COURSE NAME

SOFTWARE ENGINEERING

CSC 3114

(UNDERGRADUATE)

CHAPTER 1

INTRODUCTION TO SOFTWARE ENGINEERING

M. MAHMUDUL HASAN
ASSISTANT PROFESSOR, CS, AIUB
Web: http://cs.aiub.edu/profile/m.hasan
WordPress: https://wordpress.com/view/mhasansuman.wordpress.com

RG Google Scholar LinkedIn

WHY SYSTEM FAILS?

- The system fails to meet the business requirements for which it was developed. The system is either abandoned or expensive adaptive maintenance is undertaken.
- There are performance shortcomings in the system, which make it inadequate for the users' needs. Again, it is either abandoned or amended incurring extra costs.
- Errors appear in the developed system causing unexpected problems. Patches have to be applied at extra cost.
- Users reject the implemented system, lack of involvement in its development or lack of commitment to it.
- Systems are initially accepted but over time become un-maintainable and so pass into disuse.

WHAT IS SOFTWARE ENGINEERING?

- Technologies that make it easier, faster, and less expensive to build high-quality computer programs
- A discipline aiming to the production of fault-free software, delivered on time and within budget, that satisfies the users' needs

- An engineering: set of activities in software production
- The philosophy and paradigm of established engineering disciplines to solve what are termed software crisis

SCOPE OF SOFTWARE ENGINEERING

- The aim of Software Engineering is to solve Software Crisis:
  - Late
  - Over budget
  - Low quality with lots of faults
- Software crisis is still present over 35 years later!

SOFTWARE CHARACTERISTICS

- A logical (intangible) rather than a physical system element
- Being developed or engineered, but not being manufactured
- Software cost concentrating in engineering, not in materials
- Software does not "wearing out" but "deteriorating"(not destroyed after lifetime like hardware, but backdated by aging that needs to update)
- Software is a 'differentiator' (different sub-systems, e.g., cashier's workstation in a supermarket)
- Without "spare parts" in software maintenance (no extra useless features in software)
- Most software continuing to be custom built (based on the requirements)

SUB-SYSTEM VS MODULE

- Sub-System
  - Is a system in its own right whose operation does not depend on the services provided by other sub-systems
  - Are composed of modules
  - Have defined interfaces which are used for communication with other sub-systems
- Module
  - Is a system component that provides one or more services to other modules
  - It is not normally considered to be an independent system

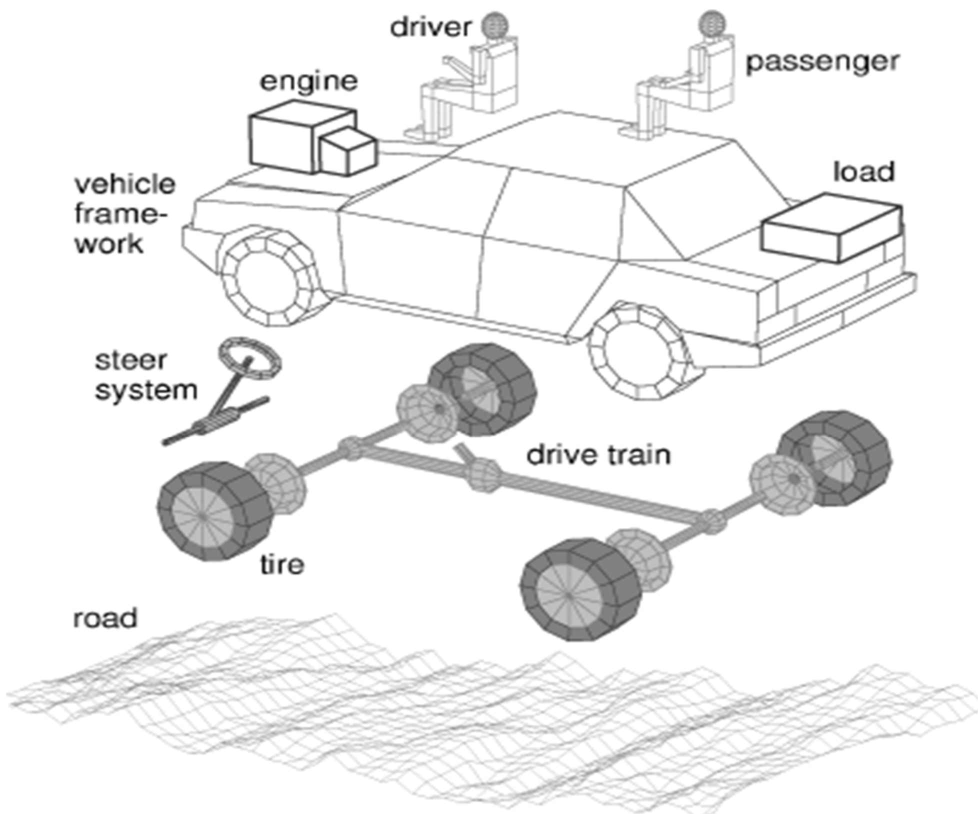
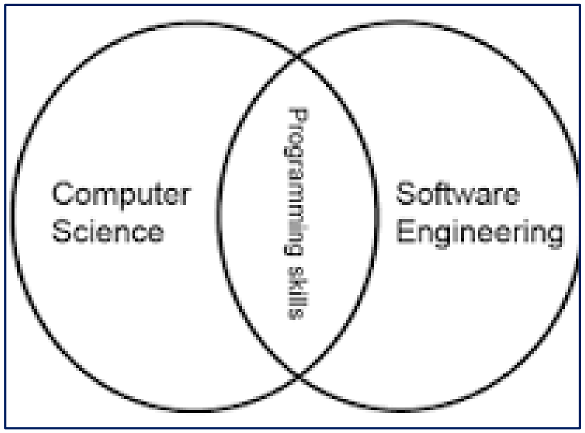
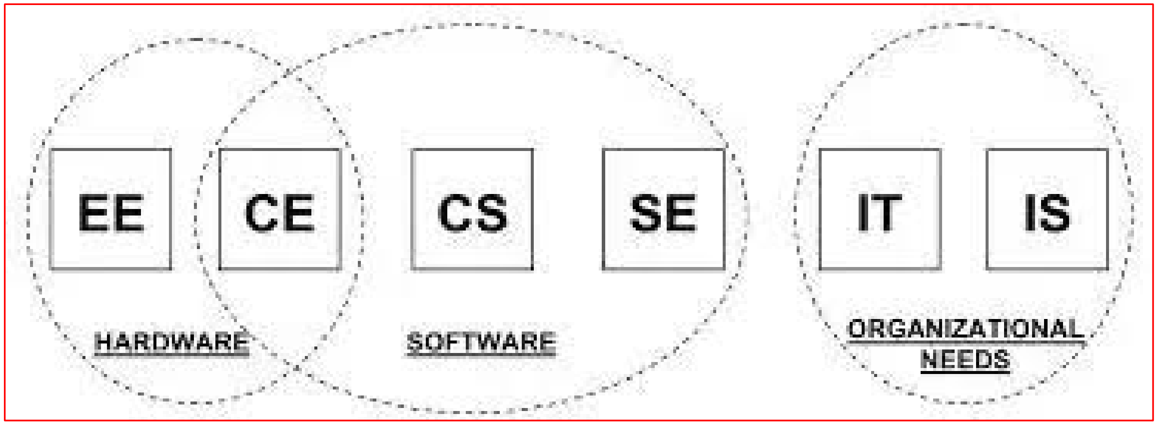


Figure 1. Vehicle model structure.

GOAL: COMPUTER SCIENCE VS. SOFTWARE ENGINEERING



- CS: to investigate a variety of ways to produce S/W, some good and some bad
- SE: to be interested in only those techniques that make sound economic sense



SOFTWARE DEVELOPMENT LIFE CYCLE (SDLC)

A structured set of activities required to develop a so
system. The way we produce software, including:

- Requirements Analysis/Specification
- Designing/Modeling
- Coding /Development
- Testing/QA/Verification & Validation
- Implementation/Integration/Deployment/Delivery
- Operation/Maintenance
- Documentation

SDLC: CASE - I

- You and your development team have been commissioned to work on a database for a major bank. For obvious reasons, your client is very concerned with security. You and your team come up with many security features that could be implemented into the product. In what phase of a software life cycle process would this task occur?

  (A) Specification

  (B) Design and Implementation

  (C) Verification and Validation

SDLC: CASE - I

- You and your development team have been commissioned to work on a database for a major bank. For obvious reasons, your client is very concerned with security. You and your team come up with many security features that could be implemented into the product. In what phase of a software life cycle process would this task occur?

  (A) Specification

  (B) Design and Implementation

  (C) Verification and Validation

GOOD & BAD SOFTWARE

- Good software is maintained—bad software is discarded
- Different types of maintenance
  - Corrective maintenance [about 20%]
    - Modification to fix a problem
  - Enhancement [about 80%]
    - Perfective maintenance (modification to improve usability,…) [about 60%]
    - Adaptive maintenance (modification to keep up-to-date) [about 20%]
    - Preventive maintenance (modification to avoid any future error) [about 20%]

FAULTS IN SOFTWARE DEVELOPMENT PHASES

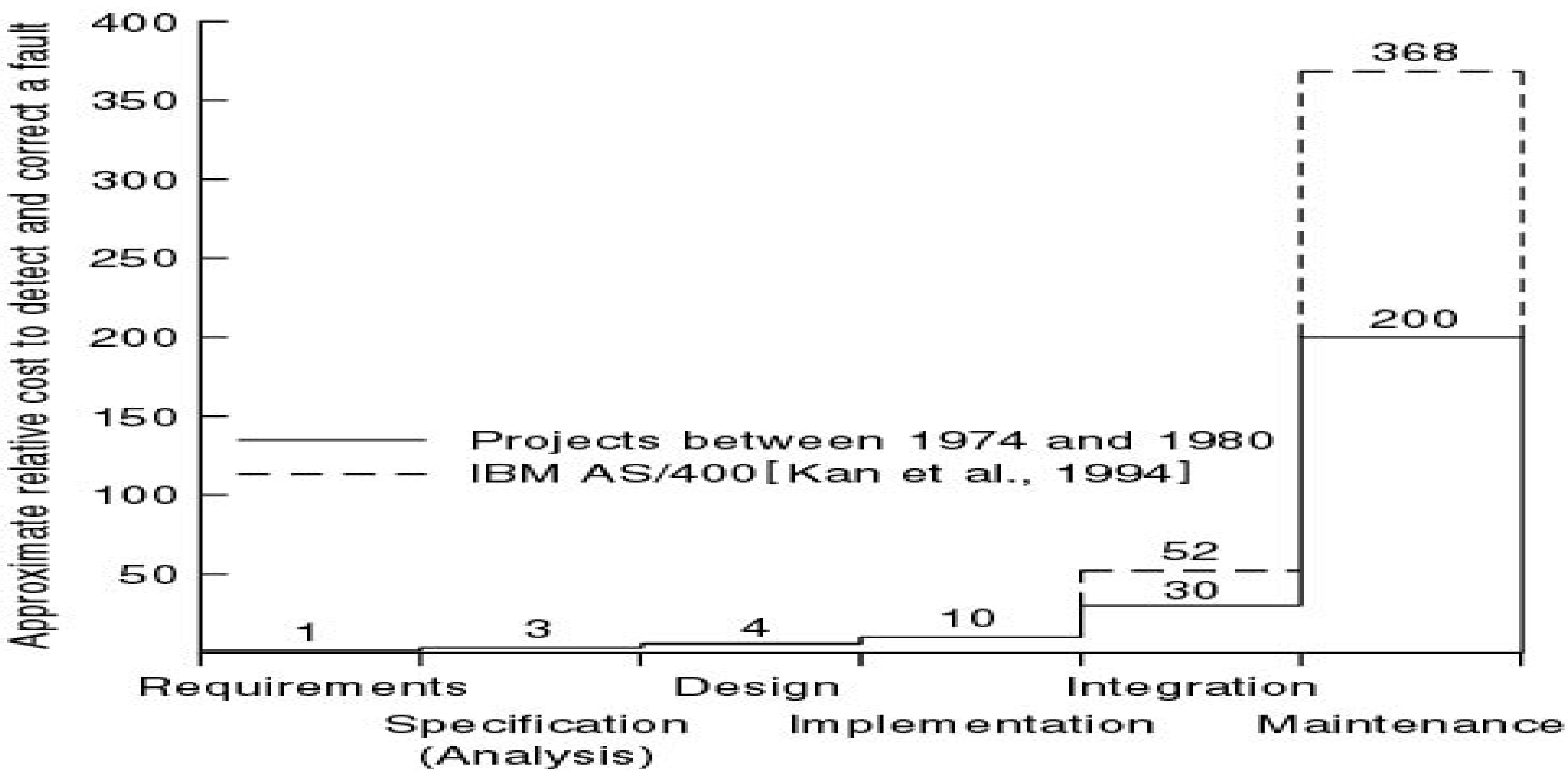
- 60 to 70 percent of faults are specification and design faults

- Data of Kelly, Sherif, and Hops [1992]
  - 1.9 faults per page of specification
  - 0.9 faults per page of design
  - 0.3 faults per page of code

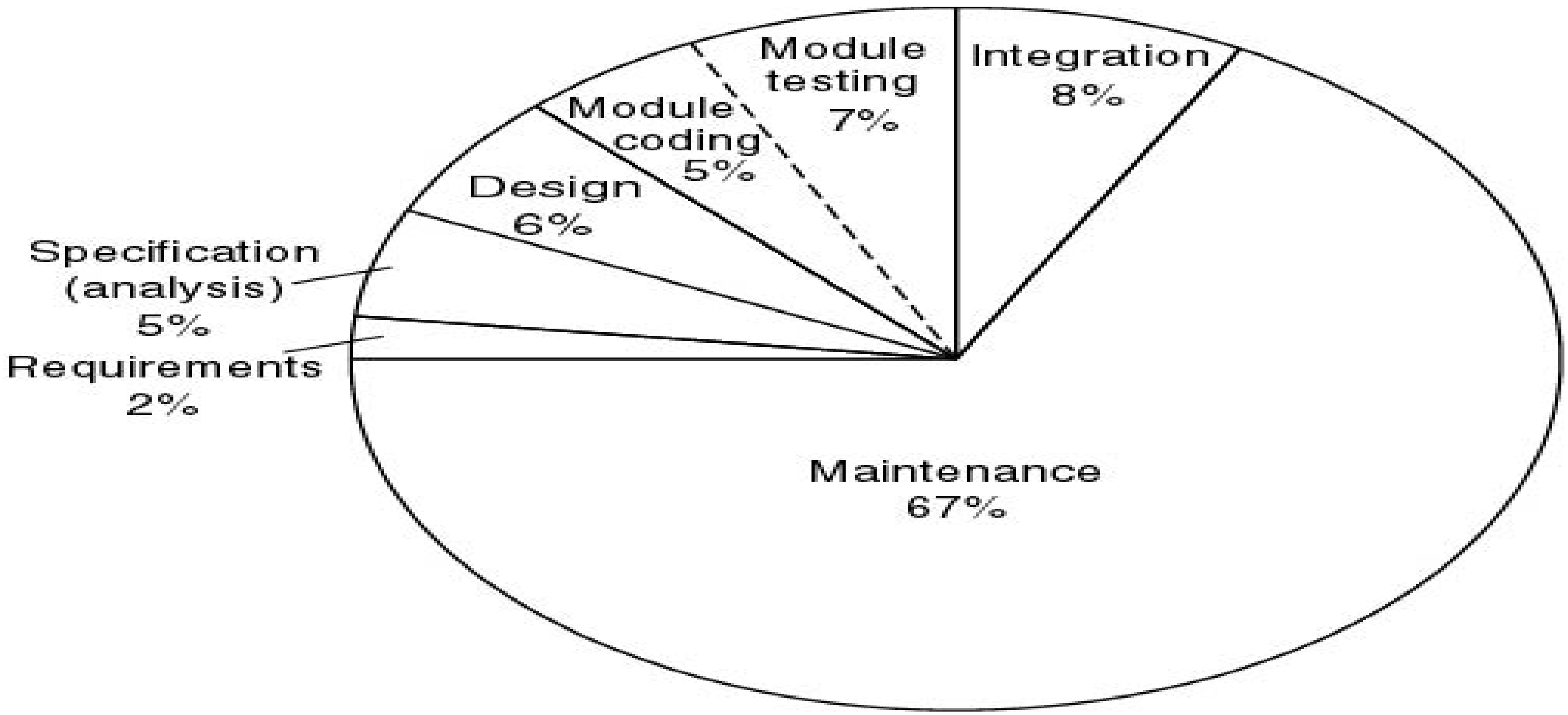
- Data of Bhandari et al. [1994]

  Faults at end of the design phase of the new version of the product
  - 13% of faults from previous version of product
  - 16% of faults in new specifications
  - 71% of faults in new design

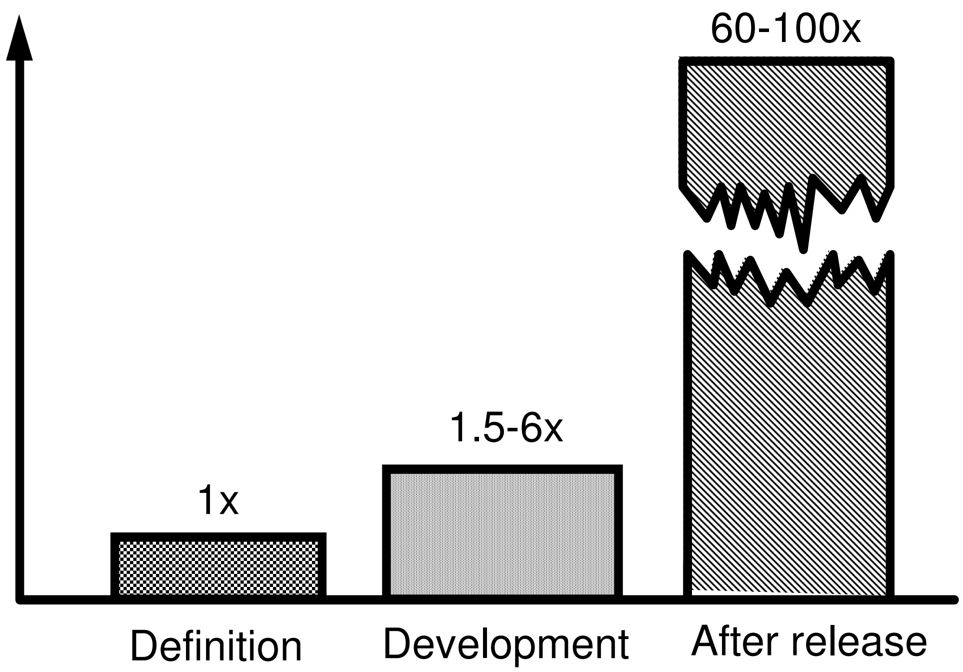
COST OF DETECTION & CORRECTION OF A FAULT



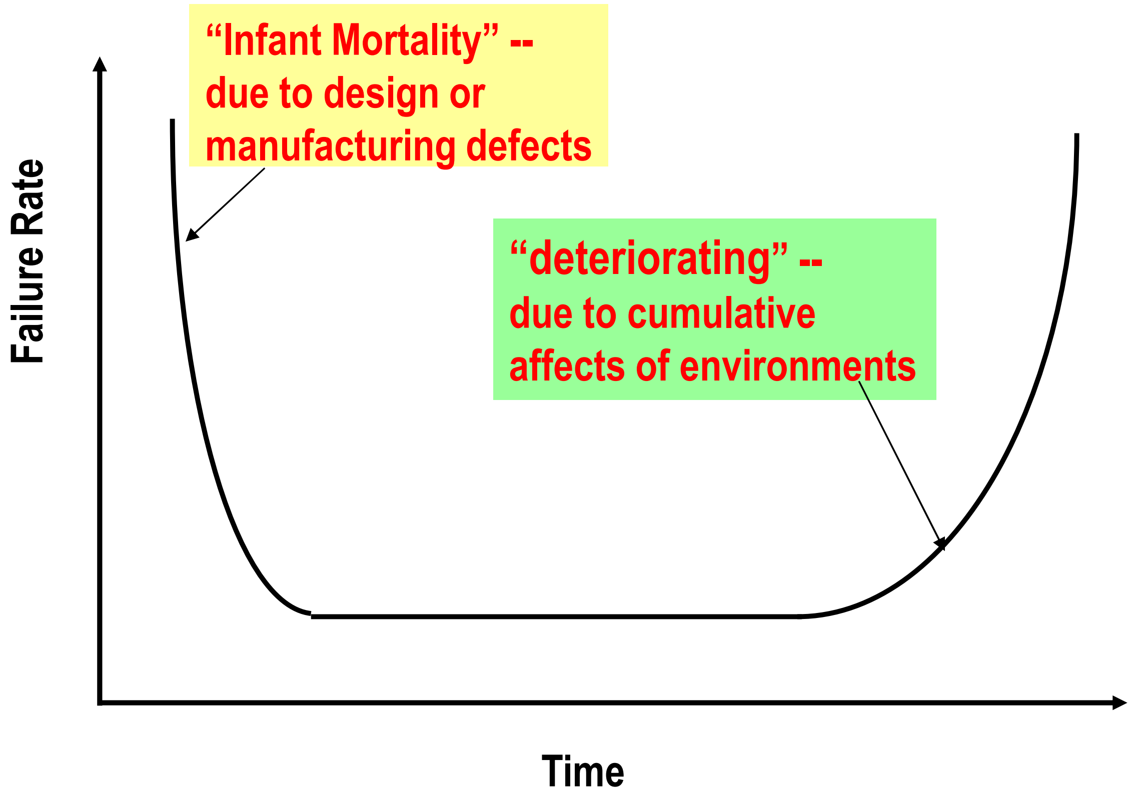
COST OF DETECTION & CORRECTION OF A FAULT



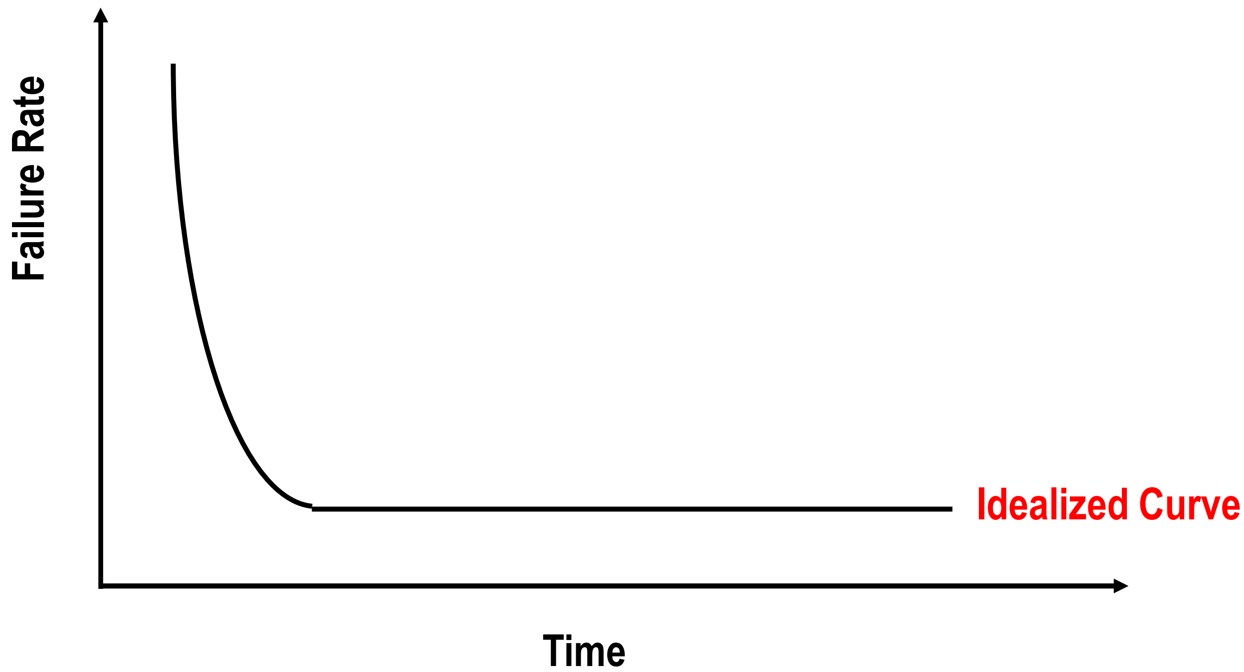
COST OF CHANGE



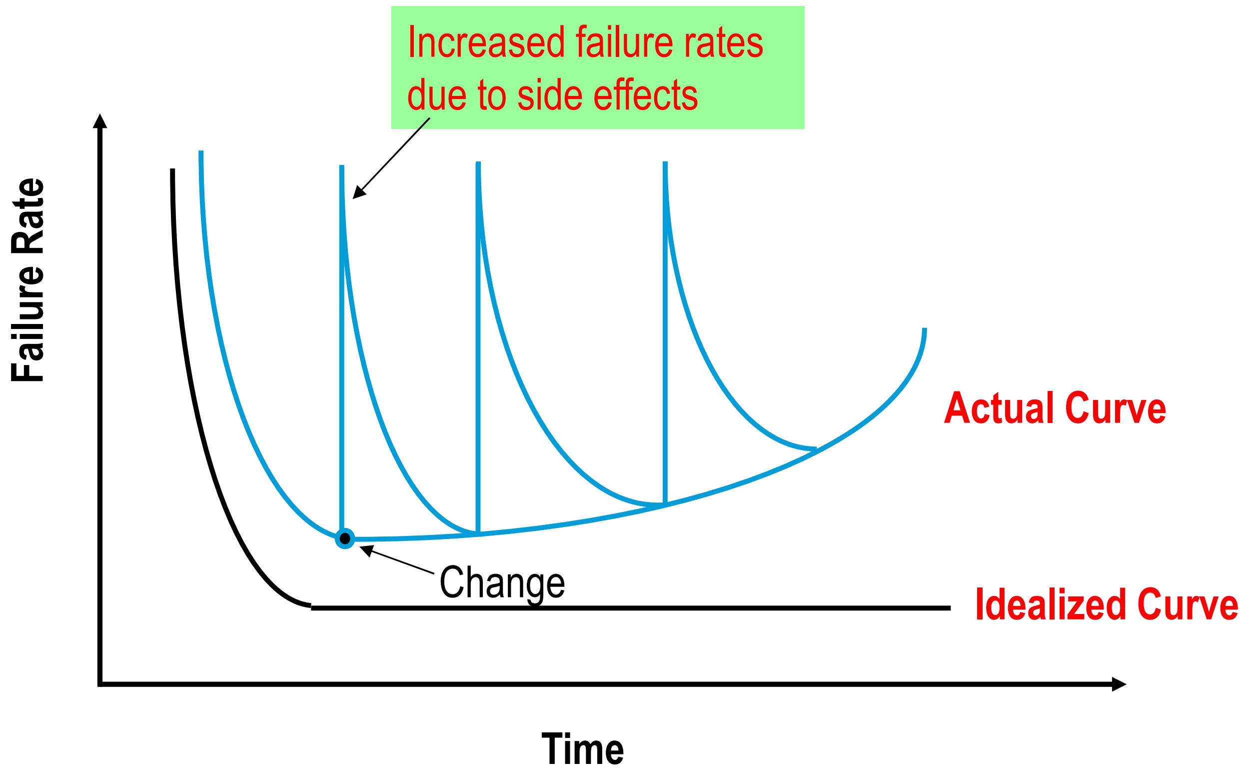
PRODUCT BATHTUB CURVE MODEL



SOFTWARE IDEALIZED CURVE



SOFTWARE ACTUAL FAILURE CURVE



SOFTWARE APPLICATION

- System software (control computer H/W such as OS)
- Embedded software (e.g., auto pilot, biometric device)
- Business software (commercial application for business users, SAP, ERP, DSE)
- Engineering and scientific software (e.g., statistical analysis-SPSS, MATLAB)
- Personal computer software (e.g., Microsoft Office)
- Web-based software (use over internet with browser, e.g., Gmail)
- Artificial intelligence software (interact with computer, HCI, game)

SOFTWARE MYTHS (MANAGEMENT)

- Myth1: We already have a book that's full of standards and procedures for building s/w, won't that provide my people with everything they need to know?

- Myth2: My people have state-of-the-art software development tools, after all, we buy them the newest computers.

- Myth3: If we get behind schedule, we can add more programmers and catch up.

- Myth4: If I decide to outsource the software project to a third party, I can just relax and let that firm build it.

SOFTWARE MYTHS (CUSTOMER)

- Myth1: A general statement of objectives is sufficient to begin writing programs – we can fill in the details later.
- Myth2: Project requirements continually change, but change can be easily accommodated because software is flexible.

SOFTWARE MYTHS (PRACTITIONER)

- Myth1: Once we write the program and get it to work, our job is done.

  Fact: the sooner you begin writing code, the longer it will take you to get done.

- Myth2: Until I get the program "running," I have no way of assessing its quality.
- Myth3: The only deliverable work product for a successful project is the working program.
- Myth4: Software engineering will make us create voluminous and unnecessary documentation and will invariable slow us down.

REFERENCES

- Pressman, R.S. (2010). *Software Engineering: A Practitioner's Approach.*
- Kelly, J. C., Sherif, J. S., & Hops, J. (1992). An analysis of defect densities found during software inspections. *Journal of Systems and Software*, *17*(2), 111-117.
- Bhandari, I., Halliday, M. J., Chaar, J., Chillarege, R., Jones, K., Atkinson, J. S., & Yonezawa, M. (1994). In-process improvement through defect data interpretation. *IBM Systems Journal*, *33*(1), 182-214.