WELCOME TO CC 3.12 / CIS 1.0

Computing: Nature, Power and Limits

- *Topics:*
  (0) Introduction to the course
  (1) What is a computer?
  (2) What is biomedical computing?
- *Instructor:*
  - Prof Simon Parsons
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- *Course web page:*
  - `http://www.sci.brooklyn.cuny.edu/~parsons/312-fall-2006`

(0) About this course

- Parallel course to the new "lower tier core" CC3.12
- Uses *biomedical computing* as a *context*
  - The basis for examples and some of the lab exercises.
- This deviation means we have to call the course **cis1.0** instead of cc3.12.
- You will get the same credit and can count this for your core requirement in the same way

(0) Syllabus

(A) Introduction to Computers and Networks
(B) Algorithms and Computer Languages
(C) Machine architecture, Data representation and storage
(D) Event-driven programming
(E) Programmer-defined functions
(F) Solvability and Feasibility
(G) Security, Privacy, Encryption and Plagiarism

(0) Course structure

- 7 *Units*
- Each unit has:
  - one *lecture*
  - two *labs*
  - one *assessment*
- Half of the labs will be hands-on sessions using the Internet in 130NE
- The other half will be hands-on sessions using *Netlogo*, also in 130NE.

(0) Assessment

- The assessments will be:
  - Written, take-home assignments ...OR
  - Written, in-class quizzes ...OR
  - Oral, in-class presentations ...OR
  - Oral, in-class demonstrations
- Your grade = 7 assessments (10% each) + final exam (30%)

(1) What is a computer?

- A device that can process data, store data and execute instructions
  - What is the difference between a computer and a calculator?

(1) What is a computer?

- What everyday devices have computers inside them?

(1) Hardware components of a computer

- Processor (i.e., central processing unit, or CPU)
- Memory
  - Short-term: RAM (random access memory)
  - Goes away when you turn off the computer
  - Long-term: permanent storage media.
  - Hard disk, USB drive, CD.



(1) Hardware components of a computer

- Input devices
  - Keyboard
  - Mouse
- Output devices
  - Screen
  - Printer
- Peripherals
  - Printer
  - Camera
  - iPod

(1) Software components of a computer

- Operating system
  - Microsoft Windows
  - Mac OS-X
  - Linux
  - Unix
- Provides the basic functionality
- Without an OS, a computer is just a fancy paperweight.

(1) Software components of a computer

- Applications
  - Email (Outlook, MacMail, Eudora, pine, ...)
  - Browser (Firefox, Internet Explorer, Safari, ...)
  - Music (iTunes)
  - Office tools (word processing, spreadsheets, presentations)
  - Calculator
- Typically the things that you switch the computer on to use.

(1) Software components of a computer

- Drivers
  - Printer
  - Scanner
- Allows you to use all the fancy add-ons.
- (In fact, all bits of internal hardware have a driver too, but they tend to come packaged with the computer so you don't notice them).

(1) How does software work?

- A human writes instructions for the computer in a language that the computer can understand
  - Low-level languages (e.g., assembly)
  - High-level languages (e.g., Java)
- High-level languages are *compiled* (translated) into *binary machine code*, i.e., a language that the computer's processor can understand

(1) How does software work?

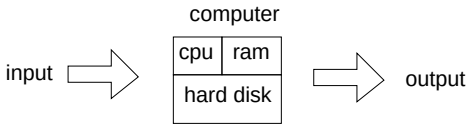
- Instructions must be very specific!
- Instructions are grouped into *programs*
- Instructions are executed *sequentially* (one after another)
- What can go wrong?
  - User or "operator" errors
  - Program errors: called *bugs*
  - Hardware errors (or "faults")

(1) How are programs written?

- Programs are written in high-level languages using a *text editor* (e.g., NotePad or TextEdit).
- This is different from a *word processor* (e.g., Microsoft Word), which stores extra formatting characters (besides what you see on the screen...)
- The *programmer* invokes a *compiler* to translate the program into code that the computer can execute.
- The *user* runs the executable program.
- The programmer's code and the executable program are stored on the computer's hard disk in *files*

(1) What is a computer again?

- A device that receives *input* from a human or another computer or another device, *processes* that input and produces *output*.



- A computer *program* is what does the processing.
- The program is stored on the computer's hard disk, and when the program runs, it is copied into the computer's memory (RAM) and the instructions contained in the program are executed by the computer's central processing unit (CPU).

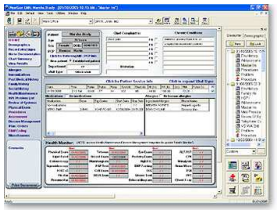
(1) What is a computer again?

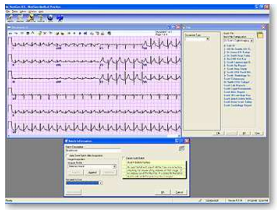
- It's like reading a book. You get the book from the shelf where it is stored (which is like fetching the program from the computer's hard drive), you open the book (which is like starting the program) and you read it, one word at a time (which is like running the program, one instruction at a time)

(2) What is biomedical computing?

- Computer processing of medical data.
  - Support patient care.
  - Telesurgery.
  - Develop new therapies.
- Computer processing of biological data
  - Sequence analysis
  - Systems biology
- Biology-inspired computation.
  - New forms of computation

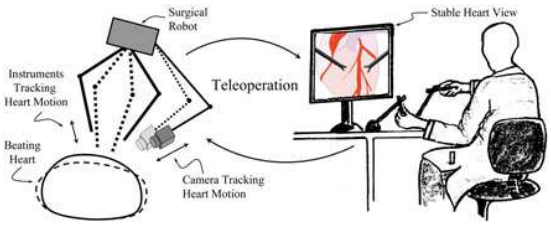
(2) What is biomedical computing?





- Support patient care.
- Electronic medical records (EMR).

(2) What is biomedical computing?



- Telesurgery.

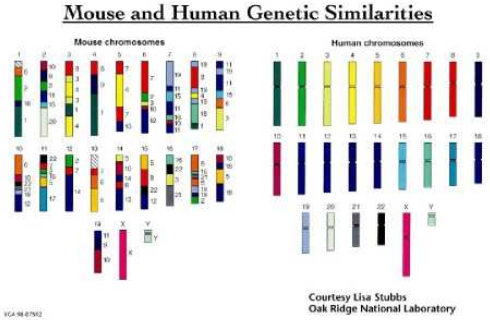
(2) What is biomedical computing?

- Surgical robots.

(2) What is biomedical computing?

- Develop new therapies.
- Process EEG data.

(2) What is biomedical computing?

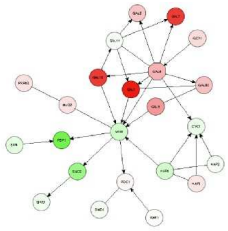


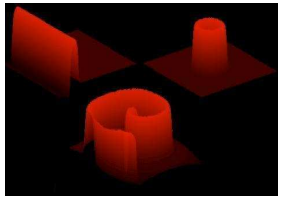
- Genome sequence analysis

(2) What is biomedical computing?

- Genome browser.

(2) What is biomedical computing?



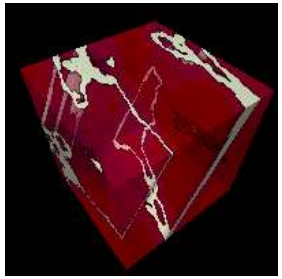


- Systems biology, simulation.

(2) What is biomedical computing?

- Biology-inspired computation.
- Ant colony optimization.

(2) What is biomedical computing?



- Genetic art.
- Kandid.

Summary

- This lecture has introduced the course.
- It has also talked about:
  - The structure and components of a computer; and
  - Described some of the context in which this course will be placed, that of biomedical computing.
- We will come back to the biomedical computing aspects in later lectures