GE2316

Computing Snapshot, Today and Tomorrow

Objective

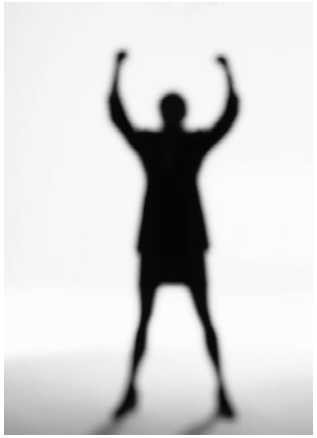
To acquire general knowledge on fundamental concepts and technologies of computing, and applications in professional disciplines such as commerce, finance, legal and health, as well as social applications, through self initiative.

Goals

A GE course – discussion-oriented
– self-initiative
– cross learning

to learn – computing concepts & applications
– how to learn
– through cross learning
– innovation

and get – inspiration
– information
– knowledge



Empower the students!

Main Course

Acquire GK on

- Computing concepts
- Computer systems – hardware & software
- Applications – concepts/methods
- Computing for tomorrow – innovations and speculations
- Application case studies

Note: It is unrealistic and unnecessary to learn everything concerning computing. Not all topics will be covered.

Side Dishes

- Learn how to learn
- Learn through self initiative – self learning
- Learn through cross learning & team work
- Learn self discipline – healthy **attitude**
- Learn to innovate
- Learn to have fun on learning

Sweets

- Acquire GK on computing
- Understand how computing functions
- Build up
  - Self initiative
  - Self confidence
  - Self stemma
  - Healthy attitude
- Freedom to choose topics
- No exam

Sweats

- Self discipline
- Work independently / work in a team
- Presentations
- Class and panel discussion
- Quizzes
- Reports and papers
- Full attendance and participation required

Deliverables

- Team project
  - Team presentation
  - Individual report, with post-present revision

  3 to 4 students per team thru random grouping
- Term project (individual)
  - Presentation
  - Term paper, with selected presentation
- Lecture notes (individual composition of class notes)

Course structure

- Lecture and discussion
- Team projects
- Term projects
- Presentations, reports, and class notes
- A 5-minute show-and-tell in lecture

  to relax, provoke innovation, or just for fun
- Quizzes

Text book

Using Information Technology, 9th ed.

by Brian K. Williams and Stacey Sawyer

McGraw-Hill, 2011. ISBN 978-0-07-122139-9

Note: The book covers many aspects of computing, from binary to technological singularity, and provides "*Practical Action*" and "*Experience Box*" in each chapter, to discuss topics of general interest, such as time management, critical thinking, tips for avoiding spyware, how to protect one's data and identity from getting stolen, and how to do Web research and plagiarism, etc.

Partnerships and tools

- Language Companion Course and Clinic
- Peer marking/comments by fellow students
  - Give marks
  - Constructive suggestions
  - Critics
- Bb, email, and face-to-face to share ideas and solve problems

Course contents

- Computing evolution
- Computing theories
- Number systems and characters
- Component technologies
- Input/Output & human interface
- Computing architectures & systems
- Software technologies
- Applications on selected disciplines
- Application methodologies
- Computing for tomorrow – innovations and speculations
- Computing “Laws”

Computing Evolution

objects

- Number
- Data
- Information
- Content
- Knowledge
- Wisdom

process

- Number crunching
- Numerical analysis
- Data processing
- Information processing
- Content structuring
- Algorithmatic
- Heuristic
- Learning

Computing theories

- Boolean Algebra
- Formal Language
- Finite Automata – FSM
- Heuristic vs. Algorithm

Number systems and characters

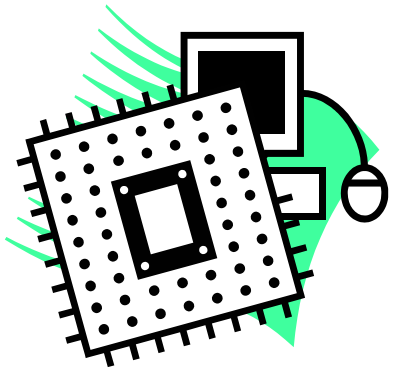
- Binary
- Hexadecimal
- Decimal
- BCD
- Floating-Point
- Characters

Digital systems means Binary. Why?

Component Technologies

Performance vs. density, vs. cost

- Electromagnetic
- Vacuum tubes
- Transistors
- Integrated circuits
- VLSI
- Optical



Storage Technologies

Non-volatile storage

Preserving data when powered off

- Punched cards, punched tapes
- Magnetic cores
- Magnetic disks
- Magnetic floppies
- ROM, PROM
- Flash memory

Storage Technologies cont.

Volatile storage

Losing data when powered off

- Transistors and solid-state memory
- RAM
  - DRAM – dynamic
  - SRAM – static
- CCD (charge-coupled device)

I/O & Human Interface

- Graphics/animation and image
- Pattern recognition
- Acoustics and sound synthesis
- Voice recognition
- GUI
- Touch screen

Computing Architectures

- Basic processor architecture
- CISC vs. RISC
- von Neumann vs. Object
- Real-time, online, batch, multiprogramming, multi-processing
- Distributed computing
- Network computing

Computing Systems

- Microprocessors
- Desktop PC, notebook/smart-phone, tablet
- Servers
- Supercomputers
- Embedded systems (why embedded?)
- Multi-core/multiprocessing
- Parallel & array processing
- Cloud computing
- Fault-tolerant computing

Design & manufacturing

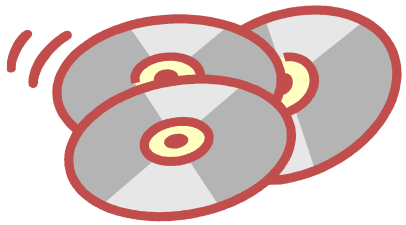
- Hardware Description Languages
- Simulation
- Testing bench/platform
- Boot-strap
- Breadboard, prototype, sample, pilot-run, production

Software Technologies

- Flowchart
- UML (unified model language)
- Programming
- High-level programming
- Object programming
- Software engineering
- Simulation and modeling
- Automatic programming

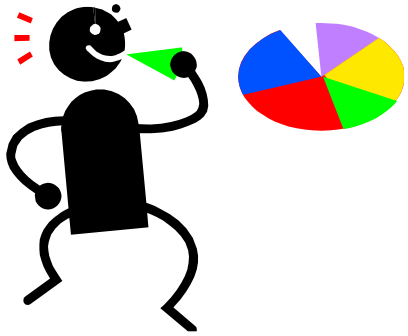
System Software

- Operating systems
- Compilers, assemblers, and linkers
- Interpreters / Emulators
- Networking
- Middleware
- Database
- Drivers



Applications

- Government
- Finance and banking
- Commerce and trading
- Retail
- Health
- Legal
- Games, social, and leisure
- Natural languages
- Other expert systems



Application methodologies

- Heuristics
  - Ad hoc
  - Trial-and-error
  - Decision tree
- Mathematical and knowledge management
  - Numerical methods
  - Resource management
  - Propositional logic
- Learning
  - Maintain past data for future use – learn from the past
    From histograms to make decisions
  - Adjust weighing factors to improve decisions
  - Simulating various models with past data

Innovation

- On thought
- On process
- On products
- On packaging
- On storage
- On delivery
- On promotion
- On ownership

Innovation cont.

- New needs and demands
- Requirement changes
- Improved affordability
- Technology improvements

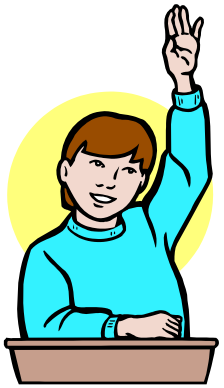
  Performance, miniaturization, energy reduction, materials, cost, etc.
- Technology transport – PC to iPhone, to iPad, to iTV (?)
- Space technology to military, to consumer

How to innovate?

- From demand side
- In-depth knowledge of the subject
- Cross-discipline
- Non-conventional
- Devil’s advocate – why and why not
- Mix of top-down and bottom-up

Ask questions

- What
- Why
- Why not
- Who
- How
- When
- Where



Computing “Laws”

- Moore’s Law
- Murphy’s Law
- Law of Change –

  “No change, no survival”
- “The simpler is the better” Law
- Common sense Law

Paper and team project topics

- Technology
- Professional applications
- Social applications

Self-proposed topics are preferred.

Potential topics on technology

- Wish-list for Cloud: desirable attributes
- Voice recognizer system – natural languages
- Graphics, images, and animation in advertisements
- Chinese language in computing
- Fault-tolerant computing
- Computing music, computing arts
- Robotics
- Apple’s business models and strategies
- Comparing IBM, Intel-Microsoft, and Apple, their business strategies
- Technological singularity

Potential topics on professional applications

- Computing technology support for Stephen Hawking
- Computing and environment – high-tech wastes and solutions
- Internet on law enforcement and crime control
- Computing and education, commerce, retail, privacy, or security.
- Program trading – stocks, bonds, and commodities
- Simulations for R&D and training
- Traffic and flight control systems
- Expert systems on resource management, scheduling, etc.

Potential topics on social applications

- Computing and social behavior
- Computing music, computing arts
- One-stop solution on Internet for home applications
- Interactive movies and TV programs
- iPod, iPhone, iPad, iTunes, and iCloud.
  What next – iTV, iHome, iSolutions, iGuru and iPal ?
- What should iTV do ?
- What should iCloud deliver ?
- Is there life beyond Apple ?
- Google, Yahoo, Baidu, Facebook, YouTube, Twitter, Linked**in** – what next?

5-minute show-and-tell

- Any topics go, not limited to computing
- By voluntary students – students' show
- Lecturer to fill in, if no volunteers
- To relax, to enjoy
- To have fun
- To provoke innovation: sky-is-the-limit
- To talk about computing news

Assessment

- Papers / team projects, class notes 40%
- Quizzes 30%
- Class participation, adjudicating 10%
- Term-paper with presentation 20%

– End –