

18-642:

Peer Reviews

9/5/2019

“The competent programmer is fully aware of the strictly limited size of his own skull; therefore he approaches the programming task in full humility, and among other things he avoids clever tricks like the plague.

– Edsger Dijkstra

Carnegie
Mellon
University

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Peer Reviews

■ Anti-Patterns:

- **No peer reviews**
- **Reviews too informal/too fast**
- **Reviews find <50% of all bugs**

■ Fresh eyes find defects

- Code and other document benefit from a second (and third) set of eyes
- Peer reviews find more bugs/\$ than testing
 - And, they find them earlier when bugs are cheaper to fix
- Everything written down can benefit from a review



https://en.wikipedia.org/wiki/Peer_review#/media/File:ScientificReview.jpg

Most Effective Quality Practices

Ebert & Jones, "Embedded Software: Facts, Figures, and Future," IEEE Computer, April 2009, pp. 42-52

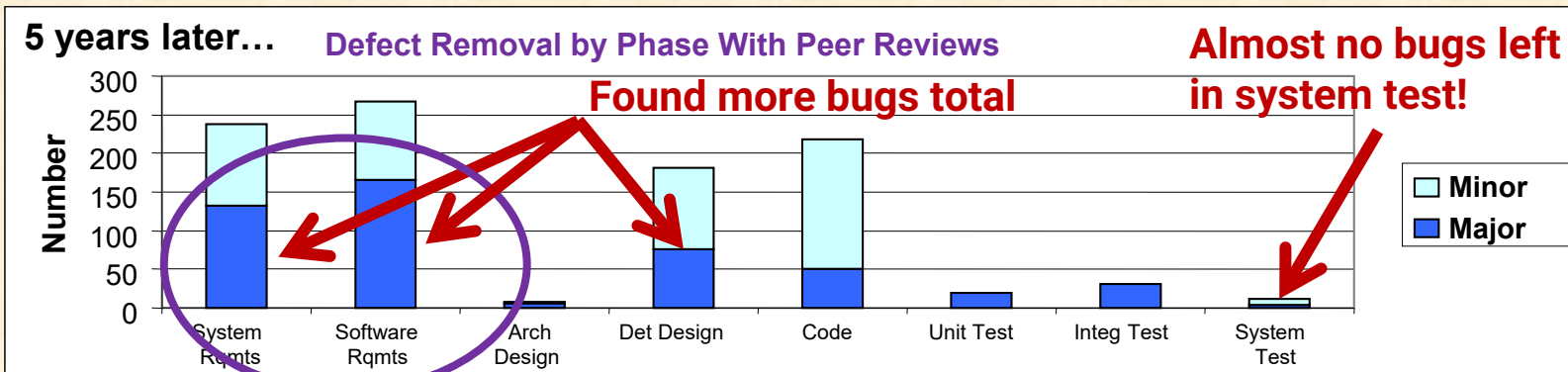
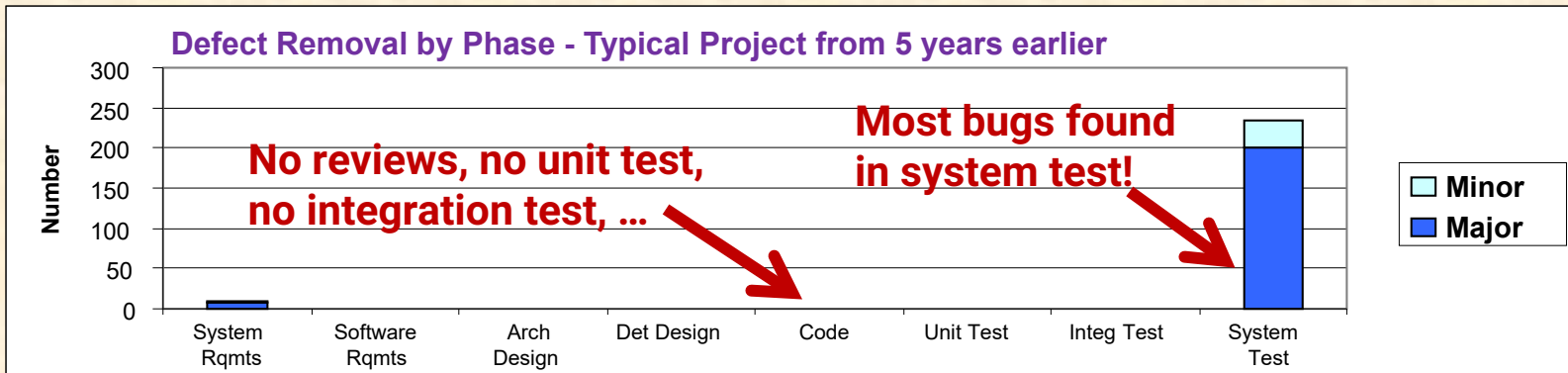
Ranked by defect removal effectiveness in percent defects detectable at that stage that are removed.

"*" means exceptionally productive technique (more than 750+ function points/month)

- * 87% static code analysis ("lint" tools, compiler warnings)
- 85% design inspection
- 85% code inspection
- 82% Quality Function Deployment (requirements analysis)
- 80% test plan inspection
- 78% test script inspection
- * 77% document review (other documents)
- 75% pair programming (informal on-the-fly review)
- 70% bug repair inspection
- * 65% usability testing
- 50% subroutine testing (unit test)
- * 45% SQA (Software Quality Assurance) review
- * 40% acceptance testing



Peer Reviews Are Effective + Efficient



Found many bugs up front, where fixes are cheaper

[Source:
Roger G.,
Aug. 2005]

Gold Standard: Fagan Style Inspections

■ Methodical, in-person review meetings

- Pre-meeting familiarity with project
- Producer explains item then leaves
- Moderator keeps things moving
- Reader (not author) summarizes as you go
- Reviewers go over every line, using checklists (perspective-based)
- Recorder takes written notes
- Result: written list of defects. The Producer fixes code off-line
- Re-inspection if the defect rate was too high



■ Methodical reviews are the most cost effective

- Important to measure bug discovery rate to ensure review quality

Rules for Successful Peer Reviews

- **Inspect the item, not the author**
 - Don't attack the author.
- **Don't get defensive**
 - Nobody writes perfect code. Get over it.
- **Find but don't fix problems**
 - Don't try to fix them; just identify them.
- **Limit meetings to two hours**
 - People are less productive after that point.
- **Keep a reasonable pace**
 - About 150 lines of code (or equivalent) per hour. Too fast and too slow are both bad.
- **Avoid "religious" debates on style**
 - Enforce conformance to your style guide. No debates on whether style guide is correct.
- **Inspect, early, often, and as formally as you can**
 - Keep records to document value (might take a while to mature).



Example Light-Weight Review Report

Peer Review Template for Project X		
Date:	4/17/2011	
Artifact:	Xyzy.cpp Functions: Foo(), Bar(), Baz()	
Reviewers:	Stella K., Joe B., Sam Q., Trish R.	
Size:	357	SLOC
Time Spent:	112	Minutes
# Issues:	3	
Outcome:	Re-Review of Bug Fixes Required	
<u>Issue#</u>	<u>Issue Description</u>	<u>Status</u>
1	Issue 1.....	Fixed
2	Issue 2....	Bugzilla
3	Issue 3....	Bugzilla
4	Issue 4....	Not a Bug
5		
6		
7		
8		
Status Key:	Fixed (trivial fix by author; no need to enter in defect list)	
	Bugzilla (entered into project defect system)	
	Not a Bug (false alarm)	

issues found is the most important item!

Free form text issue description

Just enter "fixed" if fixed within 24 hours



Perspective-Based Peer Reviews

■ Perspective-based Peer Reviews are 35% more effective

[<https://www.cs.umd.edu/projects/SoftEng/ESEG/papers/82.78.pdf>]

■ Mechanics of a Perspective-based review

- Divide a peer review checklist into three sections
- Assign each participant a different section of the checklist
 - OK to notice other things, but primary responsibility is that section
 - Multiple sets of eyes + perspective breadth

■ Example perspectives for a review:

- Control flow issues
- Data handling issues
- Style issues



Peer Review Checklist Template

Peer Review Checklist: Embedded C Code

■ **Customize
as needed**

Before Review:

0 Code compiles clean with extensive warning checks (e.g. MISRA C rules)

Reviewer #1:

1 Comments

2 Style consistency

3 Proper indentation

4 No orphaned code

5 Conditional compilation

6 Parent-child relationships

7 All switches

Reviewer #2:

8 Single point of entry

9 Loop entry and exit

10 Conditionals

11 All functions

12 Use const arrays

13 Avoid use of macros

14 Strong typing

15 All variables

Reviewer #3:

16 Minimum scope for all functions and variables; essentially no globals

17 Concurrency (locking, volatile keyword, minimize blocking time)

18 Input parameter checking (style, completeness)

19 Error handling for function returns

20 Handle null pointers, division by zero, null strings, boundary conditions

21 Floating point issues (equality, NaN, INF, roundoff); use of fixed point

22 Buffer overflow safety (bound checking, avoid unsafe string operations)

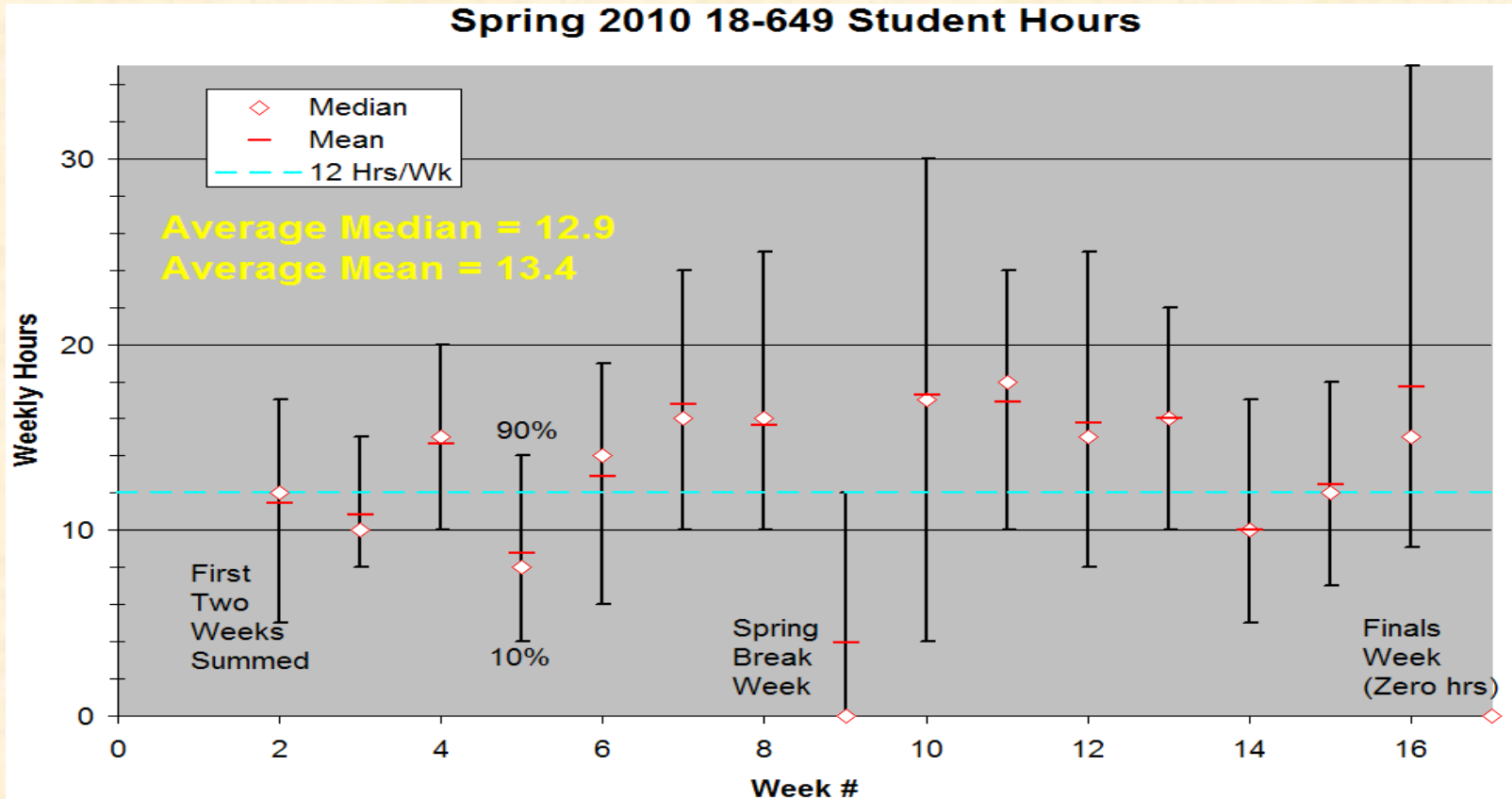
All Reviewers

23 Does the code match the detailed design (correct functionality)?

24 Is the code as simple, obvious, and easy to review as possible?

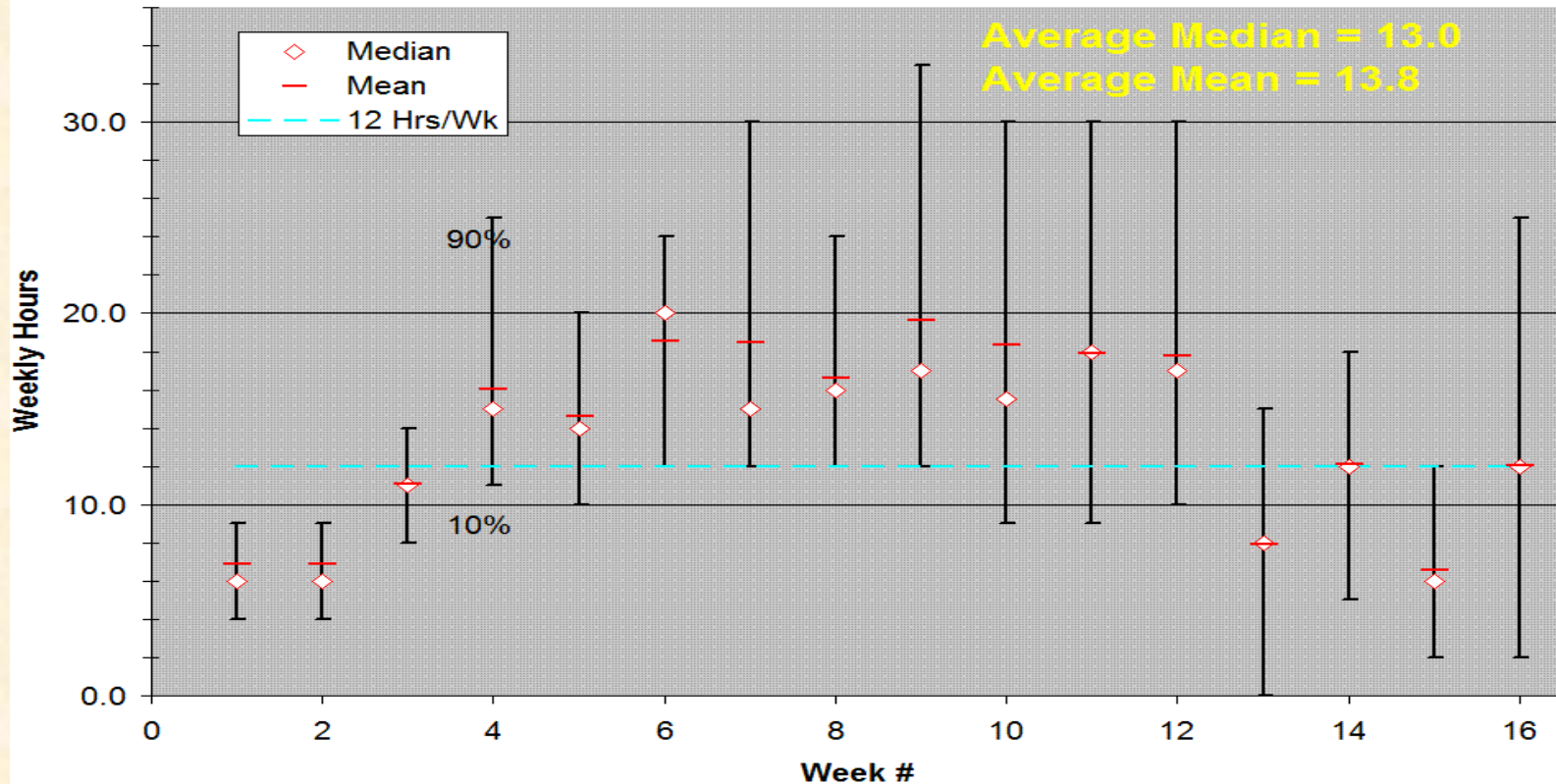
For TWO Reviewers assign items: Reviewer#1: 1-11; 23-24 Reviewer#2: 12-24

Before The Spreadsheet (Ineffective Reviews)

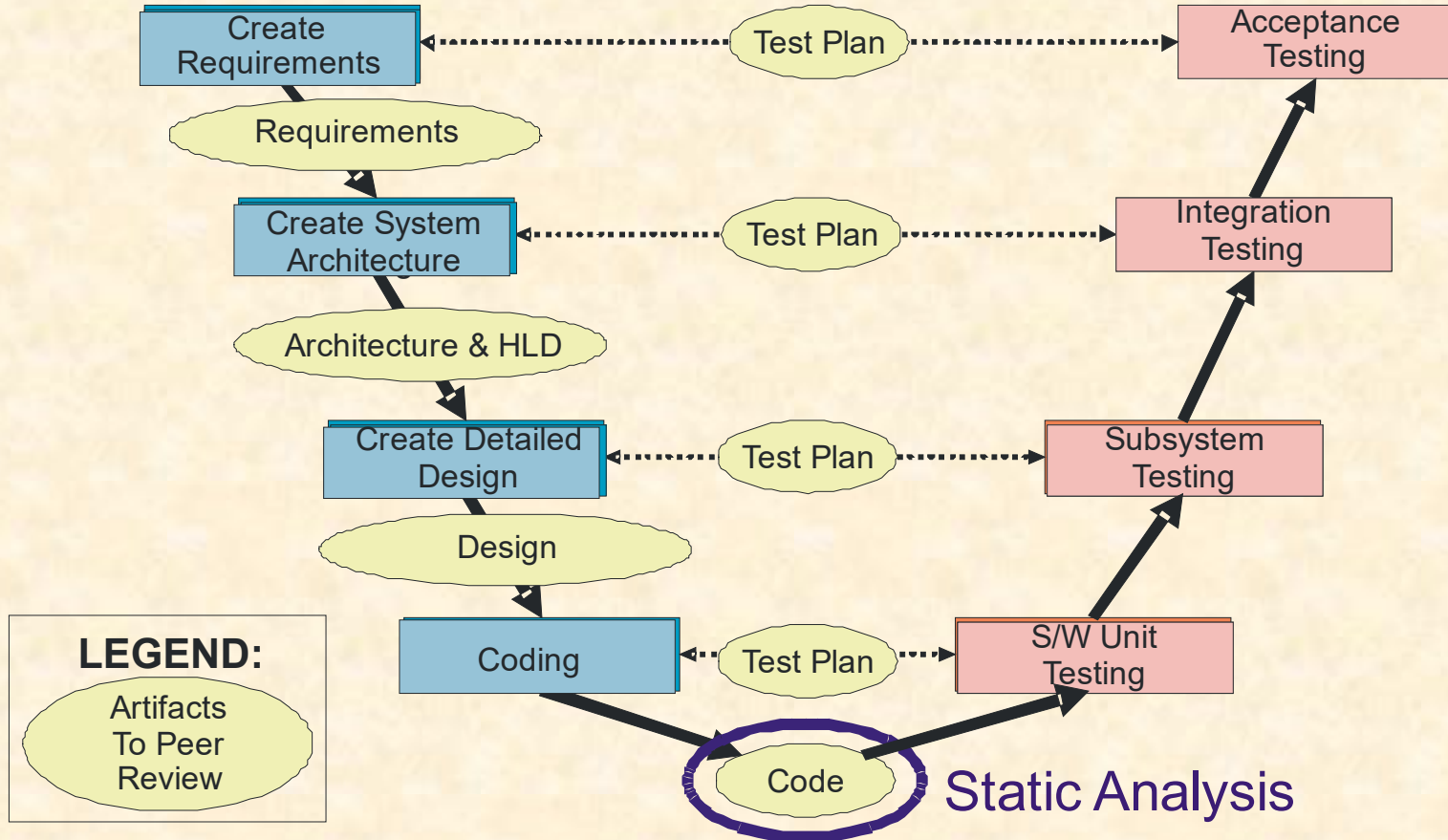


After Spreadsheet & Weekly Defect Reporting

Spring 2011 18-649 Student Hours



Review More Than Just The Code



The Economics Of Peer Review

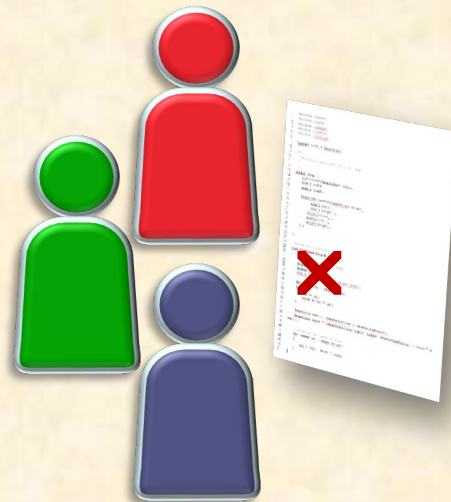
- Peer reviews provide **more eyeballs to find bugs** in an affordable way
 - Good embedded coding rate is 1-2 lines of code/person-hr
 - (Across entire project, including reqts, test, etc.)
 - A person can review 50-100 times faster than they can write code
 - If you have 4 people reviewing, that is still >10x faster than writing!
 - How much does peer review cost?
 - 4 people * 100-200 lines of code reviewed per hour
 - E.g., 300 lines; 4 people; 2 hrs review+1 hr prep = 25 LOC/person-hr
 - **Reviews are only about 5%-10% of your project cost**
- Good peer reviews **find at least half the bugs!**
 - And they find them early, so total project cost can be reduced
- Why is it folks say they don't have time to do peer reviews?



Peer Review Best Practices

■ Formal reviews (inspections) optimize bugs/\$

- Target 10% of project effort to find 50% of bugs
 - You can review 100x faster than write code; it's cheap
- Review everything written down, not just code
- Use a perspective-based checklist to find more bugs



■ Review pitfalls

- If your reviews find <50% of defects, they are **BROKEN**
 - The 80/20 rule does NOT apply to review formality! Formal reviews are best.
 - You can't review at end; need to review throughout project

■ Review tools

- On-line review tools are OK, but not a substitute for in-person meeting
- Static analysis tools are great – but not a review!



<https://www.xkcd.com/1833/>