CSE 403: Software Engineering, Winter 2016

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Code Reviews

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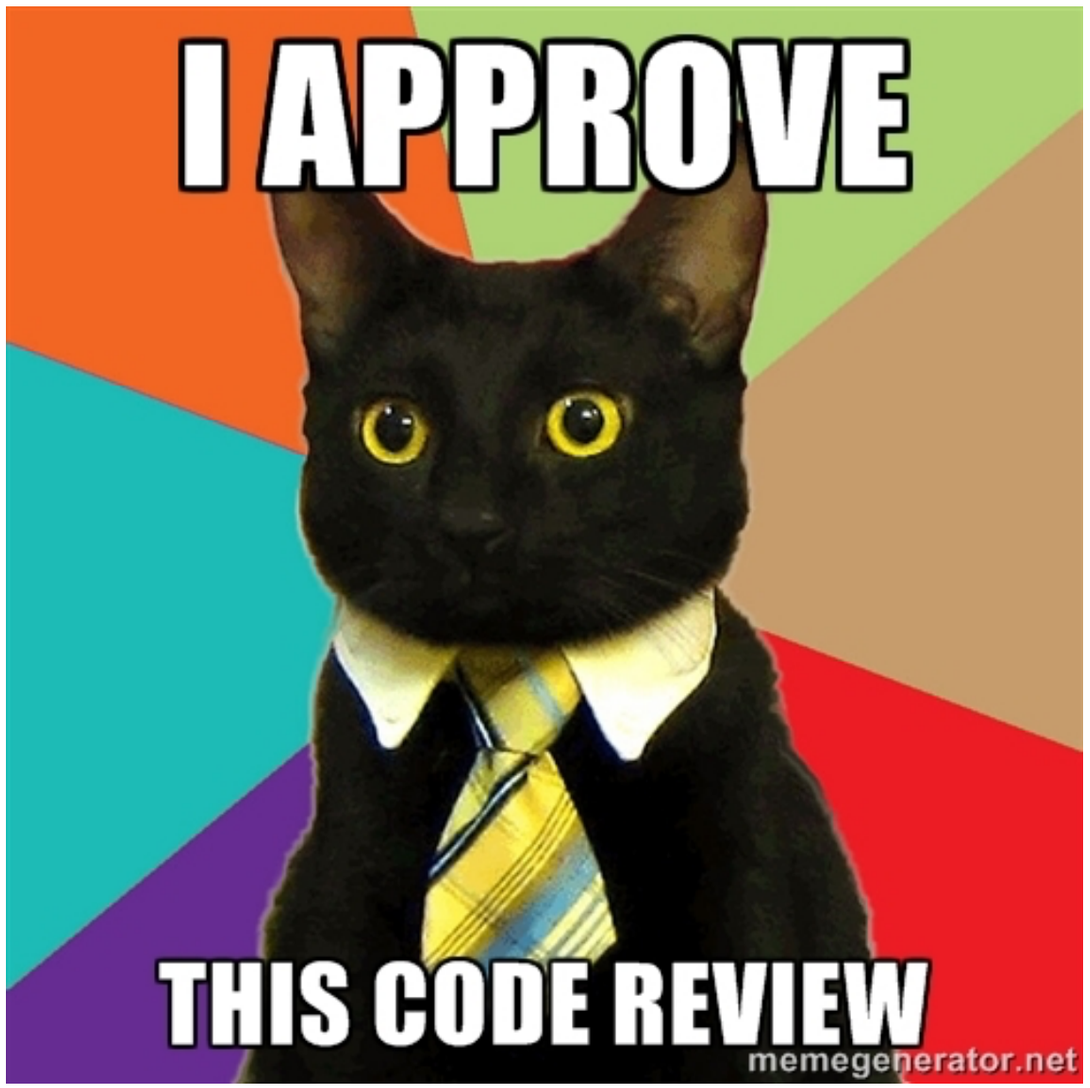
Outline

- What is code review?
- Kinds of code review
- Example



intro

code reviews: what and why

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- How do we assure it?
- How do we know we have assured it?

Challenges of building large systems

- How to ensure maintainable, DRY, readable, bug-free code?
- Average defect detection rate for various testing approaches
  - Unit testing: 25%
  - Function testing: 35%
  - Integration testing: 45%
- How can we do better?

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- Analogy: when writing articles for a newspaper, what is the effectiveness of …
    - spell-check/grammar check?
    - author editing own article?
    - others editing others' articles?

Code reviews: mechanics

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  - Feedback leads to refactoring.
  - Reviewer eventually approves code.

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- **What**: reviewer gives suggestions for improvement on a logical and/or structural level, to conform to a common set of quality standards.
    - Feedback leads to refactoring.
    - Reviewer eventually approves code.
- **When**: code author has finished a coherent system change that is otherwise ready for checkin
    - Change shouldn't be too large or too small.
    - Before committing the code to the repository or incorporating it into the new build.

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    - Direct feedback leads to better algorithms, tests, design patterns.

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    - Prospect of someone reviewing your code raises quality threshold.
    - Forces code authors to articulate their decisions.
- Hands-on learning experience from peers
    - Direct feedback leads to better algorithms, tests, design patterns.
- Better understanding of complex code bases
    - Reviewing others' code enhances overall understanding of the system, reduces redundancy.

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- 11 programs developed by the same group of people
    - First 5 without reviews: average 4.5 errors per 100 lines of code
    - Next 6 with reviews: average 0.82 errors per 100 lines of code
    - Errors reduced by **> 80 percent**.

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Code reviews: who does them?

- **Everyone**: a common industry practice.
- Made easier by advanced tools that
  - integrate with version control
  - highlight changes (i.e., diff function)
  - e.g., github pull requests

kinds of code reviews

Common types of code review

- Tool-assisted reviews
- Formal inspections
- Walkthroughs
- Pair programming

Tool-assisted code reviews

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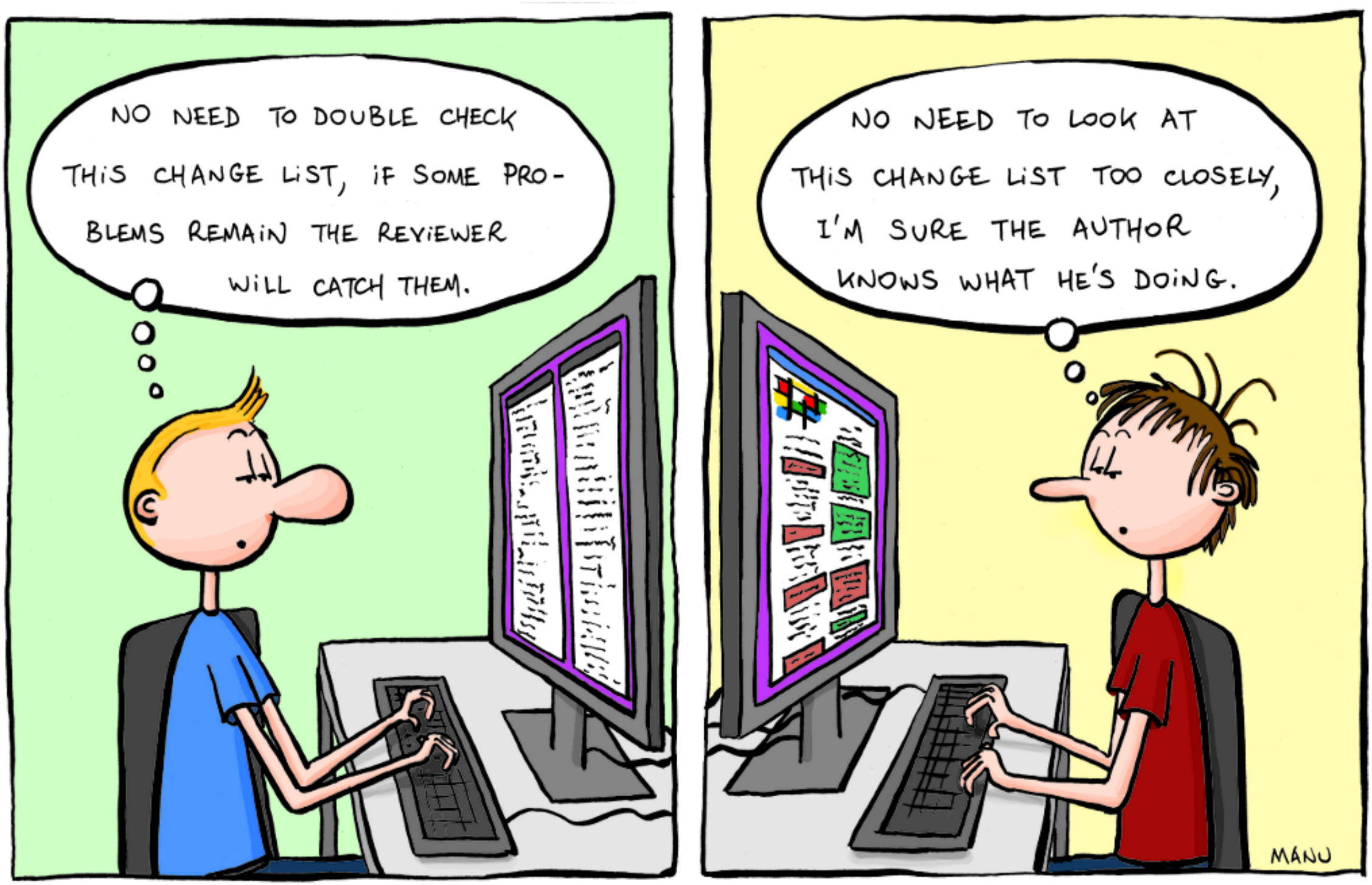
- Disadvantages
    - Hard to ensure review quality and promptness.

Tool-assisted code reviews



Formal inspections

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- A more formalized code review with
  - roles (moderator, author, reviewer, scribe, etc.)
  - several reviewers looking at the same piece of code
  - a specific **checklist** of kinds of flaws to look for
    - flaws that have been seen previously
  - high-risk areas such as security

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- Advantages
  - High review quality with specific expected outcomes (e.g. report, list of defects)
- Disadvantages
  - Heavyweight, time-consuming, expensive

Walkthroughs

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    - The author walks the reviewer through a set of code changes.
- Advantages
    - Simplicity in execution: anyone can do it, any time.
    - In-person interaction, learning, and sharing.
- Disadvantages
    - Not an enforceable process, no record of the review.
    - Easy for the author to unintentionally miss a change.
    - Reviewers rarely verify that defects were fixed.

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    - only one typing
    - continuous free-form discussion and review

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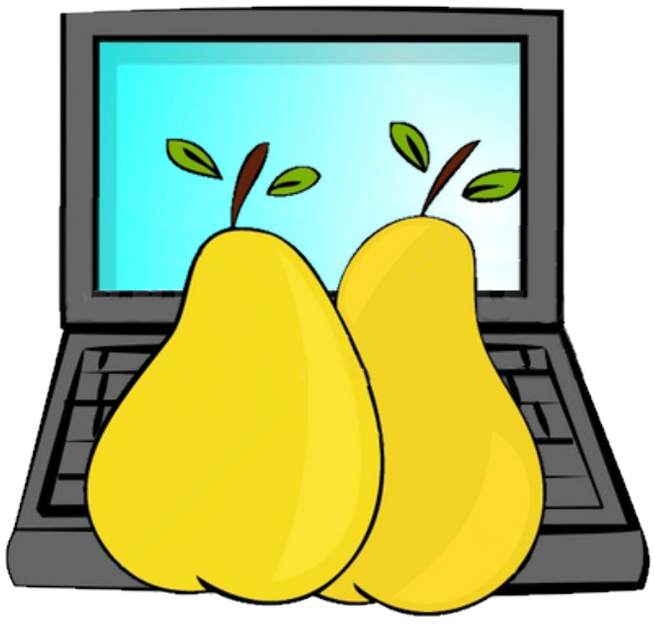
    - Learning, sharing, team-building.



Pair programming

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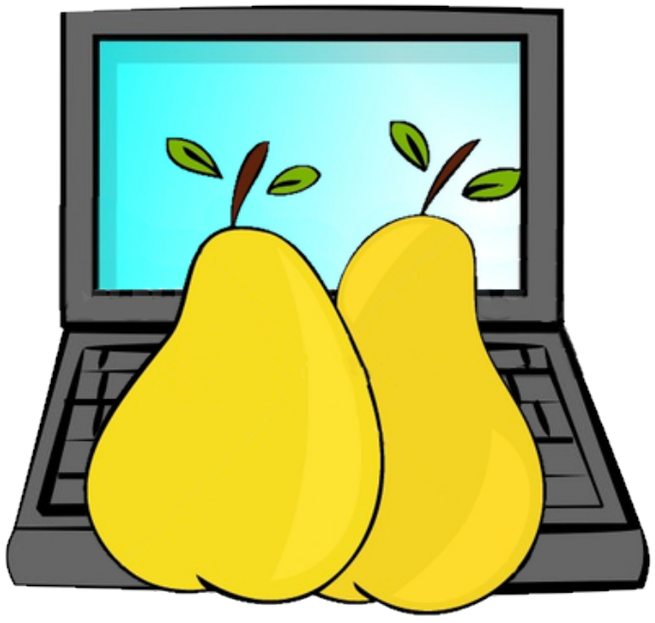
    - only one typing
    - continuous free-form discussion and review
- Advantages
    - Deep reviews, instant and continuous feedback.
    - Learning, sharing, team-building.
- Disadvantages
    - Some developers don’t like it.
    - No record of the review process.
    - Time consuming.



a code review example

What changes, if any, would you suggest?

```
public class Account {
  double principal,rate; int daysActive,accountType;
  public static final int STANDARD = 0, BUDGET=1,
      PREMIUM=2, PREMIUM_PLUS = 3;
  }

  public static double calculateFee(Account[] accounts)
  {
      double totalFee = 0.0;
      Account account;
      for (int i=0;i<accounts.length;i++) {
          account=accounts[i];
          if ( account.accountType == Account.PREMIUM ||
          account.accountType == Account.PREMIUM_PLUS )
            totalFee += .0125 * (   // 1.25% broker's fee
            account.principal * Math.pow(account.rate,
            (account.daysActive/365.25))
            - account.principal);   // interest-principal
      }
      return totalFee;
   }
}
```

Possible changes

- Comment.
- Make fields private.
- Replace magic values (e.g. 365.25) with constants.
- Use an enum for account types.
- Use consistent whitespace, line breaks, etc.

Improved code (1/2)

```
/** An individual account. Also see CorporateAccount. */
public class Account {
    /** The varieties of account our bank offers. */
    public enum Type {STANDARD, BUDGET, PREMIUM, PREMIUM_PLUS}

    /** The portion of the interest that goes to the broker. */
    public static final double BROKER_FEE_PERCENT = 0.0125;

    private Type type;
    private double principal;

    /** The yearly, compounded rate (at 365.25 days per year). */
    private double rate;

    /** Days since last interest payout. */
    private int daysActive;

    …
```

Improved code (2/2)

```
    /** Compute interest on this account. */
     public double interest() {
         double years = daysActive / 365.25;
         double compoundInterest = principal * Math.pow(rate, years);
         return compoundInterest - principal;
     }

     /** Return true if this is a premium account. */
     public boolean isPremium() {
         return accountType == Type.PREMIUM ||
                accountType == Type.PREMIUM_PLUS;
     }

     /** Return the sum of broker fees for all given accounts. */
     public static double calculateFee(Account[] accounts) {
         double totalFee = 0.0;
         for (Account account : accounts) {
             if (account.isPremium()) {
                 totalFee += BROKER_FEE_PERCENT * account.interest();
             }
         }
         return totalFee;
     }
}
```

Summary

- Code reviews improve
    - code quality
    - teamwork
    - knowledge and skills
- Kinds of code review
    - tool-assisted
    - formal inspections
    - walkthroughs
    - pair programming