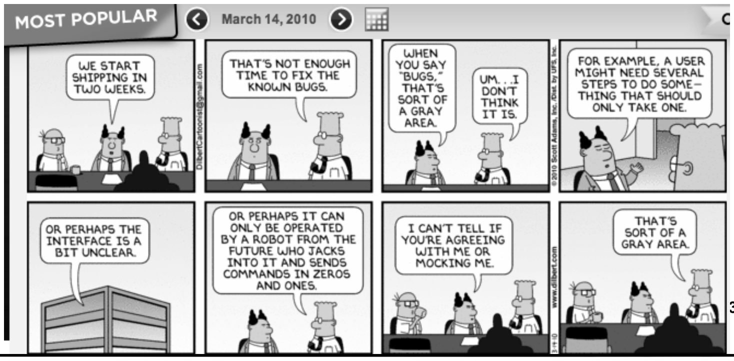
- All Project 1 materials are due at class time on Friday
- Make sure that **all project deliverables** are available on your Assembla pages with links from the Home page
  - Include source code as a downloadable package
  - Include any executable and test cases
  - Include presentation slides
  - Provide explicit instructions how to download, install and run your software!

# Quality Assurance I

Project presentations

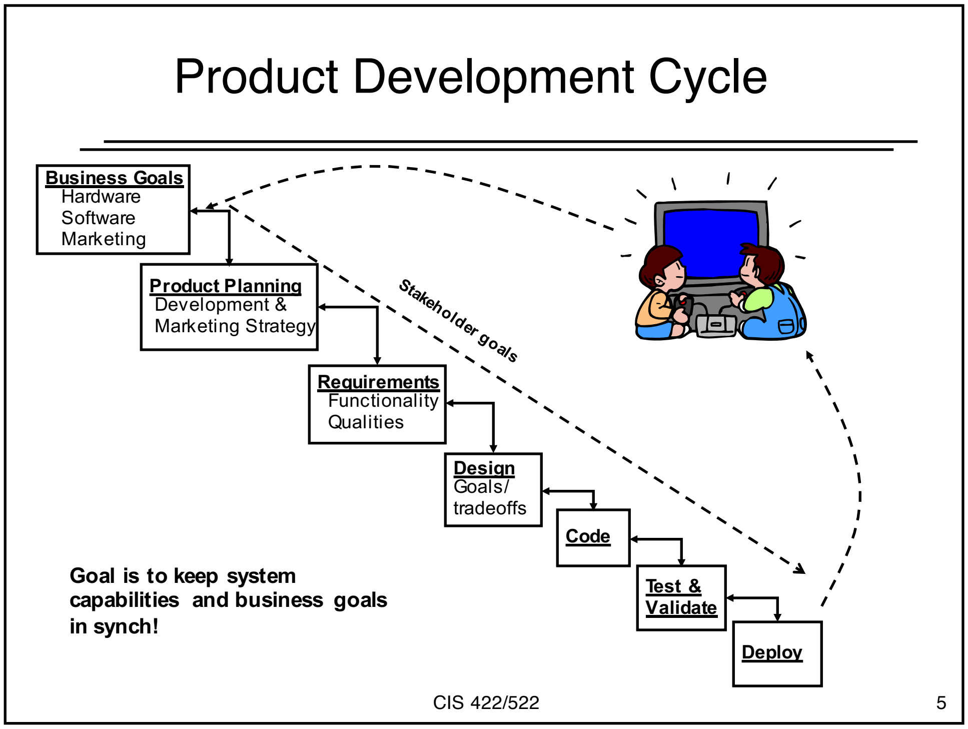
QA Basics

Need for a plan


MOST POPULAR
March 14, 2010
WE START SHIPPING IN TWO WEEKS.
THAT'S NOT ENOUGH TIME TO FIX THE KNOWN BUGS.
DilbertCartoonist@gmail.com
WHEN YOU SAY "BUGS," THAT'S SORT OF A GRAY AREA.
UM. . .I DON'T THINK IT IS.
© 2010 Scott Adams, Inc./Dist. by UFS, Inc.
FOR EXAMPLE, A USER MIGHT NEED SEVERAL STEPS TO DO SOME-THING THAT SHOULD ONLY TAKE ONE.
OR PERHAPS THE INTERFACE IS A BIT UNCLEAR.
OR PERHAPS IT CAN ONLY BE OPERATED BY A ROBOT FROM THE FUTURE WHO JACKS INTO IT AND SENDS COMMANDS IN ZEROS AND ONES.
I CAN'T TELL IF YOU'RE AGREEING WITH ME OR MOCKING ME.
www.dilbert.com
3-14-10
THAT'S SORT OF A GRAY AREA.

# Purpose of SE

- The *purpose of Software Engineering* is to *gain* and *maintain* intellectual and managerial control over the products and processes of software development.
  - **Intellectual control**: able to make rational development decisions based on an understanding of the downstream effects of those choices.
  - **Managerial control** means we likewise control development *resources* (budget, schedule, personnel).



## Product Development Cycle

**Business Goals**
Hardware
Software
Marketing

**Product Planning**
Development &
Marketing Strategy

**Requirements**
Functionality
Qualities

**Design**
Goals/
tradeoffs

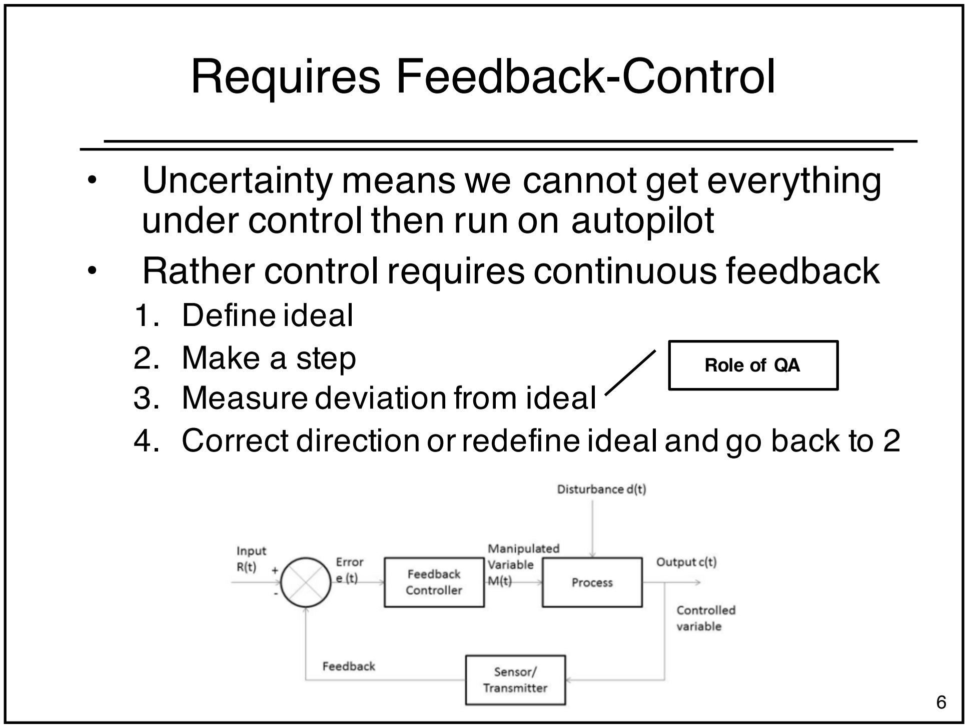
**Code**

**Test & Validate**

**Deploy**

Stakeholder goals

**Goal is to keep system capabilities and business goals in synch!**

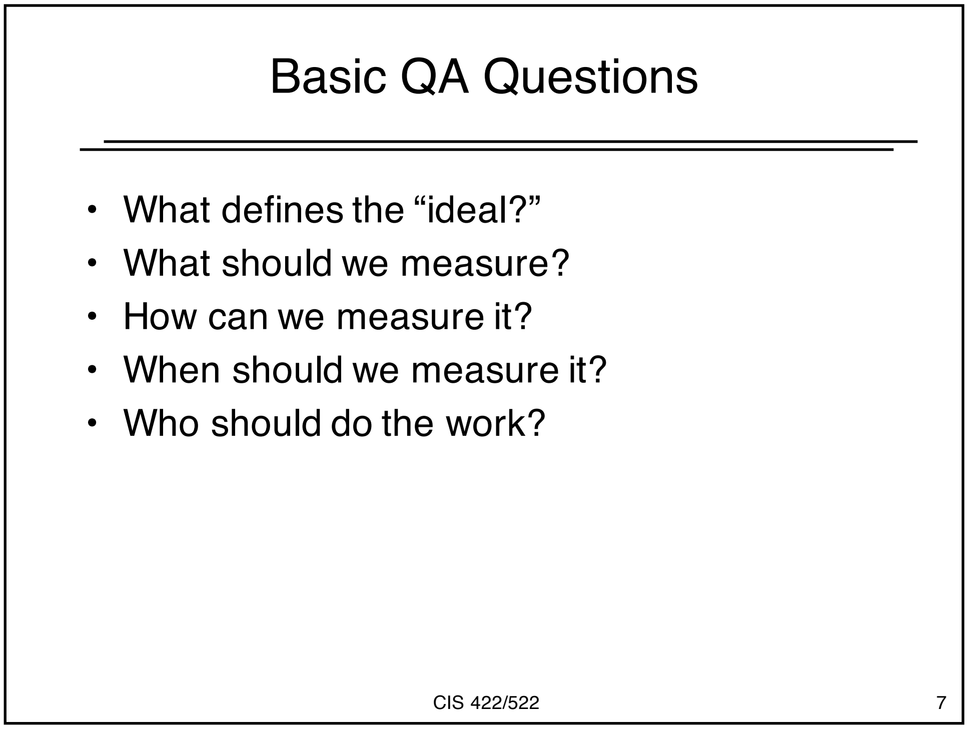


## Requires Feedback-Control

- Uncertainty means we cannot get everything under control then run on autopilot
- Rather control requires continuous feedback
  1. Define ideal
  2. Make a step
  3. Measure deviation from ideal
  4. Correct direction or redefine ideal and go back to 2

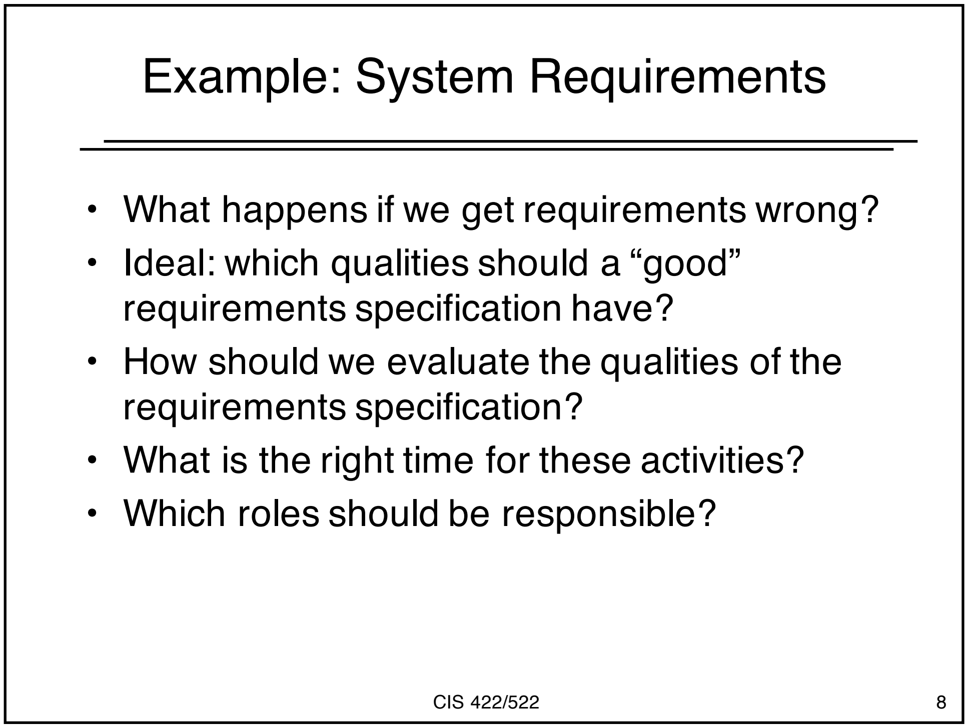
**Role of QA**

Disturbance d(t)
Input R(t)
+
-
Error e (t)
Feedback Controller
Manipulated Variable M(t)
Process
Output c(t)
Controlled variable
Feedback
Sensor/ Transmitter



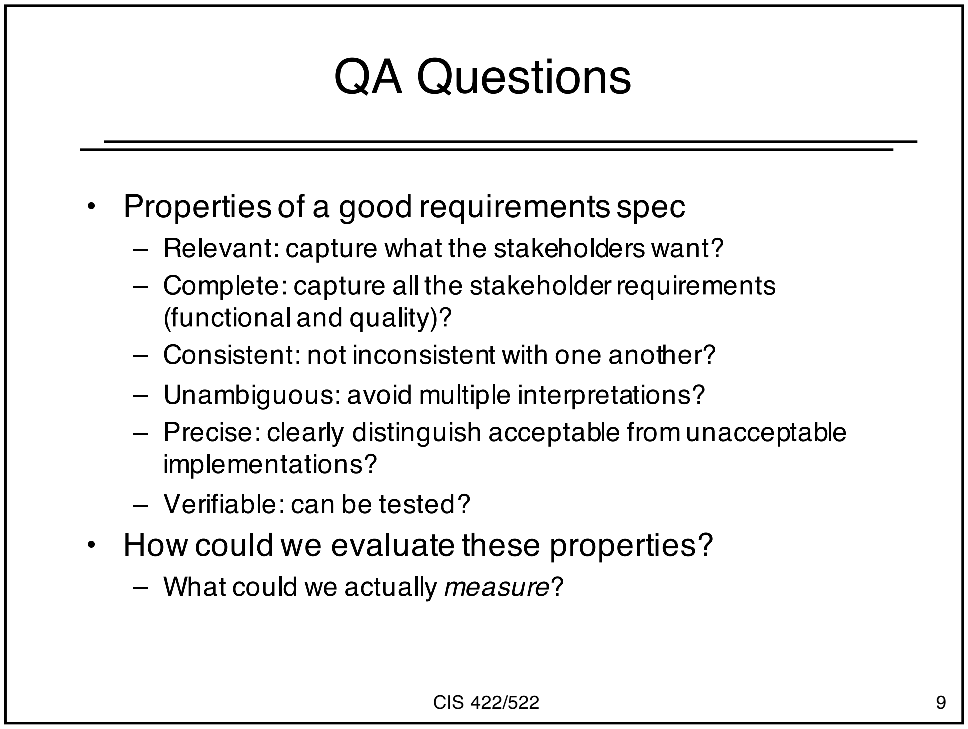
## Basic QA Questions

- What defines the “ideal?”
- What should we measure?
- How can we measure it?
- When should we measure it?
- Who should do the work?



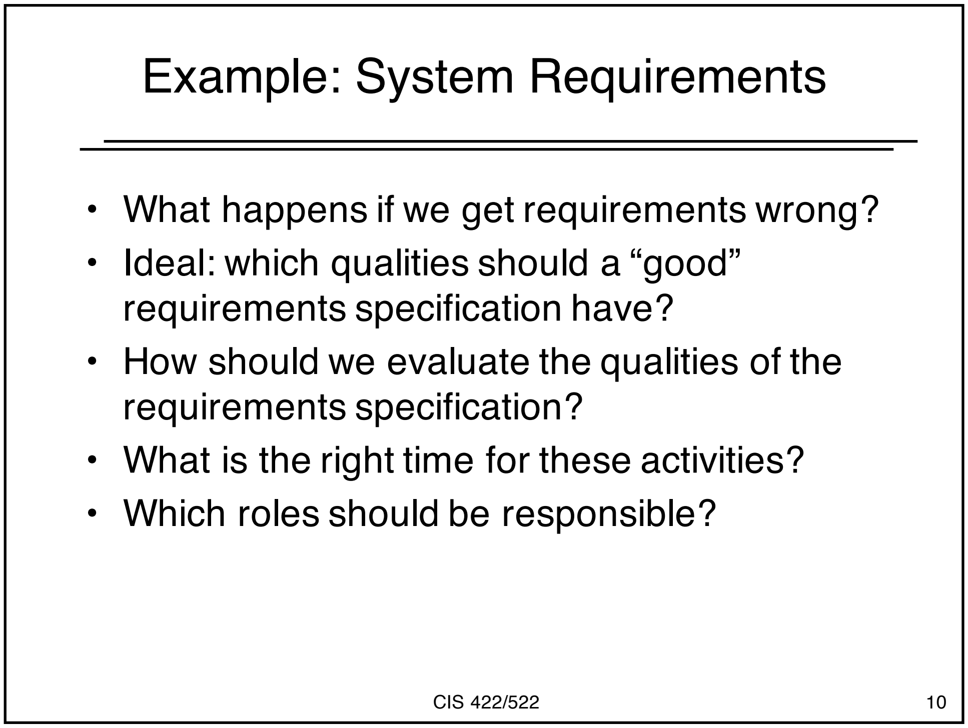
## Example: System Requirements

- What happens if we get requirements wrong?
- Ideal: which qualities should a “good” requirements specification have?
- How should we evaluate the qualities of the requirements specification?
- What is the right time for these activities?
- Which roles should be responsible?



## QA Questions

- Properties of a good requirements spec
  - Relevant: capture what the stakeholders want?
  - Complete: capture all the stakeholder requirements (functional and quality)?
  - Consistent: not inconsistent with one another?
  - Unambiguous: avoid multiple interpretations?
  - Precise: clearly distinguish acceptable from unacceptable implementations?
  - Verifiable: can be tested?
- How could we evaluate these properties?
  - What could we actually *measure*?



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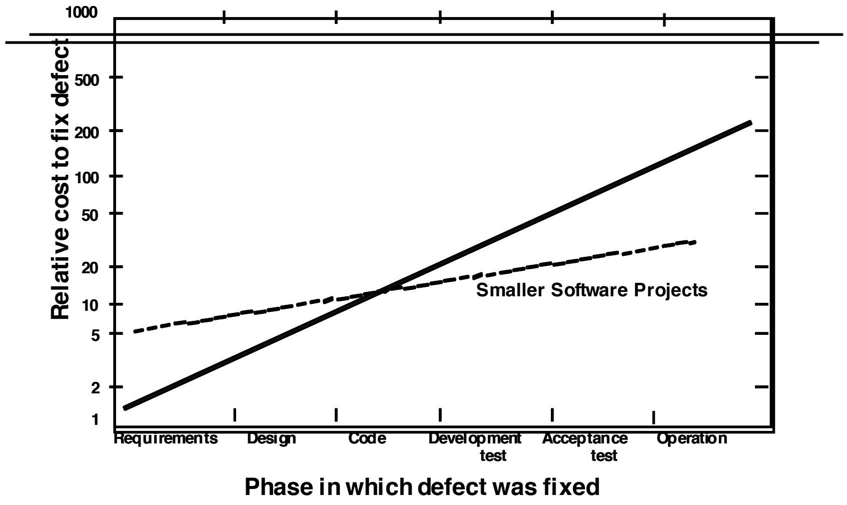
## Increase in Software Cost-to-fix vs. Phase (1976) *



* Barry Boehm - A View of 20th and 21st Century Software Engineering

## Quality is Cumulative

**Requirements Analysis**

- Are the requirements valid?
- Complete? Consistent? Implementable?
- Testable?

**Architectural Design**

- Does the design satisfy requirements?
- Are all functional capabilities included?
- Are qualities addressed (performance, maintainability, usability, etc.?

**Detailed Design**

- Do the modules work together to implement all the functionality?
- Are likely changes encapsulated?
- Is every module well defined

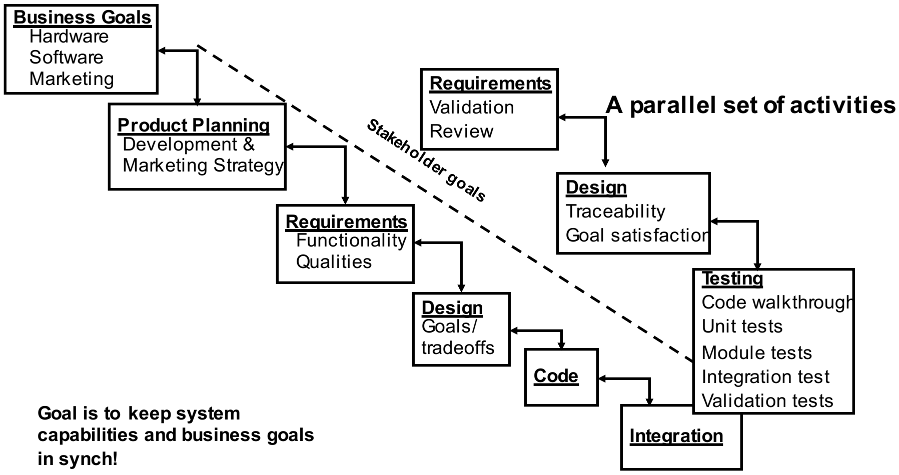
**Coding**

- Implement the required functionality?
- Race conditions? Memory leaks? Buffer overflow?

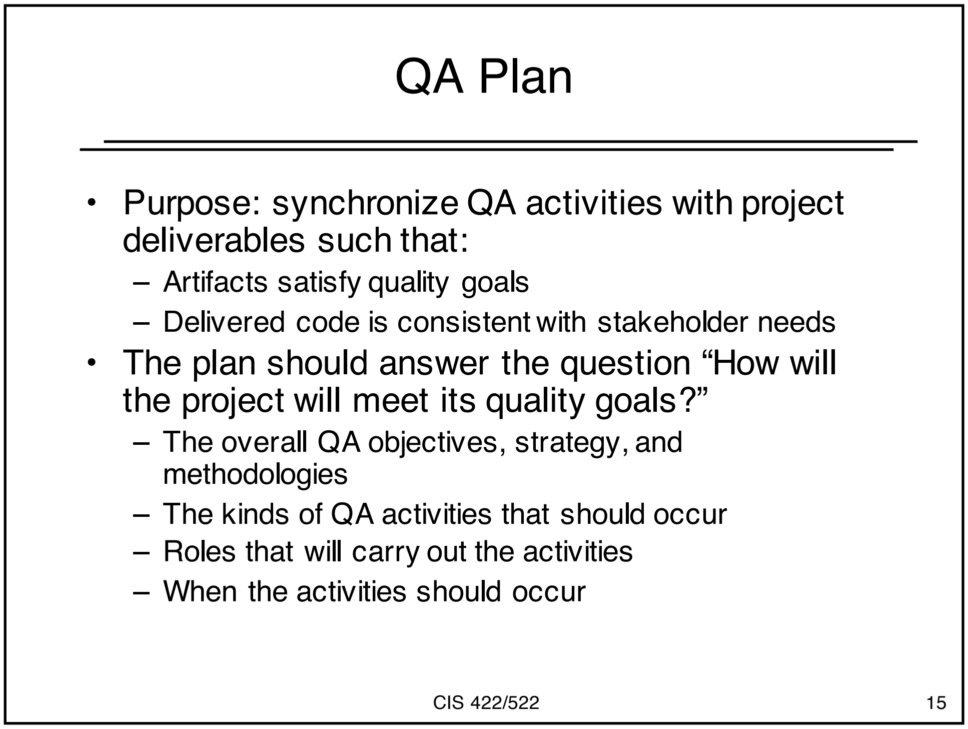
## We need a plan!

- QA activities are
  - Critical to control (and project success)
  - Part of every phase of the project
  - Time consuming, labor intensive and expensive
    - NIST Study: *~80% of development costs are consumed by software developers identifying and correcting defects*
  - Cannot do everything, need to choose
- Suggests need to plan QA activities
  - Detect issues as early as possible
  - Target highest priority/risk issues for project
  - Support cost-effective use of resources

## Product Development Cycle

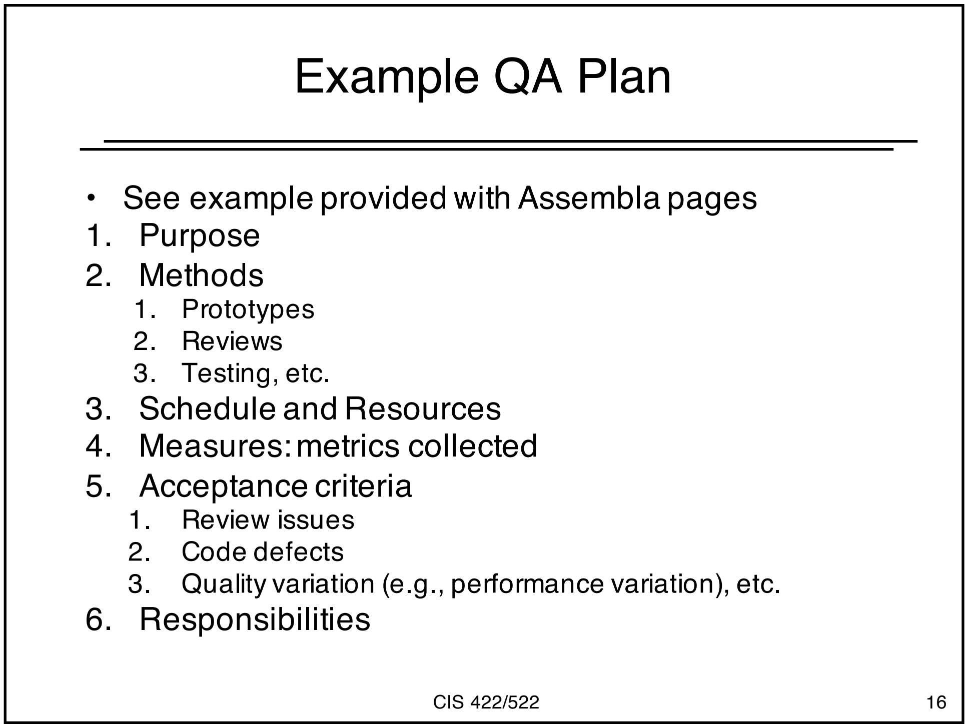


**Goal is to keep system capabilities and business goals in synch!**



## QA Plan

- Purpose: synchronize QA activities with project deliverables such that:
  - Artifacts satisfy quality goals
  - Delivered code is consistent with stakeholder needs
- The plan should answer the question “How will the project will meet its quality goals?”
  - The overall QA objectives, strategy, and methodologies
  - The kinds of QA activities that should occur
  - Roles that will carry out the activities
  - When the activities should occur



## Example QA Plan

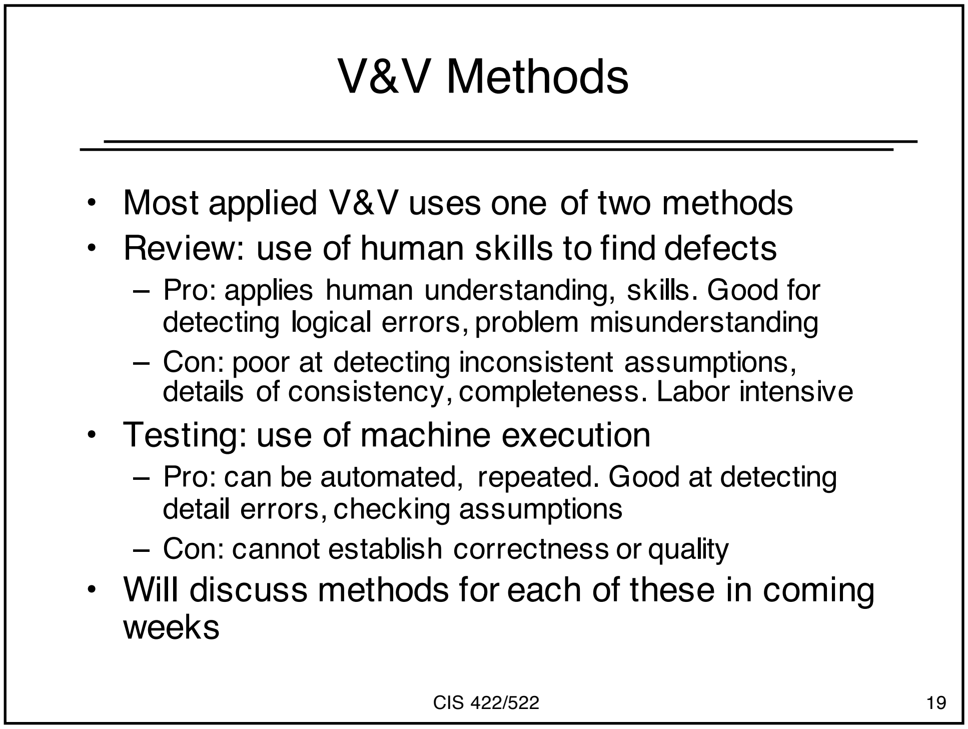
- See example provided with Assembla pages

1. Purpose
2. Methods
   1. Prototypes
   2. Reviews
   3. Testing, etc.
3. Schedule and Resources
4. Measures: metrics collected
5. Acceptance criteria
   1. Review issues
   2. Code defects
   3. Quality variation (e.g., performance variation), etc.
6. Responsibilities

## Verification and Validation

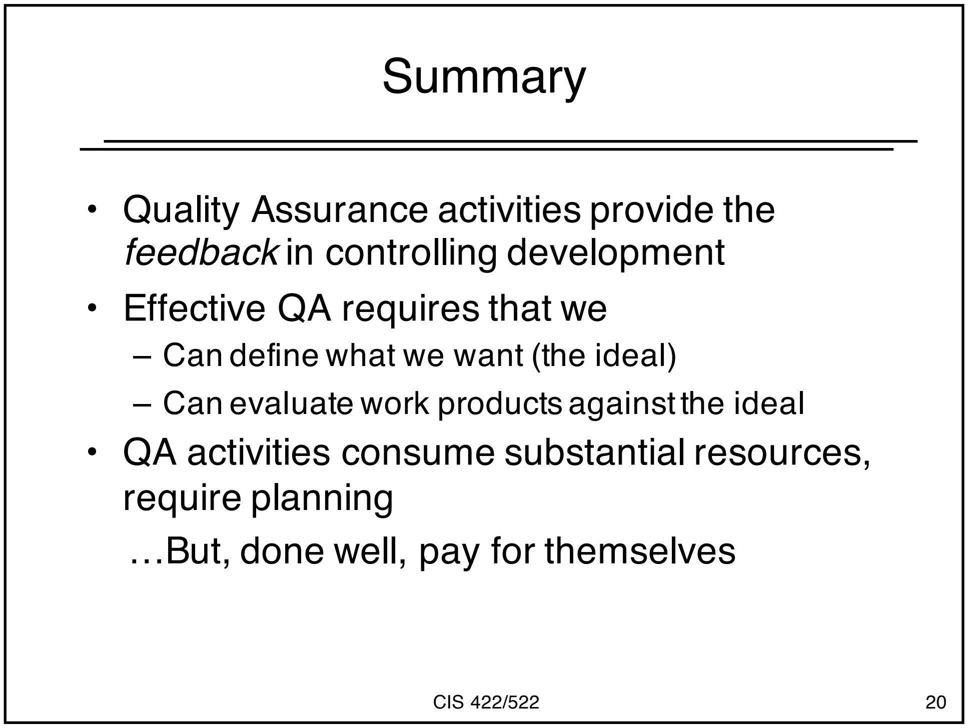
## Validation and Verification

- *Validation*: activities to answer the question – "Are we building a system the customer wants?"
  - Familiar activity: customer review of prototype
- *Verification*: activities to answer the question – "Are we building the system consistent with its specifications?"
  - Most familiar verification activity is functional testing
- Both are processes, both have many variations



## V&V Methods

- Most applied V&V uses one of two methods
- Review: use of human skills to find defects
  - Pro: applies human understanding, skills. Good for detecting logical errors, problem misunderstanding
  - Con: poor at detecting inconsistent assumptions, details of consistency, completeness. Labor intensive
- Testing: use of machine execution
  - Pro: can be automated, repeated. Good at detecting detail errors, checking assumptions
  - Con: cannot establish correctness or quality
- Will discuss methods for each of these in coming weeks



## Summary

- Quality Assurance activities provide the *feedback* in controlling development
- Effective QA requires that we
  - Can define what we want (the ideal)
  - Can evaluate work products against the ideal
- QA activities consume substantial resources, require planning

  …But, done well, pay for themselves