CE 311K
Introduction to Computer Methods

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Introduction

www.ce.utexas.edu/prof/mckinney/ce311k/ce311k.html

Introduction

- Course Introduction and Housekeeping
- Computer Systems – Hardware and Software
- The Internet
- Program Planning

Course Objectives

- **Introduce computer methods for the solution of civil engineering problems, including:**
  - Intro to computer hardware and operating systems,
  - Organization of engineering problems for computer solution,
  - Selection of appropriate numerical solution software, methods, and algorithms,
  - Elementary numerical analysis of selected algorithms,
  - Writing, compiling, and executing Visual Basic programs
  - Presentation of problems and their solution,
  - Use of the WWW to communicate and retrieve information

Housekeeping

- Prerequisites
  - M408C, Calculus I, Co-requisite: M408D, Calculus II
- Text
  - Required:
    - Schneider, D. I., An Introduction to Programming Using Visual Basic 2008, 2008, Prentice Hall
    - Microsoft Visual Studio Express Edition with VB2008 (CD in back of the text or download from the web:
    - http://www.microsoft.com/express/Downloads/#2010-Visual-Basic
  - Strongly Suggested:
    - Chapra, S. & R. Canale, Numerical Methods for Engineers
- Homework
  - Due at beginning of lecture, due date on web site
  - Lab assignments due next lab period
  - Late homework penalized 50% per day late

Housekeeping

- Grading
  - A >= 90, B >= 80, C >= 70, etc
  - Exams: 50% (2 at 25% each; open book & notes)
  - Project: 20%
  - Laboratory: 20%
  - Homework: 10%
- Exams
  - 2 exams
  - No makeups
  - Dates: on web site
  - No Final – Project Presentation and Report Instead

Projects

- Enable you to explore in-depth some aspect of Civil, Architectural, or Environmental Engineering of interest to ***you***
- Provide experience in
  - use of computer methods to solve engineering problems
  - formulation, execution and presentation of an engineering investigation
  - team effort to produce a project, report and presentation that is informative to you and your classmates

Project Steps

- Students - sign up for an area of interest
  - Architectural Engineering (ArE) – www.caee.utexas.edu/areareasofpractice/index.cfm
    - Structural Engineering
    - Building Energy and Environments
    - Construction Materials Engineering
  - Civil Engineering (CE) – www.caee.utexas.edu/ceareasofpractice/index.cfm
    - Construction Engineering and Project Management (CEPM)
    - Environmental Engineering (ENV)
    - Geotechnical Engineering (GEO)
    - Materials: Mechanics and Construction (MAT)
    - Structures (STR)
    - Transportation (TRAN)
    - Water Resources Engineering (WR)

Project Steps

- Instructor - prepares teams in areas of interest
- Teams
  - Select project topic in their area and prepare proposal
  - Work on project in teams
  - Present final project in class
  - Submit final report

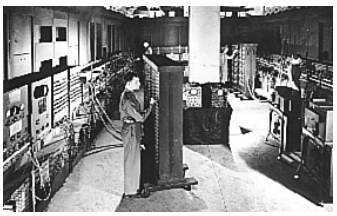
Computing Systems

- A **computer** is a machine designed to perform operations specified with a set of instructions called a **program.**

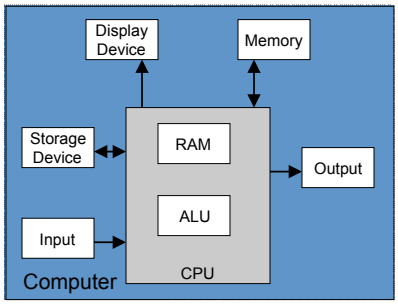
- **Hardware** refers to the computer equipment.
  - keyboard, mouse, terminal, hard disk, printer

- **Software** refers to the programs that describe the steps we want the computer to perform.

Computer Hardware

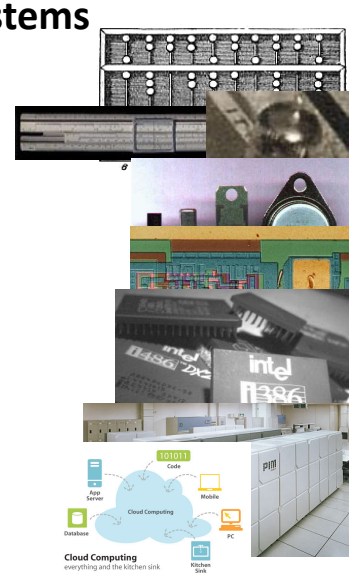


- CPU - Central processing unit
- ROM - Read only memory
  - Power off, data saved
- RAM - Random access memory
  - Power off, data lost



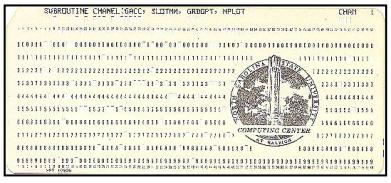
Computer Systems

- First Generation
  - 1940-1950 Vacuum tubes
- Second Generation
  - 1950-1964 Transistors
- Third Generation
  - 1964-1971 Integrated Circuits
- Fourth Generation
  - 1971-present Microprocessors
- Fifth Generation
  - Future Massively Parallel
- Cloud
  - Current Internet-based



www.wordiq.com/definition/History_of_computing_hardware

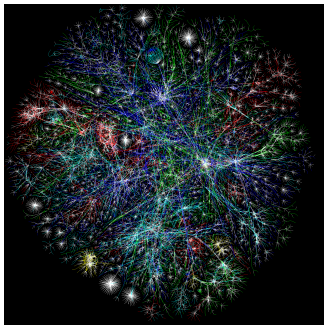
Computer Software



- Operating System
  - interface with the user
  - unix, windows, linux, ...
- Software Tools
  - word processors (MicrosoftWord, WordPerfect, ...)
  - spreadsheet programs (Excel, Lotus1-2-3, ...)
  - mathematical computation tools (MATLAB, MathCAD, ...)
- Computer Languages
  - machine language
  - assembly language
  - binary language
  - high level languages
  - (C, C++, FORTRAN, VB, java)
- Web Applications
  - Search engines
  - Online shopping
  - VOIP

Reed Harvard UT Stanford

The Internet



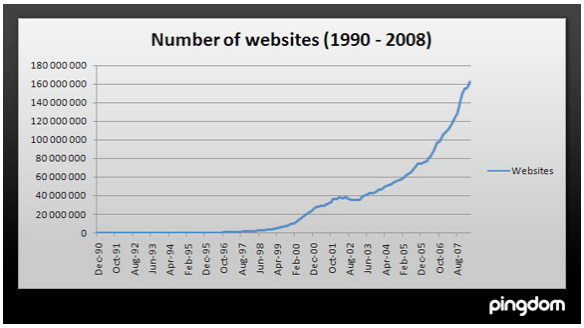
- International computer network connecting …everybody
- Computer networking and communications technology
  - i.e., wires and routers, those things that connect computers
  - TCP/IP (Transmission Control Protocol/Internet Protocol) directs the flow of data between computers on the internet
- The Internet allows you to communicate with computer users around town and around the world

World Wide Web (WWW)

- An open approach to information sharing
- Providing a distributed "hyper"-media system to easily access information spread across the world
- "Hyper"-text
  - A way to link and access information of various kinds as a web of nodes in which a user can browse at will
  - Operation of the Web relies on hypertext to interact with users
  - Enables you to read and navigate information in a nonlinear way based on what you want to know
  - Browser - programs which provide access to hypertext docs on the web
- HTML (Hypertext Markup Language)
  - Formatting standard for hypertext documents

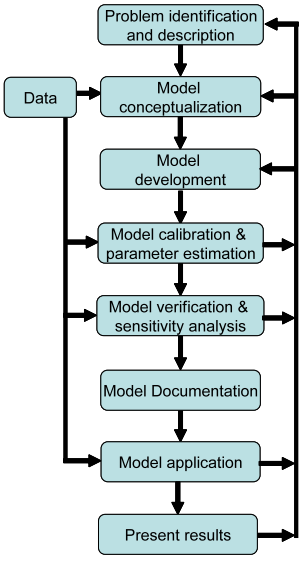
How big is the internet?

- 1830 million: individuals will use the Internet in 2010
- > 1 trillion web pages
- 5 million Tera bytes of data
- > 500 million use the Internet at least once a week
- Google Zeitgeist Search Queries: 2009
  - Fastest Rising (Global)
  - michael jackson
  - Facebook
  - Tuenti
  - Twitter
  - Sanalika
  - new moon
  - lady gaga
  - windows 7
  - dantri.com.vn
  - torpedo gratis

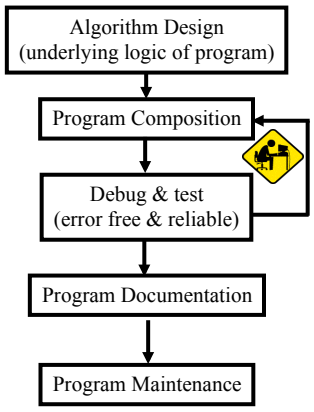


Model Building Process

- Problem identification
  - Important elements to be modeled
  - Relations and interactions between them
  - Degree of accuracy
- Conceptualization and development
  - Mathematical description
  - Type of model
  - Numerical method - computer code
  - Grid, boundary & initial conditions
- Calibration
  - Estimate model parameters
  - Model outputs compared with actual outputs
  - Parameters adjusted until the values agree
- Verification
  - Independent set of input data used
  - Results compared with measured outputs



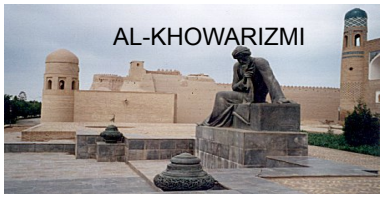
Programming Process



Grace M. Hopper

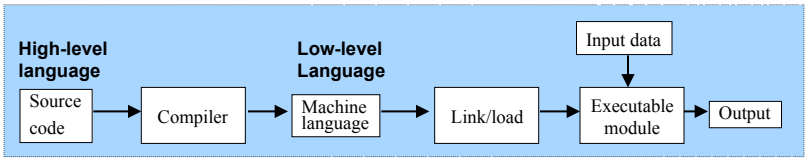
First "Bug"

Algorithms

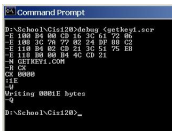


- **Example:**
  - Write a letter.
  - To mail it, you must decide how much postage to put on the envelop.
- **Rule of Thumb:** One stamp for every 5 sheets of paper.
- **Algorithm:** Step-by-Step procedure for solving a problem
  1. Input = Number of ***sheets*** of paper in the letter
  2. Divide ***Sheets*** by 5. Round up to the next highest whole number
  3. Output = Number of ***Stamps***

Composing a Computer Program



- Programmer
  - Writes program in **source code** (VB or other language)
- Compiler
  - Converts source code to **machine language** code
- Linker
  - Combines machine language with libraries & converts them to an **executable module**
- Interpreter
  - Converts source code to machine language and executes one line at a time



6 Elements of Programming

- 6 things you need to program in any language:
  1. Variables
  2. Input/Output
  3. Selection
  4. Subprograms
  5. Repetition
  6. Arrays

- VB
- C, C++, C#
- FORTRAN
- Pascal
- Cobol
- Java, J++
- YouNameItLanguage

Summary

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