Lecture 23: Course Summary

What we've covered in this course

Some underlying principles

Course Evaluation

Course Outline

Modeling
- Sketching vs. Blueprints (vs. programming)
- Structure vs. Behaviour vs. Function
- Abstraction, Decomposition, Projection
- UML

Maintenance and Re-engineering
- Software Evolution
- Program Comprehension
- Reverse Engineering for Design Recovery

Software Architecture
- Conway's Law
- Coupling and Cohesion
- Architectural Patterns

Software Processes
- Agile vs. Disciplined
- Iterative development
- RUP, ICONIX, XP, SCRUM,…
- QA and process improvement

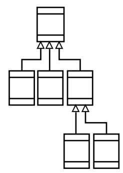
Project Management
- Resources, Time, Product, Risk
- Estimation & Prioritization
- Risk Assessment & Control
- Monitoring and Controling a project
- Organising a team

Requirements Analysis
- Requirements vs. Specifications
- Stakeholders, Goals, Obstacles
- Use Cases
- Robustness Analysis

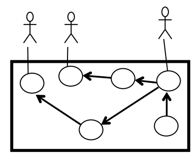
Verification and Validation
- Testing
- Static Analysis
- Inspection
- Prototyping
- Formal model analysis

Software Quality…

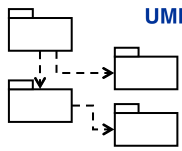
Modeling Notations



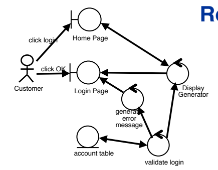
UML Class Diagrams
- information structure
- relationships between data items
- modular structure for the system



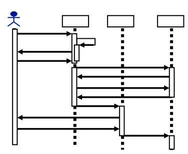
Use Cases
- user's view
- Lists functions
- visual overview of the main requirements



UML Package Diagrams
- Overall architecture
- Dependencies between components



Robustness Diagrams
- Maps use cases onto s/w architecture
- Allocation of responsibility, control



UML Sequence Diagrams
- individual scenario
- interactions between users and system
- Sequence of messages

Goal Models
- Stakeholder's goals and priorities
- Means-ends analysis and rationale
- dependencies between stakeholders

Why models are important

Abstraction
- Ignore detail to see the big picture
- Treat objects as the same by ignoring certain differences
- (beware: every abstraction involves choice over what is important)

Decomposition
- Partition a problem into independent pieces, to study separately
- (beware: the parts are rarely independent really)

Projection
- Separate different concerns (views) and describe them separately
- Different from decomposition as it does not partition the problem space
- (beware: different views will be inconsistent most of the time)

Modularization
- Choose structures that are stable over time, to localize change
- (beware: any structure will make some changes easier and others harder)

Scaling Up

Complexity grows rapidly

"For every 25% increase in problem complexity there is a 100% increase in solution complexity" (Robert Glass)

Why?

- Software development is largely an intellectual task
  - (80% intellectual, 20% clerical)
- To scale up, you need more brains
- Software development becomes a social activity
- Coordinating more people is hard

Glass's Facts (slightly refactored)

Adapted from Robert Glass "Facts and Fallacies of Software Engineering"

People
- ✔ Most important factor is quality of your developers
- ✔ Best programmers are 28 times more effective than the worst

Tools
- ✔ There is no silver bullet
- ✔ Each tool/technique offers only small improvements
- ✔ Any new tool/technique initially causes a reduction in productivity
- ✔ Most tools become shelfware

Estimation
- ✔ Poor estimation is endemic
- ✔ Estimation is done by the wrong people, at the wrong time, and never adjusted…

Re-use
- ✔ Re-use in the small is solved;
- ✔ Re-use in the large is intractable

Requirements
- ✔ Requirements errors are the most expensive to fix during development
- ✔ Missing requirements are hardest errors

Design
- ✔ Design is a complex, iterative process
- ✔ There is seldom one best design

Testing
- ✔ 55-60% branch coverage is typical
- ✔ 100% coverage is unachievable
- ✔ 100% coverage is insufficient

Defects
- ✔ Error removal is the most time-consuming part of software development
- ✔ Errors tend to cluster (80:20)
- ✔ Most programmers make the same mistakes

Maintenance
- ✔ Maintenance is 40-80% of software costs
- ✔ Understanding the existing product is the hardest part

The Joel Test

1. Do you use source control?
2. Can you make a build in one step?
3. Do you make daily builds?
4. Do you have a bug database?
5. Do you fix bugs before writing new code?
6. Do you have an up-to-date schedule?
7. Do you have a spec?
8. Do programmers have quiet working conditions?
9. Do you use the best tools money can buy?
10. Do you have testers?
11. Do new candidates write code during their interview?
12. Do you do hallway usability testing?

Source: http://www.joelonsoftware.com/