CS20006: Software Engineering
Module 01: Course Information & Introduction to Software Engineering

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Table of Contents

Engineering: Skills of Construction

- Civil Engineering
  - Construction of Buildings
- Mechanical Engineering
  - Construction of Automobiles
- Electrical Engineering
  - Construction of Power Plants
- **Software Engineering**
  - *Development of Software*

What Software Engineering is NOT!

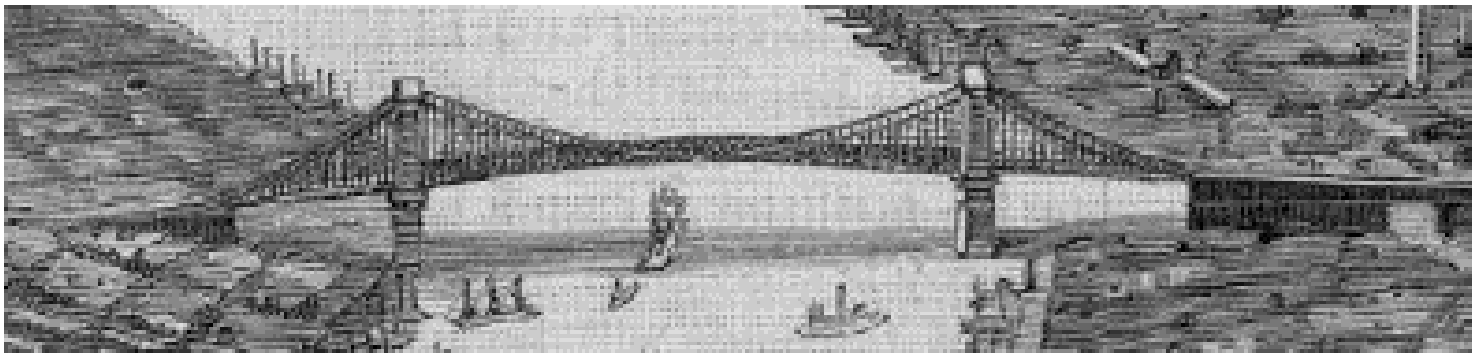
- Programming
- Data Structures
- Algorithms
- Design
- Testing
- Deployment
- Maintenance
- . . .
- . . .
- . . .
- Construction!

Evolution of Domains

- Construction
- Medicine
- Aviation
- Computing
- Software

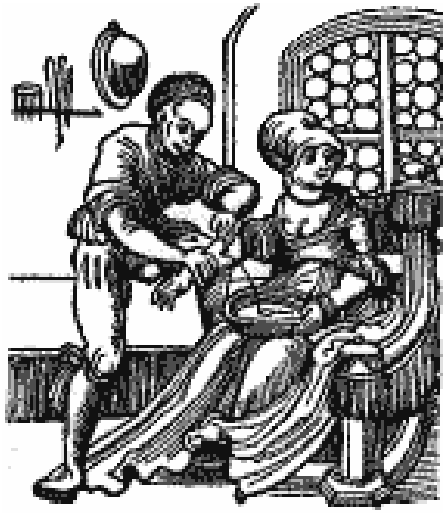
Construction

- Fallen trees, Stepping stone (10000 BC), Boardwalk
- Arch bridge, 1300 BC
- Iron bridge, 1779
- Concrete Bridges, 1877
- Steel bridge, 1912
- Bailey bridge, 1940
- Constructing a bridge is different from innovating a bridge (with new material for instance) for the first time
- Engineers use well established metrics to design bridges – they do not innovate at this stage



Medicine

- *Health was thought to be restored by purging, starving, vomiting, or bloodletting*
  - Surgeons and barbers specialized in this practice
  - Widely practiced in 18^{th} & 19^{th} century
  - Declared quackery by 1900



- Infection control
  - Survived surgery, died out of infection
  - Germ theory and sterility came only in late 1800s (Lister)
  - Current rate of infection $< 2.5\%$

Aviation

- 400 BC Chinese fly kite aspiring humans to fly
- For centuries, we try to fly like birds. . . disastrous
- Steam powered, hot air
- Gliders, single man
- Engine powered
- 1903 Wright brothers' first flight – 12s, 120' long, 10' high
- UK's Frank Whittle registered patent for the turbojet engine in 1930, first flight test in 1941
- Concorde, 1976, mach 2

Computing

1801:	In France, Joseph Marie Jacquard made Punch cards for fabric design in **Jacquard Loom**
1822:	English mathematician **Charles Babbage Machine** (failed)
1890:	Herman **Hollerith punch card** for 1880 census saves $5 m. His company becomes **IBM**
1936:	Alan Turing - **Turing machine**
1939:	**Hewlett-Packard** is founded
1941:	Atanasoff & Clifford Berry introduces **main memory** to solve 29 equations simultaneously
1943-1944:	John Mauchly & J. Presper Eckert, build **ENIAC**: 20' X 40', 18,000 vacuum tubes.
1946:	Mauchly & Presper build the **UNIVAC**, the first commercial computer for business applications
1947:	William Shockley, John Bardeen and Walter Brattain of Bell Laboratories invent the **transistor**
1953:	Grace Hopper develops the first computer language **COBOL**
1954:	The **FORTRAN** programming language, developed by an IBM team led by John Backus
1958:	Jack Kilby (Physics Nobel, 2000) & Robert Noyce unveil the **integrated circuit**
1964:	Douglas Engelbart shows a prototype of the modern computer, with **a mouse and a GUI**
1969:	A group of developers at Bell Labs produce **UNIX**
1970:	Intel unveils the Intel 1103, the first **Dynamic Access Memory (DRAM)** chip.
1971:	Alan Shugart leads a team of IBM engineers who invent the **floppy disk**
1973:	Robert Metcalfe, Xerox, develops **Ethernet**
1974-1977:	A number of **personal computers** hit the market
1975:	Paul Allen & Bill Gates, write software for the Altair 8080, using BASIC language; form **Microsoft**
1976:	Steve Jobs and Steve Wozniak start **Apple Computers** on April Fool's Day
1977:	Apple offers **color graphics** and incorporates an **audio cassette drive for storage**
1978:	Accountants **VisiCalc**, the first computerized **spreadsheet program**
1979:	MicroPro International releases **WordStar**

Computing

1981: The **first IBM personal computer**, code-named "Acorn," uses Microsoft's **MS-DOS**

1983: Apple's **Lisa is the first personal computer with a GUI**

1985: Microsoft announces **Windows**

1985: First dot-com domain name, **Symbolics.com**, registered on Mar. 15 by Symbolics Computer Company

1986: Compaq brings the **Deskpro 386, 32-bit architecture**, providing speed comparable to mainframes

1990: Tim Berners-Lee, a researcher at CERN, develops **HTML**, giving rise to the **World Wide Web**

1993: The **Pentium microprocessor** advances the use of graphics and music on PCs.

1996: Sergey Brin and Larry Page develop the **Google Search Engine** at Stanford University.

1997: **Microsoft invests $150 million in Apple**

1999: The term **Wi-Fi** becomes part of the computing language

2001: Apple unveils the **Mac OS X**

2003: **The first 64-bit processor, AMD's Athlon 64**

2004: **Mozilla's Firefox 1.0** challenges Microsoft's Internet Explorer. **Facebook** launches

2005: **YouTube** is founded. Google acquires **Android**, a Linux-based mobile phone operating system

2006: Apple introduces the **MacBook Pro Nintendo's Wii game console** hits the market

2007: The **iPhone** brings many computer functions to the smartphone.

2010: Apple unveils the iPad

2012: **Facebook gains 1 billion users on October 4**

2015: Apple releases the **Apple Watch**. Microsoft releases **Windows 10**

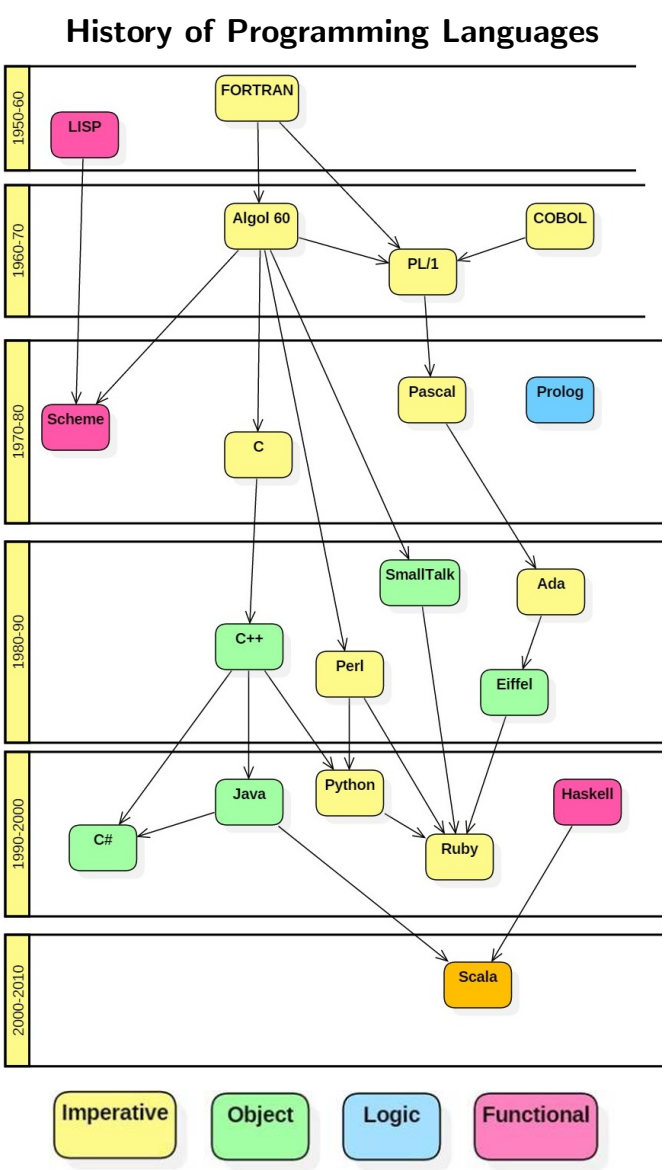
2016: The first **reprogrammable quantum computer** was created

2017: DARPA is developing a new **Molecular Informatics** program that uses molecules as computers.

2019: **Corona hits!**

History of Computers: A Brief Timeline

History of Programming Languages



Paradigms: *Imperative*: Algorithms + Data, *Object*: Data, *Logic*: Facts + Rules + Queries, and *Functional*: Functions

- **FORTRAN**: IBM
- **LISP**: John McCarthy
- **Algol 60**: John Backus & Peter Naur
- **COBOL**: Grace Murray Hopper
- **PASCAL**: Niklaus Emil Wirth
- **Prolog**: Alain Colmerauer & Philippe Roussel
- **Scheme**: Guy L. Steele & Gerald Jay Sussman
- **C**: Brian W. Kernighan & Dennis M. Ritchie
- **SmallTalk**: Alan Kay, Dan Ingalls, & Adele Goldberg
- **Ada**: Jean Ichbiah & Tucker Taft
- **C++**: Bjarne Stroustrup
- **Objective-C**: Brad Cox
- **Perl**: Larry Wall
- **Java**: James Gosling
- **Python**: Guido van Rossum
- **Haskell**: Paul Hudak
- **C#**: Microsoft Corporation
- **Ruby**: Yukihiro Matsumoto
- **Scala**: Martin Odersky

Source: http://www.cs.sjsu.edu/ pearce/modules/lectures/languages2/concepts/evolution.htm

TIOBE Index of Programming Languages

Jan 2021	Jan 2020	Change	Programming Language	Ratings	Change
1	2	↑	C	17.38%	+1.61%
2	1	↓	Java	11.96%	-4.93%
3	3		Python	11.72%	+2.01%
4	4		C++	7.56%	+1.99%
5	5		C#	3.95%	-1.40%
6	6		Visual Basic	3.84%	-1.44%
7	7		JavaScript	2.20%	-0.25%
8	8		PHP	1.99%	-0.41%
9	18	⇈	R	1.90%	+1.10%
10	23	⇈	Groovy	1.84%	+1.23%
11	15	⇈	Assembly language	1.64%	+0.76%
12	10	↓	SQL	1.61%	+0.10%
13	9	⇊	Swift	1.43%	-0.36%
14	14		Go	1.41%	+0.51%
15	11	⇊	Ruby	1.30%	+0.24%
16	**20**	⇈	**MATLAB**	**1.15%**	**+0.41%**
17	19	↑	Perl	1.02%	+0.27%
18	13	⇊	Objective-C	1.00%	+0.07%
19	12	⇊	Delphi/Object Pascal	0.79%	-0.20%
20	16	⇊	Classic Visual Basic	0.79%	-0.04%

Software

- Relatively nascent field in comparison
- Machines are getting faster or more powerful
- Are we getting better in delivering software applications though?

Success (or Lack thereof)

- How successful are we in developing software?
- Less than 10% of software projects succeed!
- Criteria for success?
  - On time,
  - Within budget,
  - Feature complete,
  - Works (failure free)
- Why is it so hard to get this right?

Change In Projects

- Changes From Requirements
  - Customers Learn from the Solution
  - Business Environment and Conditions Change
  - Business Processes are Re-engineered
- Changes From Technology
  - Tools/Platform Release New Versions
  - Actual Tool/Platform Capabilities May Vary from Plans
- Changes From People
  - Interactions are Complex
  - Individual Behavior is Unpredictable

Software Engineering

- What's Engineering?
  - *the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people*
  - *the design and manufacture of complex products* <**software engineering**>

Software Engineering

- If software engineering like manufacturing or designing a manufacturing plant?
  - Is it like making another cell phone or making of cell phones (took 37 years for commercialization)?
- Manufacturing is predictive
  - You can measure and control quality, quantity
- Designing a manufacturing plant is creative/innovative
- Most software development is innovative process rather than predictive manufacturing
  - Requires great deal of innovation, interaction / communication

Course: Software Engineering

- We demystify software construction and learn the *good practices*

Agenda: Software Engineering

- Software as a product
  - Clients and their needs
  - Quality
- Requirements and specification
  - Usability
  - Evolution
- Software design
  - Software architecture
  - Object-oriented design

Agenda: Software Engineering

- Software Processes
  - Coding
  - Reading
  - Review
  - Source Management
  - Debugging
  - Testing
  - Reliability
  - Verification
  - Documentation
  - Quality
  - Maintenance

Agenda: Software Engineering

- Project management
  - Personnel management
  - Economic, legal, and social factors
- Standards

Prerequisites

1. Programming
2. Data Structure
3. Algorithms
4. Object-Oriented Analysis and Design (*optional*)

Modules

- Module 01: Course Information & Introduction to Software Engineering
- Module 02: Object Oriented Programming in C++
- Module 03: Software Development Life Cycle (SDLC)
- Module 04: Software Modeling in UML
- Module 05: Software Testing & Maintenance
- Module 06: Design Pattern
- Module 07: Selected topics in Software Engineering (*depending to time availability*)

Course Material

- Slides will be uploaded to Moodle.
- Books:
  - Software Engineering by Rajib Mall
  - Software Engineering: A Practitioner's Approach by Roger S Pressman
  - An Integrated Approach to Software Engineering by Pankaj Jalote
  - Software Project Management – A Process-Driven Approach by Ashfaque Ahmed
  - The Java Programming Language by Ken Arnold, James Gosling, & David Holmes
  - The C++ Programming Language by Bjarne Stroustrup
  - Modern C++ Design by Andrei Alexandrescu
  - Design Patterns: Elements of Reusable Object-Oriented Software by Erich Gamma, Richard Helm, Ralph Johnson, & John Vlissides
  - Learning UML 2.0 – A Pragmatic Introduction to UML by Russ Miles & Kim Hamilton (O'Reilly)
  - Effective C++ & More Effective C++ by Scott Meyers
  - Exceptional C++ & More Exceptional C++ by Herb Sutter

About the Course: Interactions

- Timings: WED(11:00-12:00), THR(12:00-1:00), FRI(8:00-9:00)
- Classes and interactions will be held on Microsoft Teams: Software Engineering CS20006
- Kindly keep your microphone muted
- Kindly keep your video off
- Kindly put your comments / doubts on the chat – chats will be periodically checked and responded
- Kindly raise your hand to ask a question
- Deeper interactions / feedback will be over Forum on Moodle
- Interaction Outside Class: By appointment through mail - over audio / video chat

About the Course: Evaluations

- Offline Assignments
  - Marks: 10~20
  - # of Assignments: 6
  - Total Marks: 70
  - Total of the 6 assignments will be scaled to 70
  - To be hand-written, scanned and uploaded - write clearly preferably using a little bigger font styles
- Online Quiz
  - Marks: 15
  - Time: 1 hour
  - # of Test: 3
  - Best 2 of 3
  - Total Marks: 30
- Relative Grading
  - Marks of assignments and quizzes will be added to get to total out of 100
  - Grade boundary will be decided relatively based on the bell curve

The Coordinating Platforms

- Moodle will be used for the course. Register on Moodle immediately to:
  - CS20006: Software Engineering
  - Course Key: STUSENG
- All assignments / presentations / material will be uploaded to Moodle
- The submissions will be accepted *only* through Moodle up to the specified deadline. No submission through mail will be entertained
- Extensions permissible only on medical ground (B C Roy certificate) and IIT duty (like inter-IIT Sports meet on Dean's Order)
- 10% to 50% penalty (depending on assignment and amount of delay) on late submission on discretionary basis
- Zero tolerance to plagiarized submissions. Penalty applies to both parties
- Online Quiz will be held online in Moodle
- All announcements will be made on Moodle. Keep checking
- ERP will also be used at times for communication. Make sure that your registered email at ERP works
- Recording of class lectures will be posted on YouTube:

Tentative Schedule for Quiz

Quiz	Date	Time
Theory Quiz 1	27-Jan-21	14:15–15:15
Laboratory Quiz 1	27-Jan-21	15:30–16:30
Theory Quiz 2	24-Feb-21	14:15–15:15
Laboratory Quiz 2	24-Feb-21	15:30–16:30
Theory Quiz 3	31-Mar-21	14:15–15:15
Laboratory Quiz 3	31-Mar-21	15:30–16:30

TA and Teachers

Sr. No.	Name	Mobile	Gmail Id	Institute Id
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Prefer to contact by email. Use mobile call only for extreme urgency