

SOFTWARE QUALITY ASSURANCE

John Abbott College

Automated Testing

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Why do programs have bugs?

- **Involvement makes us blind**
- **Expectations mask reality**
- **Interactions are unpredictable**
- **Testing takes too much time**
- **Testing is repetitive and tedious**

The Cost of Software Quality

- At least *60%* of your development budget
- is used to test only *20-25%*
- of your application features

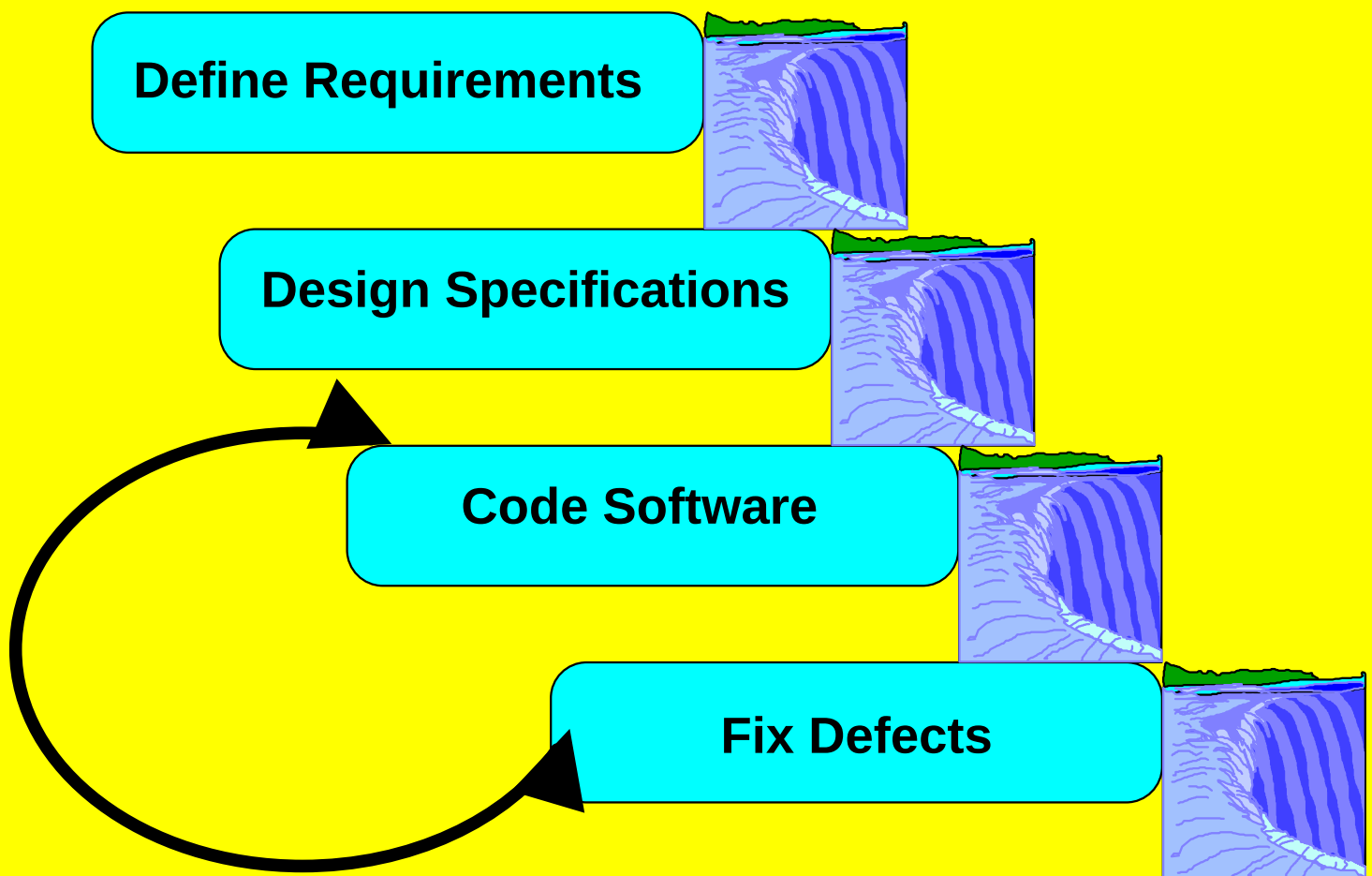
Quality Assurance Depends on Testing

- **Critical examination**
- **Doing everything feasible to find errors**
- **Errors are deviations from specification**

To Achieve Software Quality

**We must conduct
a critical
examination of a
system's quality
every time we
implement a change**

The System Development Life Cycle (SDLC)



Why QA?

- **Errors in mission-critical systems can be real-world and business disasters**
- **E.g., software error in chemical-plant in Netherlands**
 - **allowed operator to enter codes for wrong chemical substances**
 - **exploded on contact in vat**
 - **destroyed plant**
 - **killed two people**

Why automated testing?

- **SDLC known as "waterfall"**
- **Software backlog running 2 years and more**
- **JAD/RAD more popular than ever**
- **Therefore user I/F changes constantly**

Current Testing Methods are Inadequate

- **Manual input**
- **Unstructured**
- **Slow**
- **Depend on testers' awareness and attention**
- **Leave no audit trail**
- **Poor or no statistics**
- **Manual demonstration of errors**

Consequences of Manual Testing Methods

- **Quality is not emphasized during SDLC**
- **Time pressures always squeeze testing**
- **Testing never catches all the bugs**

Automated Testing

- **Capture/Playback**
 - record macros showing mouse movements and alphanumeric input
 - typically no editing language
- **Structured Automated Testing**
 - tool creates structured, editable script
 - can use databases as source of input
 - intelligent handling of errors

Limitations of Capture/Playback

- **Merely automate manual procedures**
- **Difficult to maintain as application changes**
- **Cannot build regression database**
- **Must wait until application is ready**
- **No mechanism for detecting errors**
- **No mechanism for reporting results**

Good Applications Are Easily Maintained and Enhanced

- **Structured development**
- **System documentation**
- **Metric: ease of reliably changing application**
- **QA must learn from general programming experience**

Structured Testing

- **Modular design**
- **Documentation**
- **Segregation of data from procedures**
- **Re-usability**

Structured Automated Testing

- Define test plan
- Document logic
- Generate test procedures
- Apply test procedures
- Evaluate results

Benefits of Structured Automated Testing

- **Consistent, reproducible testing**
- **Increased test coverage**
- **Easier maintenance**
- **Fully documented testing**
- **Higher-quality software**

Case Study: **COGNOS / Ottawa**

- 15 days for testing
- 6 people @ \$300/day
- 3 test phases per product release
- 3000 manual tests per phase
- 12.5% test coverage
- \$81,000 per release @ 12.5%
- \$648,000 per release @ 100%

Case Study:

COGNOS / Ottawa

- "Our goal was to improve the level of testing while at the same time reducing the time and manpower for each release."
 - Doug Clement, COGNOS

AutoTester at COGNOS

- 5 days elapsed time
- 6 people
- 3 test phases
- 24,000 tests/phase
- \$27,000/phase using AutoTester

Case Study:

HRL CANADA / Ottawa

- Jacques Joannis, manager
- Built regression database
- 80% of the application features were tested
- Redeployed 60-80% of test group back into development

Case Study:

New York Life / Toronto

- **Business case showed that up-front cost of implementing automated QA process will be repaid in the first year**
- **Cost-reduction: lower staffing, shorter cycle**
- **Cost-avoidance: identifying more errors**

Sample ROI

- **Take \$1,000,000 SW development budget**
- **Manual testing costs 60% = \$600,000**
- **Manual testing: ~20% of application features**
- **Automated testing: test 90-95% of features**
- **Automated testing costs 24% = \$260,000**
- **Real savings: \$300,000 including cost of testing tool**

Structured Automated Testing

- **Emulates trained human operator**
- **Single tool for multiple platforms**
- **Supports corporate standards**
- **Simplifies training and support**

PC-based S.A.T. are Platform Independent

- Works on PCs
- Can test PC programs
- Can test link to hosts using emulators
- Handles online, real-time systems
- Can deal with batch and hard-copy report systems by examining results on screen
- Has been used for ATMs, POS, telephone switches

AutoTester Plus Components

- **Script Station**
 - Uses screen image and screen definitions
 - Fully generate all scripts for application tests
- **Test Station**
 - Menu-driven application
 - Uses generated scripts to guide users
 - Users create, manage and execute test cases
 - Apply meaningful and comprehensive tests

Solution to the Software Quality Gap

- **Structured development is key to effective maintenance**
- **Tie test cases to application specs**
- **Don't write programs to test application**
- **Test-procedures stored in database**

Independent Analysis

Gartner Group:

- **"AutoTester from AutoTester, Inc. of Dallas reduces testing effort and improves the quality of resulting systems."**
- **"AutoTester can effectively provide a facility for regression testing most interactive applications at a fraction of the cost and effort required to do so manually."**

Independent Analysis

Software Quality Engineering:

- "AutoTester is unique because it can test both PC-based applications as well as applications which run on mini or mainframe computers.
- Variable files support in AutoTester allows test cases to be imported from external PC or remote sources, and permits single scripts to exercise unlimited permutations, thus conserving script development and maintenance effort."

Automated Testing is Suitable for Many Types of Quality Assurance Tests

- Unit tests
- Integration tests
- Regression tests
- Stress tests

Testing Spans the Organization

- **Way of working**
- **Not gimmick**
- **Permeates development team**
- **Management support required**
- **Involves users**
- **Plan for pilot project before choosing tool**

Demonstration Disks

- **Load the demo disk onto a workstation**
- **Follow the instructions to proceed through the demonstration.**

Homework

- Readings: Chapters 7, 11, and 13 from your textbook
- Answer all the review questions distributed by the instructor
 - Avoid copying the textbook blindly -- you will not remember as much as if you think about the answers yourself
 - Use simple language; usually a few words or sentences will be ample
- Submit your work by 09:00 tomorrow morning.
- Because of the short time available, *do not be late* in submitting your review answer