What is Software Engineering?
- What is software?
- What is engineering?
- Why taught in Computer Science Department?

What does SE do?
- Software engineering comprises
  - Problem
    - customer wants it solved
  - Theories & Algorithms
    - taught in computer science
- SE brings these together
  - produce tools and techniques to solve customer’s problems
  - includes non-CS tools, e.g., management techniques, ROI estimation etc.
**Terminology**

- Analysis vs. synthesis of a problem
- Method or technique: procedure for producing a result
- Tool: instrument or automated system for accomplishing something
- Procedure: recipe for combination of tools and techniques
- Paradigm: style of doing something

---

**How successful has SE been**

- Suppose your TV or car had the same reliability as your PC software
  - no one would want to get into a car anymore, your TV's CRT might explode
  - you'd be signing a waiver of liability when you buy
- Software, compared to real-life artifacts, is riddled with problems
  - why does hardware not experiment the same phenomenon?

---

**Quality terminology**

**What are bugs?**

- Error: human mistake
- Fault: result of mistake, evidenced in some development or maintenance product
- Failure: departure from the system’s required behavior
Garvin’s perspectives on quality

- Transcendental view: something we recognize but can’t define
- User view: fitness for purpose
- Manufacturing view: conformance to specification
- Product view: tied to inherent product characteristics
- Value-based view: depends on customer’s willingness to pay

McCall’s Quality Model

External quality criteria:
- Correctness
- Reliability
- Efficiency
- Integrity
- Usability
- Maintainability
- Testability
- Portability
- Reusability
- Interoperability

McCall’s Quality Model: product quality criteria

- Concision
- Instrumentation
- Self-descriptiveness
- Expandability
- Generality
- Modularity
- Software system independence
- Machine independence
- Communications commonality
- Data commonality
Systems approach to SE

- Identify activities and objects.
- Define the system boundary.
- Consider nested systems, system interrelationships.

Building a house vs. software

- Determining and analyzing requirements
- Producing and documenting the design
- Detailed specifications
- Identifying and designing components
- Building components
- Testing components
- Integrating components
- Making final modifications
- Continuing maintenance

- Requirements analysis and definition
- System design
- Program design
- Writing programs
- Unit testing
- Integration testing
- System testing
- System delivery
- Maintenance

Key factors altering software engineering practice (Wasserman)

- Criticality of time-to-market for commercial products
- Shifts in economics of computing (lower HW, higher development/maintenance costs)
- Availability of powerful desktop computing
- Extensive local- and wide-area networking
- Availability and adoption of OO technology
- Graphical user interfaces
- Unpredictability of waterfall model of development
Wasserman’s basis for good software engineering

- Abstraction
- Analysis and design methods and notations
- User interface prototyping
- Software architecture
- Software process
- Reuse
- Measurement
- Tools and integrated environments

Information systems example

- Piccadilly Television: regional British TV franchise
- Advertising scheme has many constraints:
  - Alcohol adverts only after 9pm
  - If actor in show, no same actor in advert within 45 minutes
  - If advert in class of product, no other advert in same class during same break
  - Rates dependent on amount of time bought
- Software to determine, track advertising time

Real-time example

- Ariane-5 rocket, from European Space Agency
- June 4, 1996: functioned well for 40 seconds, then veered off course and was destroyed
- Contained four satellites: cost was $500 million
- Reused code from Ariane-4 rocket
Ariane-5 definition of quality

- From Lions report:
  - "... demonstrated the high quality of the Ariane-5 programme as regards engineering work in general and completeness and traceability of documents."
  - "... the supplier of the SRI ... was only following the specification given to it. ... The exception which occurred was not due to random failure but a design error."

Homework (due 9/1)

- Using your favorite news source discuss a recent (past year) system malfunction reported in the press that involved a software system. Discuss the failures, faults and errors involved.
- Turn in a printout of the news story along with your discussion.
- Reading
  - Chapter 1 of textbook

Administratrivia

- Subscribe to class mailing list
  - send email to
    - cs1530-subscribe@cs.pitt.edu
- check web page
  - http://www.cs.pitt.edu/~mock/cs1530/
    - has lectures
    - handouts, agenda etc.