BIOC0023 – A (shortened) introduction to computing

Andrew C.R. Martin
University College London

Aims and Objectives

To introduce some fundamentals of:

- **Computing concepts**
- **Operating systems**
- **Databases**
- **Algorithms**
- **Programming**
- **Using the command line**

Computing concepts

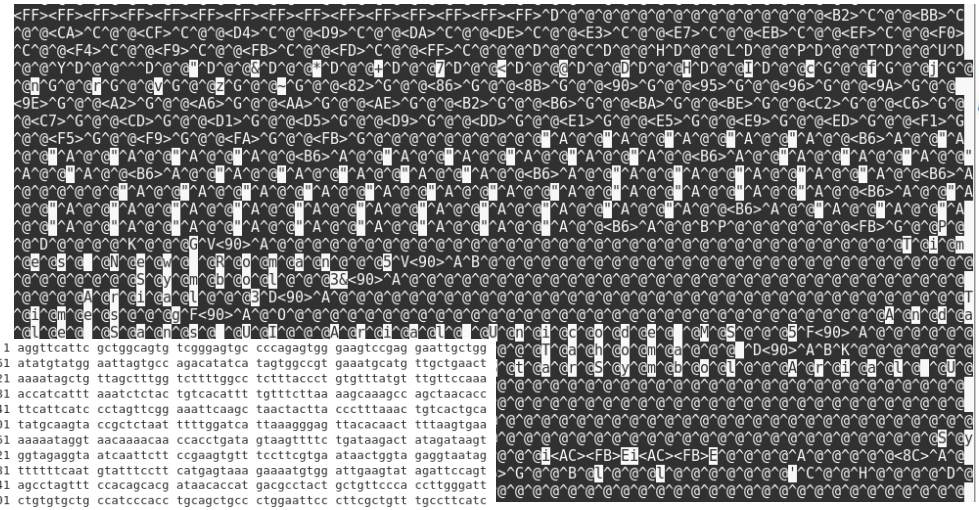
Computing concepts

Data

Program

Database

Visual Output



```
  1 aggttcattc gctggcagtg tcgggagtgc cccagagtgg gaagtccgag gaattgctgg
 61 atatgtatgg aattagtgcc agacatatca tagtggccgt gaaatgcatg ttgctgaact
121 aaaatagctg ttagctttgg tcttttggcc tctttaccct gtgtttatgt ttgttccaaa
181 accatcattt aaatctctac tgtcacattt tgtttcttaa aagcaaagcc agctaacacc
241 ttcattcatc cctagttcgg aaattcaagc taactactta ccctttaaac tgtcactgca
301 tatgcaagta ccgctctaat ttttggatca ttaaagggag ttacacaact tttaagtgaa
361 aaaaatagggt aacaaaacaa ccacctgata gtaagttttc tgataagact atagataagt
421 ggtagaggta atcaattctt ccgaagtgtt tccttcgtga ataactggta gaggtaatag
481 ttttttcaat gtatttcctt catgagtaaa gaaaatgtgg attgaagtat agattccagt
541 agcctagttt ccacagcacg ataacaccat gacgcctact gctgttccca ccttgggatt
601 ctgtgtgctg ccatcccacc tgcagctgcc ctggaattcc cttcgctgtt tgccttcatc
661 tccctccacg tttgagaggc tgtcaggcag cagcgaaagc ttgttaggat gtcctgtgct
721 gcttgtgatg agagcctcca cactgtactg ttcaagtcaa tgttaataaa gcatttcaaa
781 accagctgct ttattcagca cgtgtgtgtg ctgtgtgtgt gtgtgtgtgt gtgtgtgtgt
841 taaataagga aagagctttt atccttgtgt gtgtgtgtgt gtgtgtgtgt gtgtgtgtgt
901 acctgggaaa gaataatggg ctgcttgtgt gtgtgtgtgt gtgtgtgtgt gtgtgtgtgt
961 aaaagctgtc cctgagctga cgccttgtgt gtgtgtgtgt gtgtgtgtgt gtgtgtgtgt
1021 gaggccaggc gttgtggctc acgcctgtaa tcccagcact ttgggaggcc gaggcgggcg
1081 gatcacctga ggtcaggagt tcaagaccag cctggccaac atggtgaaac cccgtctcta
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1381 agatttaaaa ttctactaga tgtgtgtgtg tgtgtgtgtg tgtgtgtgtg tgtgtgtgtg
1441 gttttgagac agggtctcac tatgttgccc aggctggtct caaactcctg ggctcaagcg
1501 atcctcacgc ctggaccttc caaggtgctg ggattacagg cgtgagccac cgcgcccggc
```
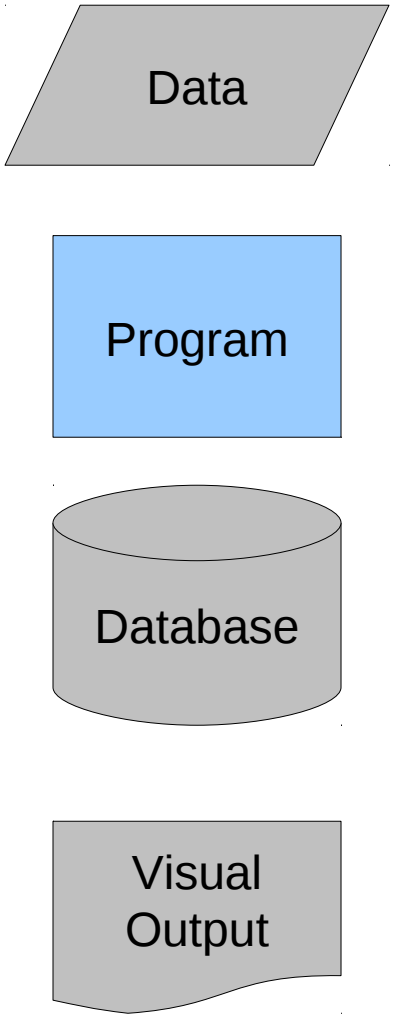
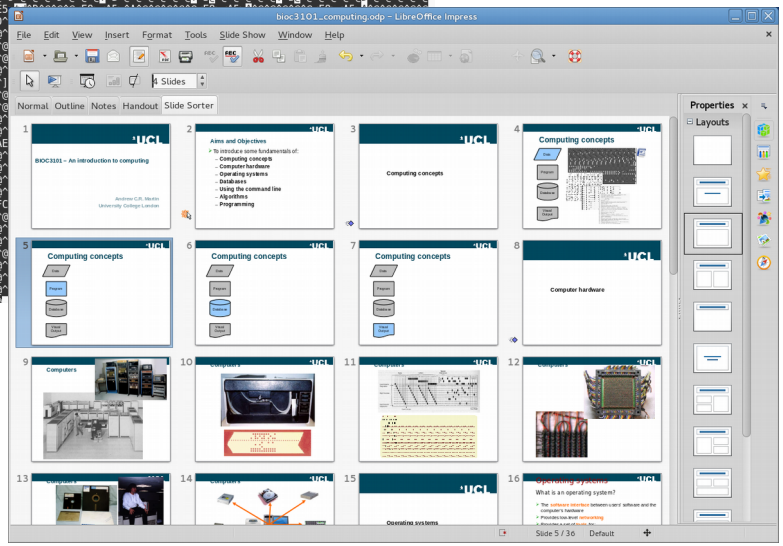

```
ATOM    120  C   GLU L  17     -12.869  -9.053  17.387  1.00 29.00           C
ATOM    121  O   GLU L  17     -12.097  -8.093  17.476  1.00 27.63           O
ATOM    122  CB  GLU L  17     -12.718 -10.348  15.276  1.00 31.42           C
ATOM    123  CG  GLU L  17     -13.476 -11.182  14.257  1.00 38.05           C
ATOM    124  CD  GLU L  17     -12.575 -12.170  13.538  1.00 41.19           C
ATOM    125  OE1 GLU L  17     -11.786 -12.864  14.217  1.00 43.88           O
ATOM    126  OE2 GLU L  17     -12.660 -12.265  12.295  1.00 45.79           O
ATOM    127  N   LYS L  18     -13.[illegible]
ATOM    128  CA  LYS L  18     -12.[illegible]
ATOM    129  C   LYS L  18     -11.[illegible]
ATOM    130  O   LYS L  18     -10.[illegible]
ATOM    131  CB  LYS L  18     -13.[illegible]
ATOM    132  CG  LYS L  18     -12.[illegible]
ATOM    133  CD  LYS L  18     -13.[illegible]
ATOM    134  CE  LYS L  18     -12.[illegible]
ATOM    135  NZ  LYS L  18     -13.[illegible]
ATOM    136  N   VAL L  19     -10.[illegible]
ATOM    137  CA  VAL L  19      -8.[illegible]
ATOM    138  C   VAL L  19      -8.[illegible]
ATOM    139  O   VAL L  19      -8.[illegible]
ATOM    140  CB  VAL L  19      -7.[illegible]
ATOM    141  CG1 VAL L  19      -6.[illegible]
ATOM    142  CG2 VAL L  19      -8.[illegible]
ATOM    143  N   THR L  20      -7.[illegible]
ATOM    144  CA  THR L  20      -6.[illegible]
```

```
ID   G6PD_HUMAN              Reviewed;         515 AA.
AC   P11413; D3DWX9; Q16000; Q16765; Q8IU70; Q8IU88; Q8IUA6; Q96PQ2;
DT   01-OCT-1989, integrated into UniProtKB/Swiss-Prot.
DT   23-JAN-2007, sequence version 4.
DT   09-DEC-2015, entry version 212.
DE   RecName: Full=Glucose-6-phosphate 1-dehydrogenase;
DE            Short=G6PD;
DE            EC=1.1.1.49;
GN   Name=G6PD;
OS   Homo sapiens (Human).
OC   Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi;
OC   Mammalia; Eutheria; Euarchontoglires; Primates; Haplorrhini;
OC   Catarrhini; Hominidae; Homo.
OX   NCBI_TaxID=9606;
RN   [1]
RP   NUCLEOTIDE SEQUENCE [MRNA] (ISOFORM SHORT).
RX   PubMed=3515319; DOI=10.1093/nar/14.6.2511;
RA   Persico M.G., Viglietto G., Martini G., Toniolo D., Paonessa G.,
RA   Moscatelli C., Dono R., Vulliamy T.J., Luzzatto L., D'Urso M.;
RT   "Isolation of human glucose-6-phosphate dehydrogenase (G6PD) cDNA
RT   clones: primary structure of the protein and unusual 5' non-coding
RT   region.";
RL   Nucleic Acids Res. 14:2511-2522(1986).
RN   [2]
RP   NUCLEOTIDE SEQUENCE [GENOMIC DNA].
RX   PubMed=2428611;
RA   Martini G., Toniolo D., Vulliamy T., Luzzatto L., Dono R.,
RA   Viglietto G., Paonessa G., D'Urso M., Persico M.G.;
RT   "Structural analysis of the X-linked gene encoding human glucose 6-
RT   phosphate dehydrogenase.";
RL   EMBO J. 5:1849-1855(1986).
RN   [3]
RP   NUCLEOTIDE SEQUENCE [MRNA] (ISOFORM SHORT), PARTIAL NUCLEOTIDE
RP   SEQUENCE [MRNA] (ISOFORM LONG), AND VARIANTS NSHA MET-68 AND ASP-126.
RX   PubMed=2836867; DOI=10.1073/pnas.85.11.3951;
RA   Hirono A., Beutler E.;
RT   "Molecular cloning and nucleotide sequence of cDNA for human glucose-
RT   6-phosphate dehydrogenase variant A(-).";
RL   Proc. Natl. Acad. Sci. U.S.A. 85:3951-3954(1988).
```

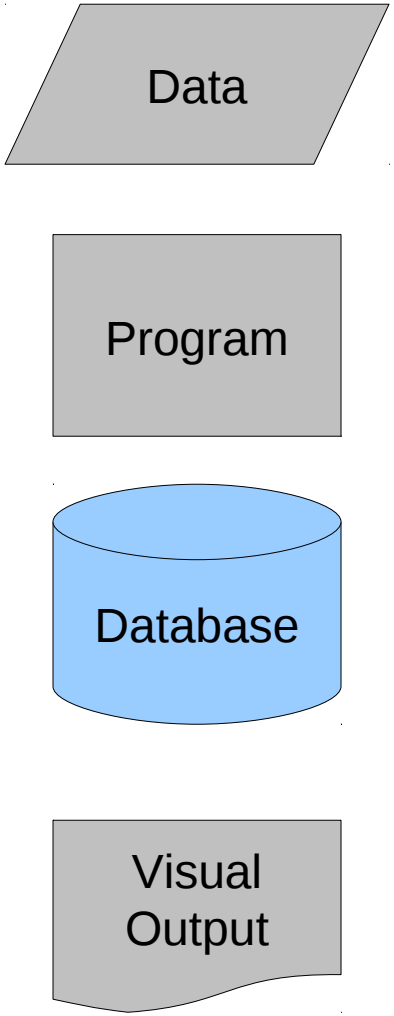
Computing concepts



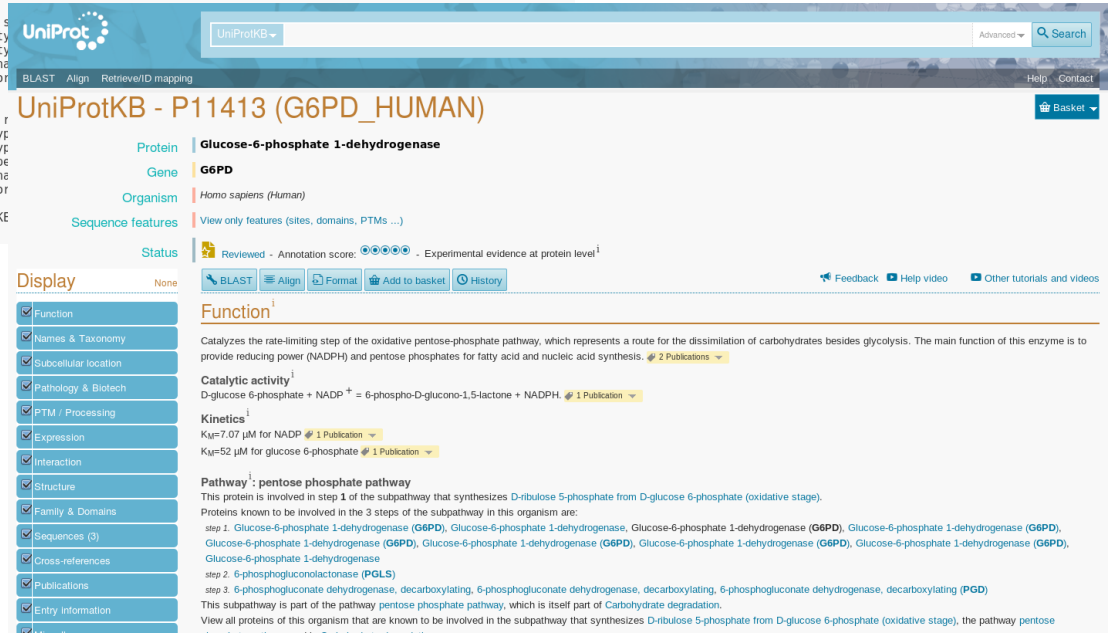

```
/* Read PDB file                                                    */
if(((wpdb = blReadWholePDBAtoms(in)) == NULL)||(wpdb->pdb==NULL))
{
   fprintf(stderr,"Error: Unable to read atoms from input file%s%s\n",
           ((gLabel[0])?" Label: ":""),
           ((gLabel[0])?gLabel:""));
   return(1);
}
pdb = wpdb->pdb;

if(UseSEQRES)
{
   /* Read MODRES and SEQRES records                                */
   modres = blGetModresWholePDB(wpdb);
   seqres = blGetSeqresAsStringWholePDB(wpdb, seqchains, modres,
                                        doNucleic);
}

/* Extract sequence from PDB linked list                            */
if((atomchains = blGetPDBChainLabels(pdb, &nAtomChains)) == NULL)
{
   fprintf(stderr,"Error: N
   return(1);
}

/* Convert PDB linked list
if(SkipX)
{
   if(doNucleic)
   {
      if((sequence = blPDB2
      {
         fprintf(stderr,"Er
         return(1);
      }
```



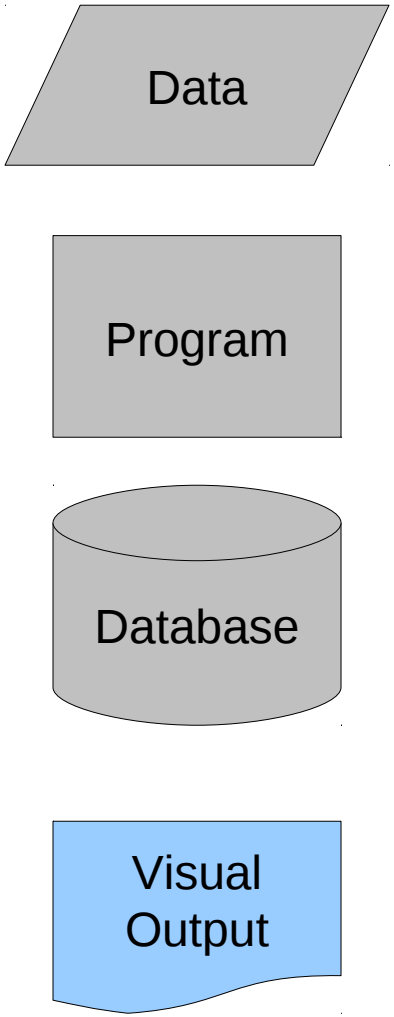
Computing concepts

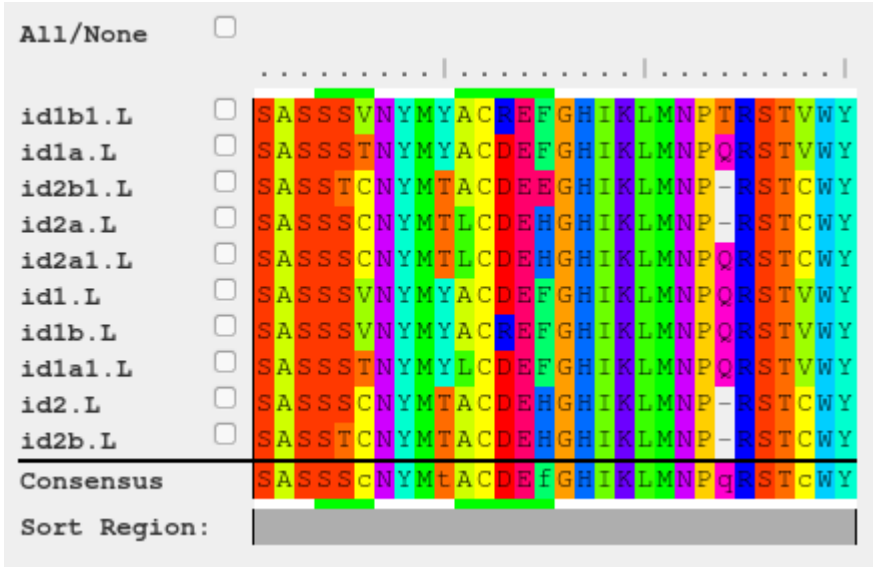


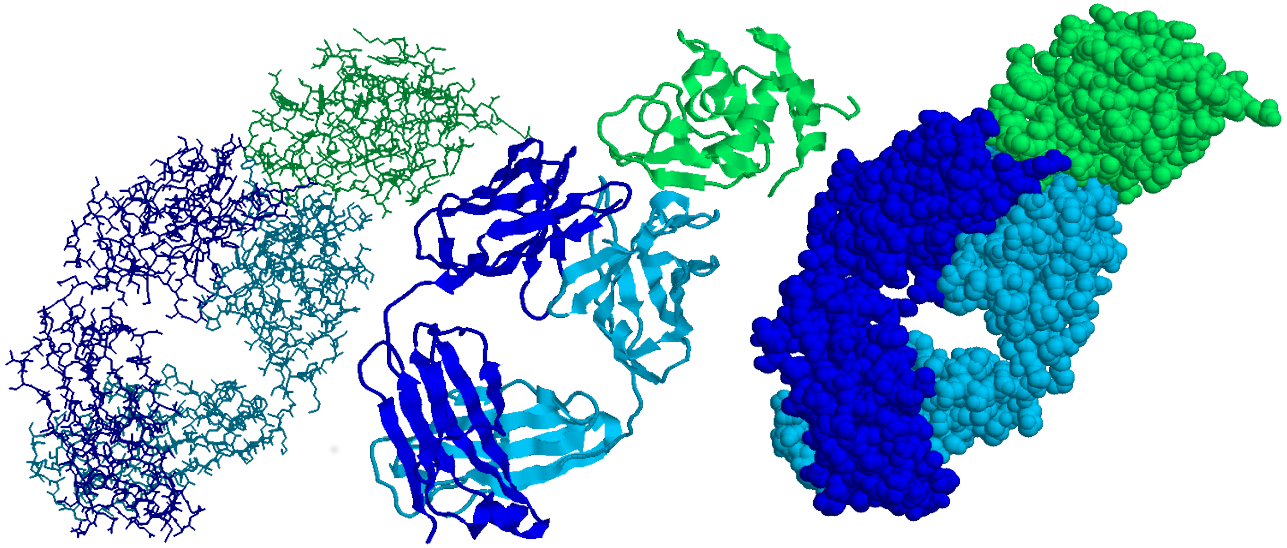

```
CREATE TABLE data_source_type (
    data_source_type_id serial PRIMARY KEY,
    data_source_type_name varchar(100) NOT NULL UNIQUE check ( data_source_type_name <> '' ),
    display_name varchar(100) NOT NULL UNIQUE check ( display_name <> ''),
    display_order integer NOT NULL
);

CREATE TABLE chain_type (
    chain_type_id serial PRIMARY KEY,
    chain_type_name varchar(100) NOT NULL UNIQUE check ( chain_type_name <> '' ),
    higher_chain_type_id integer,
    display_name varchar(100) NOT NULL UNIQUE check ( display_name <> ''),
    receptor_type_particle varchar(100) NOT NULL UNIQUE check ( receptor_type_particle <> ''),
    display_order integer NOT NULL,

    FOREIGN KEY(higher_chain_type_id) REFERENCES chain_type(chain_type_id)
);

CREATE TABLE human_subgroup (
    human_subgroup_id serial PRIMARY KEY,
    human_subgroup_name varchar(100) NOT NULL UNIQUE check ( human_subgroup_name <> '' ),
    chain_type_id integer NOT NULL,
    display_name varchar(100) NOT NULL UNIQUE check ( display_name <> ''),
    display_order integer NOT NULL,

    FOREIGN KEY(chain_type_id) REFERENCES chain_type(chain_type_id)
);

CREATE TABLE s
    segment_ty
    segment_ty
    display_na
    display_or
);

CREATE TABLE r
    region_typ
    region_typ
    chain_type
    display_na
    display_or

    FOREIGN KE
);
```



Computing concepts







Computing concepts


```
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ATOM    127  N   LYS L  18     -13.131  -9.865  18.403  1.00 27.62           N
ATOM    128  CA  LYS L  18     -12.493  -9.684  19.695  1.00 25.99           C
ATOM    129  C   LYS L  18     -11.113 -10.322  19.622  1.00 25.02           C
ATOM    130  O   LYS L  18     -10.951 -11.410  19.072  1.00 25.02           O
ATOM    131  CB  LYS L  18     -13.314 -10.351  20.794  1.00 28.03           C
ATOM    132  CG  LYS L  18     -12.714 -10.191  22.176  1.00 28.69           C
ATOM    133  CD  LYS L  18     -13.561 -10.879  23.234  1.00 31.64           C
ATOM    134  CE  LYS L  18     -12.901 -10.773  24.598  1.00 33.25           C
ATOM    135  NZ  LYS L  18     -13.706 -11.408  25.679  1.00 36.75           N
ATOM    136  N   VAL L  19     -10.118  -9.643  20.178  1.00 23.61           N
ATOM    137  CA  VAL L  19      -8.756 -10.152  20.155  1.00 22.78           C
ATOM    138  C   VAL L  19      -8.168 -10.222  21.553  1.00 21.59           C
ATOM    139  O   VAL L  19      -8.325  -9.300  22.347  1.00 21.97           O
ATOM    140  CB  VAL L  19      -7.845  -9.259  19.292  1.00 22.79           C
ATOM    141  CG1 VAL L  19      -6.398  -9.696  19.441  1.00 22.72           C
ATOM    142  CG2 VAL L  19      -8.278  -9.336  17.832  1.00 24.05           C
ATOM    143  N   THR L  20      -7.486 -11.321  21.846  1.00 22.21           N
ATOM    144  CA  THR L  20      -6.865 -11.500  23.145  1.00 22.76           C
```
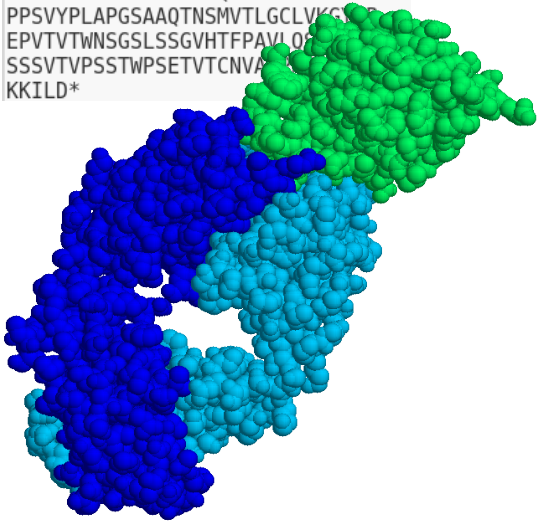

pdb2pir

```
>P1;PDBPIR
Sequence extracted from PDB file
MDIVLTQSPAIMSASPGEKVTMTCSASSSV
NYMYWYQQKSGTSPKRWIYDTSKLASGVPV
RFSGSGSGTSYSLTISSMETEDAATYYCQQ
WGRNPTFGGGTKLEIKRADAAPTVSIFPPS
SEQLTSGGASVVCFLNNFYPKDINVKWKID
GSERQNGVLNSWTDQDSKDSTYSMSSTLTL
TKDEYERHNSYTCEATHKTSTSPIVKSFNR
N*
EVQLQQSGAELMKPGASVKISCKASGYTFS
DYWIEWVKQRPGHGLEWIGEILPGSGSTNY
HERFKGKATFTADTSSSTAYMQLNSLTSED
SGVYYCLHGNYDFDGWGQGTTLTVSSAKTT
PPSVYPLAPGSAAQTNSMVTLGCLVK
EPVTVTWNSGSLSSGVHTFPAVLQ
SSSVTVPSSTWPSETVTCNVA
KKILD*
```

RASMOL



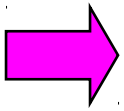
Operating systems

Operating Systems

- The **software interface** between users' software and the computer's hardware
- Provides low-level **networking**
- Provides a set of **tools** for:
  - file handling
  - user handling and security (e.g. passwords)
- May provide a **graphical user interface (GUI)**
- May include other non-essential **bundled tools**

Operating Systems

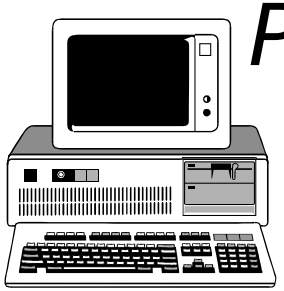
- VMS (Dec)
- VME (ICL)
- CP/M (PCs)
- PRIMOS (Prime)
- MS-DOS (PCs)
- OS/2 (PCs)
- AmigaDOS (CBM)
- Unix (Various)
- MacOS (Apple)



- Windows (PCs)
- Unix/Linux (Various)
- MacOS (Apple)

Operating Systems

Mac



PC

Mini/Mainframe

Zoology
DNA
Phylogeny

Crystallography
Protein
sequence &
structure

Computer
Scientists

MacOS

Windows

Linux

Databases

Databases and databanks

- **Databank**
  - A collection of data (normally in simple text files) without an associated query tool
  - Query tools may be written as separate applications

- **Database**
  - A structured collection of data with some tool enabling it to be ‘queried’

Relational databases

- Microsoft Access
- SQL Server
- Oracle
- Sybase
- MySQL
- PostgreSQL

Relational databases

- Data are separated into ***tables*** or ***relations***
- Good **database design** requires
  - careful thought and planning
  - normalization
- Maintains **data integrity**

SQL - Structured Query Language

- '**Standard**' database query language
  - Unfortunately most databases extend or deviate from the standard

- Provides 4 types of command:
  - **Schema** creation
  - Data **insertion**
  - Data **extraction**
  - Database **management**

Algorithms

Algorithms

"A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer."

A complete and precise set of steps that will solve a problem and achieve an identical result whenever given the same set of data to a defined level of accuracy.

- **Ordered steps**
- **Repeatable**
- **Known/defined accuracy**

Algorithms

Suppose we wish to count the amino acids in a PDB file...

Count the C-alpha (CA) atoms

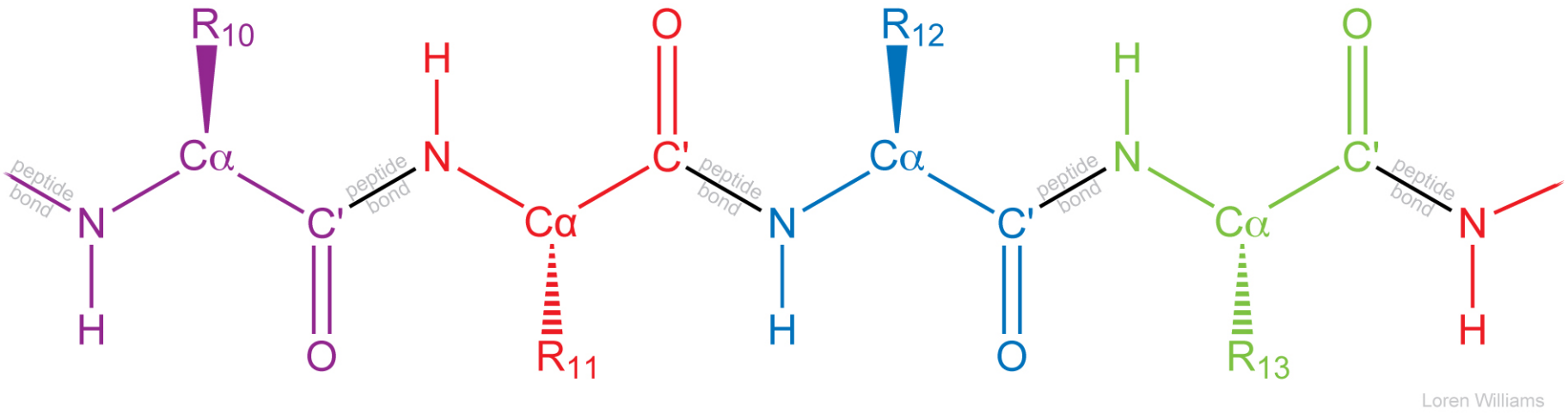
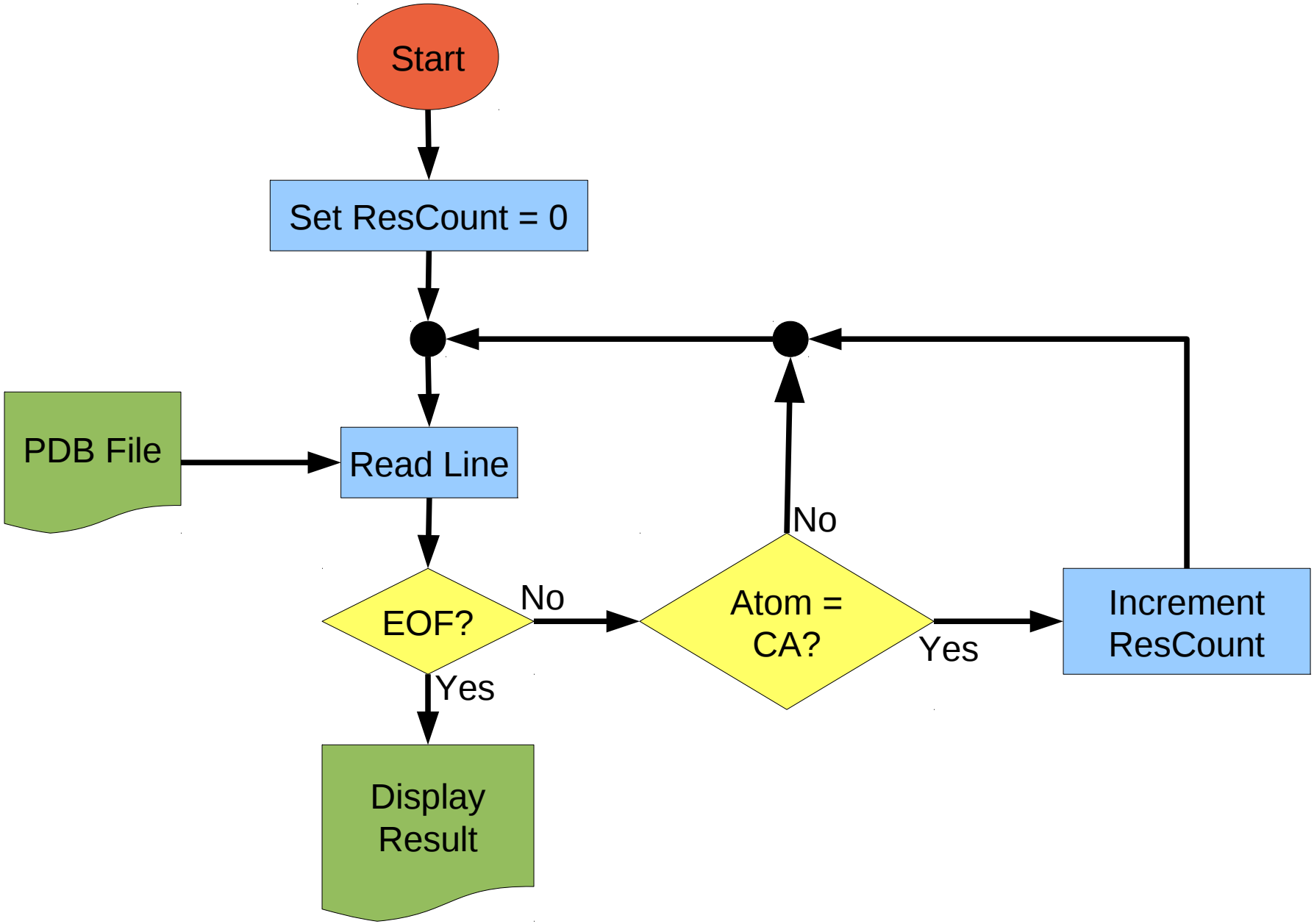


Image from:
ww2.chemistry.gatech.edu/~lw26/structure/protein/peptide_bond/

Algorithms

Count the CA atoms

```
ATOM    412  N   LYS L  53      -3.744   0.441  32.828  1.00 19.24           N
ATOM    413  CA  LYS L  53      -3.918   1.859  32.529  1.00 21.00           C
ATOM    414  C   LYS L  53      -3.602   2.152  31.066  1.00 19.26           C
ATOM    415  O   LYS L  53      -2.544   1.771  30.559  1.00 19.24           O
ATOM    416  CB  LYS L  53      -3.005   2.700  33.430  1.00 22.69           C
ATOM    417  CG  LYS L  53      -3.163   2.411  34.918  1.00 27.89           C
ATOM    418  CD  LYS L  53      -4.592   2.607  35.383  1.00 31.37           C
ATOM    419  CE  LYS L  53      -4.727   2.311  36.869  1.00 34.46           C
ATOM    420  NZ  LYS L  53      -6.149   2.369  37.331  1.00 34.97           N
ATOM    421  N   LEU L  54      -4.514   2.835  30.382  1.00 19.88           N
ATOM    422  CA  LEU L  54      -4.303   3.155  28.975  1.00 18.71           C
ATOM    423  C   LEU L  54      -3.428   4.390  28.776  1.00 21.13           C
ATOM    424  O   LEU L  54      -3.642   5.427  29.410  1.00 20.98           O
ATOM    425  CB  LEU L  54      -5.646   3.368  28.271  1.00 20.67           C
ATOM    426  CG  LEU L  54      -6.632   2.192  28.234  1.00 22.27           C
ATOM    427  CD1 LEU L  54      -7.786   2.553  27.308  1.00 24.52           C
ATOM    428  CD2 LEU L  54      -5.938   0.930  27.745  1.00 24.94           C
ATOM    429  N   ALA L  55      -2.439   4.276  27.895  1.00 20.95           N
ATOM    430  CA  ALA L  55      -1.550   5.397  27.602  1.00 20.98           C
ATOM    431  C   ALA L  55      -2.332   6.453  26.820  1.00 22.37           C
ATOM    432  O   ALA L  55      -3.423   6.179  26.311  1.00 20.12           O
ATOM    433  CB  ALA L  55      -0.355   4.916  26.792  1.00 20.40           C
ATOM    434  N   SER L  56      -1.779   7.657  26.718  1.00 25.32           N
ATOM    435  CA  SER L  56      -2.468   8.731  26.009  1.00 27.06           C
ATOM    436  C   SER L  56      -2.741   8.390  24.547  1.00 25.53           C
ATOM    437  O   SER L  56      -1.869   7.888  23.833  1.00 26.22           O
ATOM    438  CB  SER L  56      -1.671  10.038  26.099  1.00 29.91           C
ATOM    439  OG  SER L  56      -0.396   9.914  25.494  1.00 35.66           O
ATOM    440  N   GLY L  57      -3.972   8.652  24.117  1.00 25.76           N
ATOM    441  CA  GLY L  57      -4.359   8.380  22.748  1.00 24.53           C
ATOM    442  C   GLY L  57      -4.862   6.970  22.498  1.00 24.68           C
ATOM    443  O   GLY L  57      -5.416   6.694  21.437  1.00 25.32           O
ATOM    444  N   VAL L  58      -4.684   6.075  23.464  1.00 22.98           N
ATOM    445  CA  VAL L  58      -5.130   4.693  23.286  1.00 22.67           C
ATOM    446  C   VAL L  58      -6.646   4.581  23.452  1.00 23.27           C
ATOM    447  O   VAL L  58      -7.192   4.959  24.490  1.00 22.54           O
ATOM    448  CB  VAL L  58      -4.426   3.758  24.290  1.00 21.70           C
ATOM    449  CG1 VAL L  58      -4.874   2.315  24.068  1.00 19.47           C
ATOM    450  CG2 VAL L  58      -2.918   3.878  24.129  1.00 20.49           C
```


Start
Set ResCount = 0
PDB File
Read Line
EOF?
No
Yes
Atom = CA?
No
Yes
Increment ResCount
Display Result

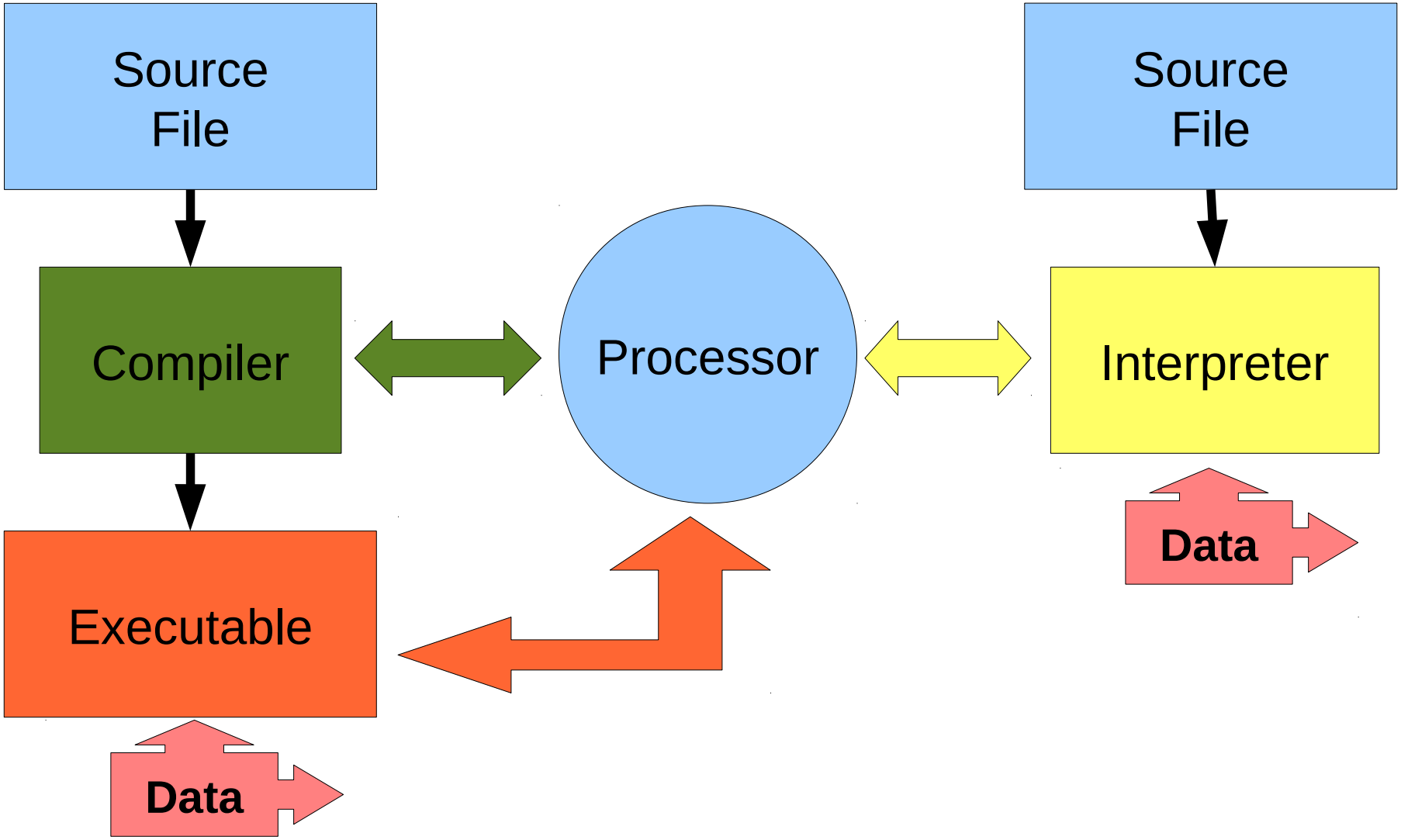
Programming

Programming languages

- Rarely write directly in instructions understood by a computer
- Use a **high-level language**
- Many such languages:

- **C**
- **Perl**
- **C++**
- **Java**
- Smalltalk
- **Python**
- Forth
- BASIC
- **FORTRAN**
- Modula-II
- Simula
- Prolog
- BCPL
- **JavaScript**
- Pascal
- AWK
- LISP
- Cobol

Language Categories



General Purpose Languages - Python

General Purpose / JIT/Part-Compiled / OO

- Design emphasizes code readability; concise syntax.
- Comprehensive standard library, plus maths and scientific and BioPython libraries.

Variables

Scalar variables

```
a = 5
a = a + 1
print (a)
b = 'Hello world'
```

Variables

Lists / Arrays (vectors)

```
position = [5.4, 2.7, 9.5]
print (position[1])
position[2] = 3.6
```

Variables

Dictionaries / Hashes

```
position      = {}
position['x'] = 5.4
position['y'] = 2.7
position['z'] = 9.5
```

Control statements

if:

```
x = -6
if x > 0:
    print “Positive”
elif x == 0:
    print “zero”
else:
    print “negative”
```

Comparisons:

```
<    <=    ==    >=    >    !=
```

Control statements

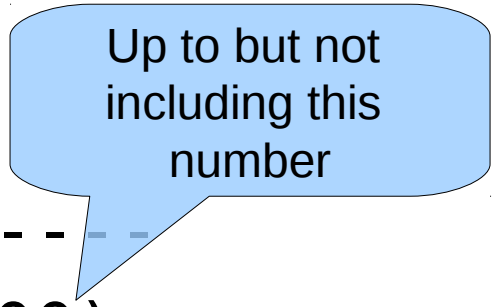
while:

```
x = 5
while x > 0:
    print x
    x = x - 1
```

Control statements

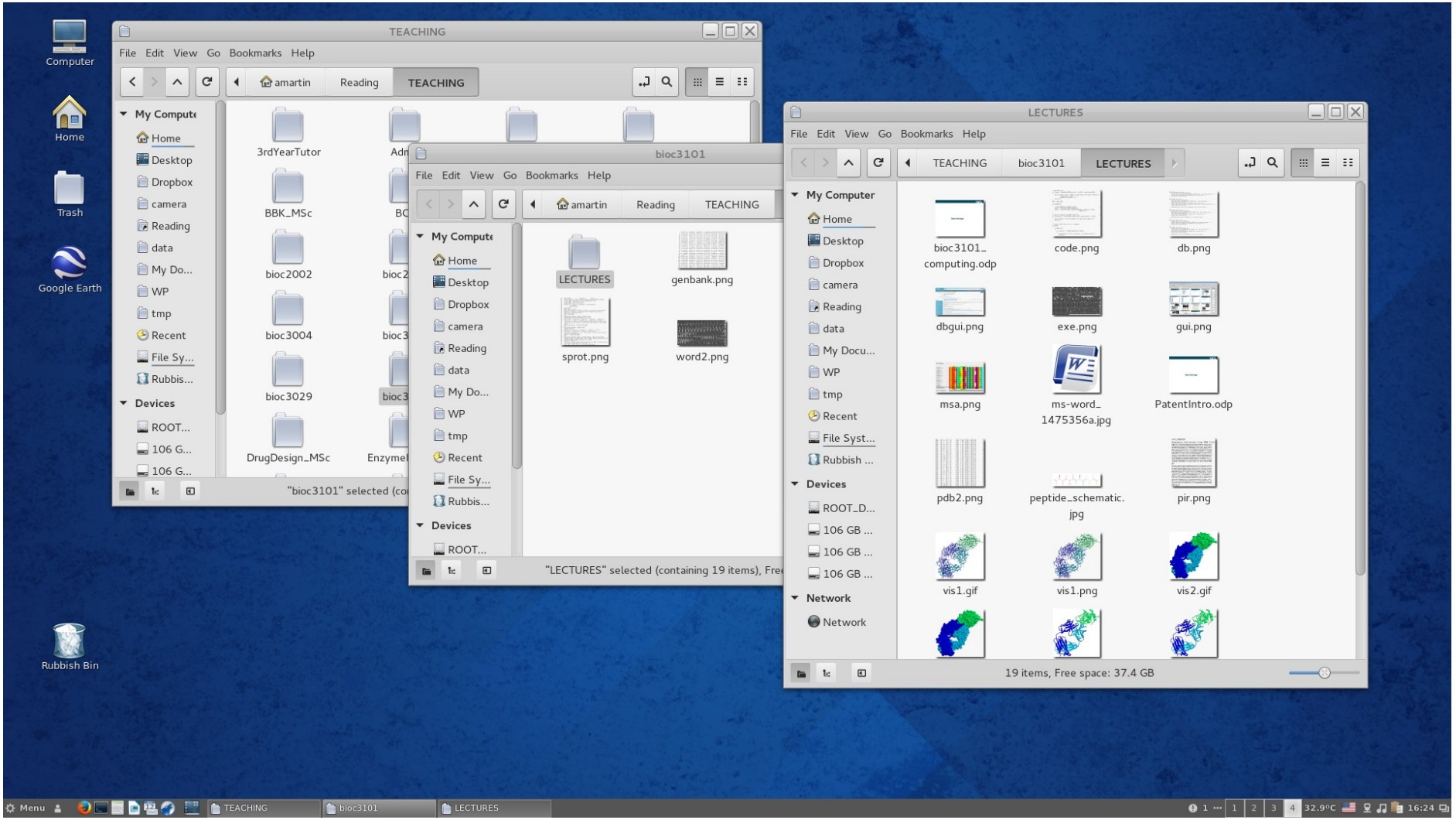
for:

```
x = [100, 200, 300]
for i in x:
    print i
------------------------
for i in range(0, 100):
    print i
------------------------
x = [100, 200, 300]
for i in range(3):
    print x[i]
```



Folders, trees and directories

OS GUIs


Computer
Home
Trash
Google Earth
Rubbish Bin
TEACHING
File Edit View Go Bookmarks Help
amartin
Reading
TEACHING
My Compute
Home
Desktop
Dropbox
camera
Reading
data
My Do...
WP
tmp
Recent
File Sy...
Rubbis...
Devices
ROOT...
106 G...
3rdYearTutor
BBK_MSc
bioc2002
bioc3004
bioc3029
DrugDesign_MSc
bioc3101
LECTURES
genbank.png
sprot.png
word2.png
"LECTURES" selected (containing 19 items), Free
LECTURES
File Edit View Go Bookmarks Help
TEACHING
bioc3101
LECTURES
My Computer
Home
Desktop
Dropbox
camera
Reading
data
My Docu...
WP
tmp
Recent
File Syst...
Rubbish ...
Devices
ROOT_D...
106 GB ...
106 GB ...
106 GB ...
Network
Network
bioc3101_computing.odp
code.png
db.png
dbgui.png
exe.png
gui.png
msa.png
ms-word_1475356a.jpg
PatentIntro.odp
pdb2.png
peptide_schematic.jpg
pir.png
vis1.gif
vis1.png
vis2.gif
19 items, Free space: 37.4 GB
Menu
TEACHING
bioc3101
LECTURES
16:24

Trees and directories

amartin
- Reading
  - ...
- TEACHING
  - ...
  - bioc1007
  - bioc2001
  - bioc2004
  - bioc3010
  - bioc3101
    - ...
    - LECTURES
      - genbank.png
      - pdb.png
      - sprot.png
      - word2.png
      - ...
    - bioc3101.odp
    - Code.png
    - db.png
    - dbgui.png
    - exe.png
    - ...

Trees and directories

Windows

Each disk (or network share) is the root of the tree:

C:\system
D:\data

Linux/Mac

Everything lives under the same root:

/
/home
/home/amartin
/data
/data/pdb

Using the BASH shell command line

Linux / Mac :- the standard command line
Windows :- git-bash

Navigating the tree

Where am I?

pwd

```
/c/Documents and Settings/amartin
```

What's in here?

ls

```
Application Data/        Cookies/
Desktop/                 Favorites/
…
```

-l	Long format
-t	Sort by time
-r	Reverse the sort
-h	Human format for file sizes

ls -ltrh

Navigating the tree

Moving down the tree

```
cd Desktop
pwd
```

/c/Documents and Settings/amartin/Desktop

Moving up the tree

```
cd ..
```

Moving across the tree

```
cd ../Start\ Menu
pwd
```

/c/Documents and Settings/amartin/Start Menu

Going home

```
cd      --or--      cd ~      --or--      cd $HOME
pwd
```

/c/Documents and Settings/amartin/

Handling files

View a whole file

```
cat   /etc/bash.bashrc
```

View a page at a time

```
less   /etc/bash.bashrc
```

Press
- spacebar for next page
- 'b' for previous page
- '>' for last page
- '<' for first page
- '/string' to search for 'string'
- 'q' to quit

Copying a file

```
cp   /etc/bash.bashrc   ~/mybashrc.txt
```

Default input and output

Default input (stdin) is the keyboard

```
cat                    (no command prompt displayed)
Hello
World
CTRL-d                 (i.e. press and hold CTRL while pressing d)
```

Default output (stdout) is the screen

```
cat    ~/mybashrc.txt
```

Redirection and pipes

Send the output of a command to a file

```
cat > test.txt
Hello World
CTRL-d
```

(no command prompt displayed)

```
cat test.txt
```

```
Hello World
```

Receive input from a file

```
cat < test.txt
```

```
Hello World
```

Sending the output of one program to the input of another

```
cat /etc/bash.bashrc | less
```

Other

Searching: Find lines in a file that contain a string

```
grep  return  /etc/bash.bashrc
```
(finds all lines containing 'return')

Creating directories

```
mkdir  newdir
```

Removing an empty directory

```
rmdir  newdir
```

Removing a file

```
rm  myfile
```

Removing a directory and all its content

```
rm  -rf  newdir
```

Other

Sorting

sort /etc/bash.bashrc (alphabetical sort of lines in the file)

Making scripts executable

chmod +x scriptfile

Programming in BASH

Renaming a set of files with extension .text to .txt

```
for file in *.text
do
  mv  $file  `basename  $file  .text`.txt
done
```