

# CS 5704: Software Engineering

Introduction

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# The software era

- We live in a digital age
- Computing systems are ubiquitous
- No domain untouched
- Software drives digital systems
  - a product
  - a platform for delivering a product

# Questions to ponder

- Why is building software challenging?
- Why is building software so expensive?
- Why cannot we build bug-free software?
- Why is maintenance so expensive?
- Why is measurement of software progress hard?

# In 1995...

- US spent \$250 billion on IT applications
- 31% projects cancelled before completion
- 53% costed 189% of their original estimates
- 16% were on-time and on-budget
- What % of those were bug-free?

\* Chaos report by Standish group

# Compare to other engineering areas

- Bridge building
- Automobile manufacturing
- Others...

Why is our track record like this?

# Characteristics of software

- Software is abstract, virtual, “embodied knowledge”, intangible
- Complex software can have infinite states
- Often difficult to test
- Often necessary to represent rich real-world domains using limited vocabulary and grammar
- More than just dealing with “gravity in bridge building”

# Compared to hardware

- Software is developed or engineered, not manufactured
  - costs are mostly in engineering
- Software has no “wear out”
  - it deteriorates due to changes
- Software is mostly custom built

# Software Engineering

- IEEE definition: “The application of systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software”
- “The study of approaches as in above”
- Question: How did a “systematic, disciplined, quantifiable approach” lead to the state-of-the-art?

# The Chaos Report

- Why projects fail:
  - Lack of user input
  - Incomplete requirements and specifications
- Success factors:
  - User involvement
  - Executive management support
  - Clear statement of requirements

# In this class

- Laboratory approach
  - Learn from experiments
- Case studies and experience reports
  - Learn from other's experience
- Research approach
  - Attempt to solve a research problem