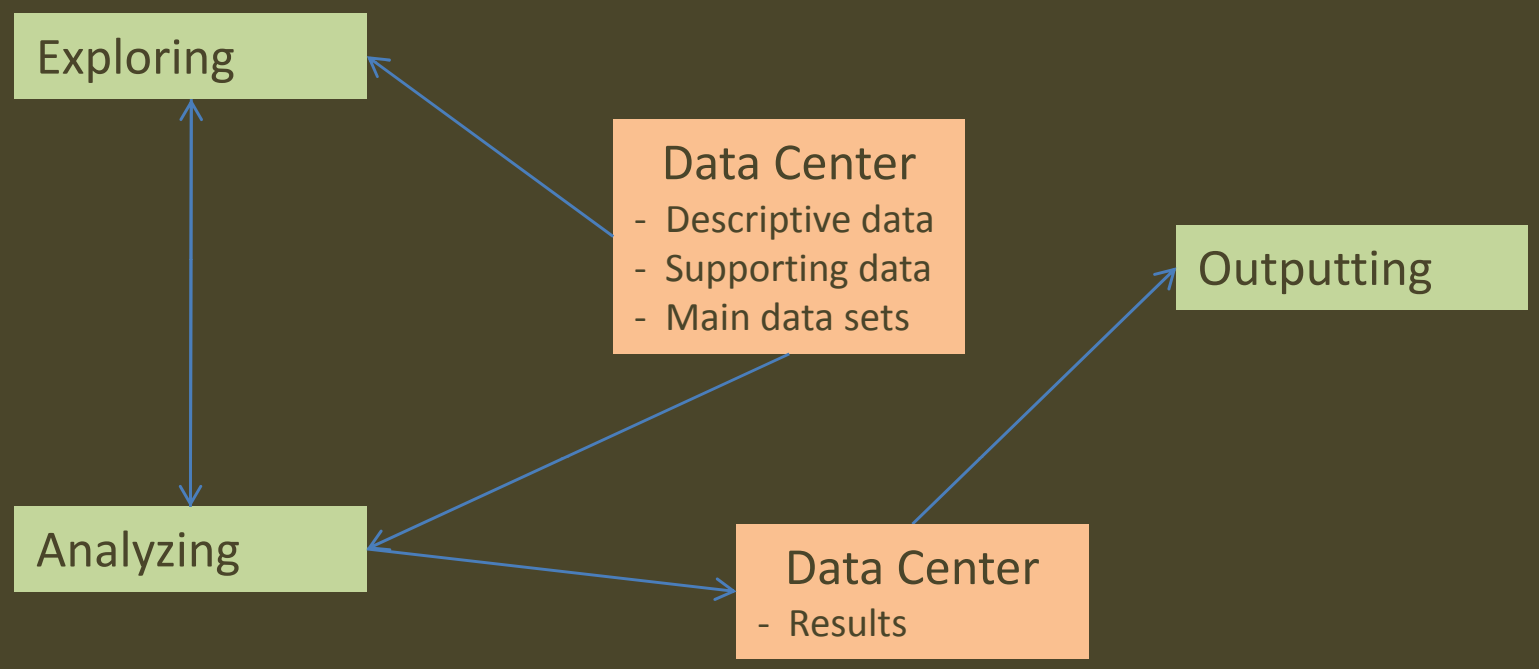
Survival Skills for Analytical Processing of Data of statistical genetics research *in* UNIX-like Systems

robert yu :: March 2011

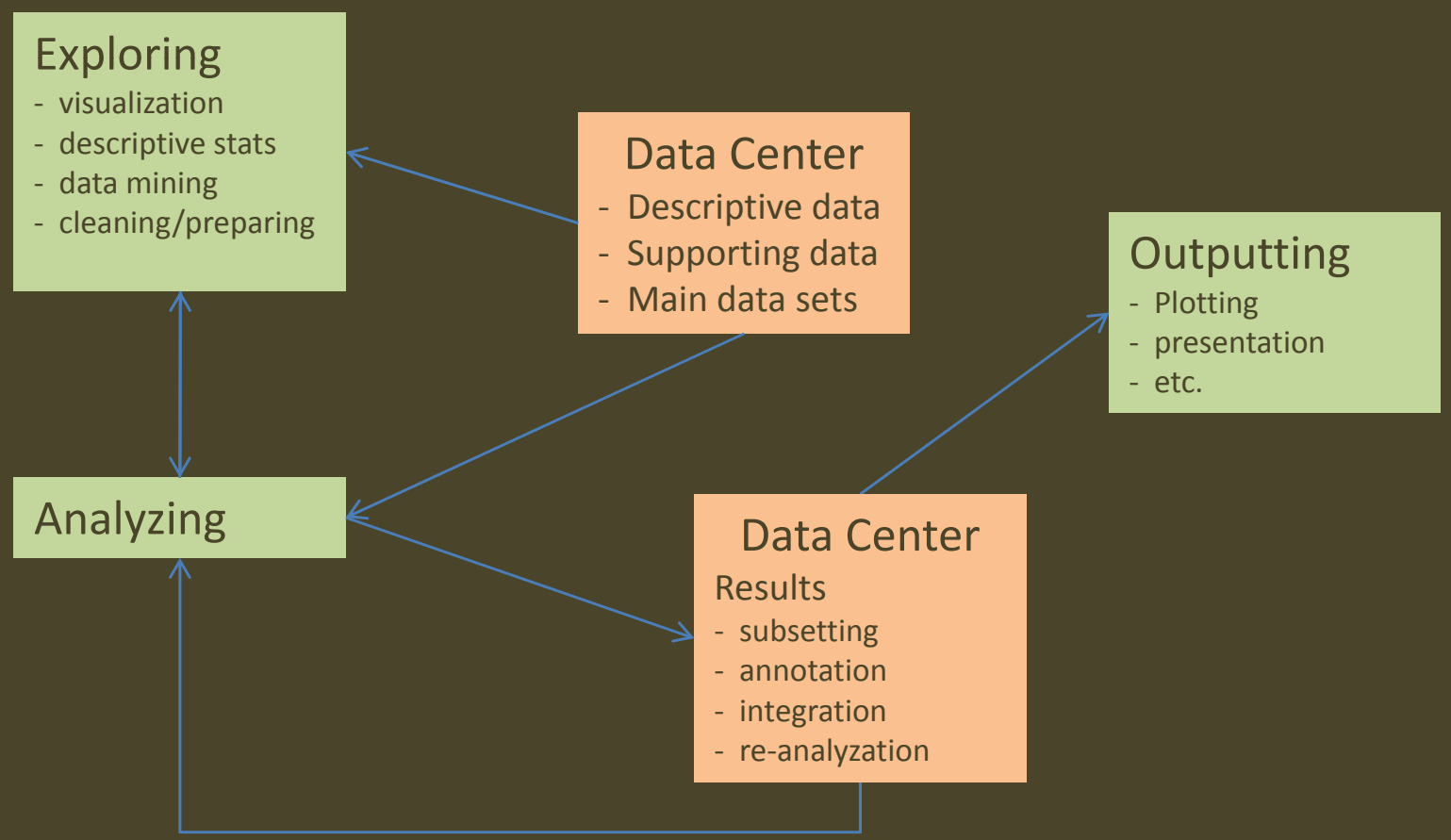
UNIX-like?

- Traditional/classical UNIX,
  e.g. System V (Solaris), BSD (SunOS), etc.
- Various variants of Linux
- Windows-based cygwin
- Other types, e.g. MacIntosh?

Analytical Processing of Data

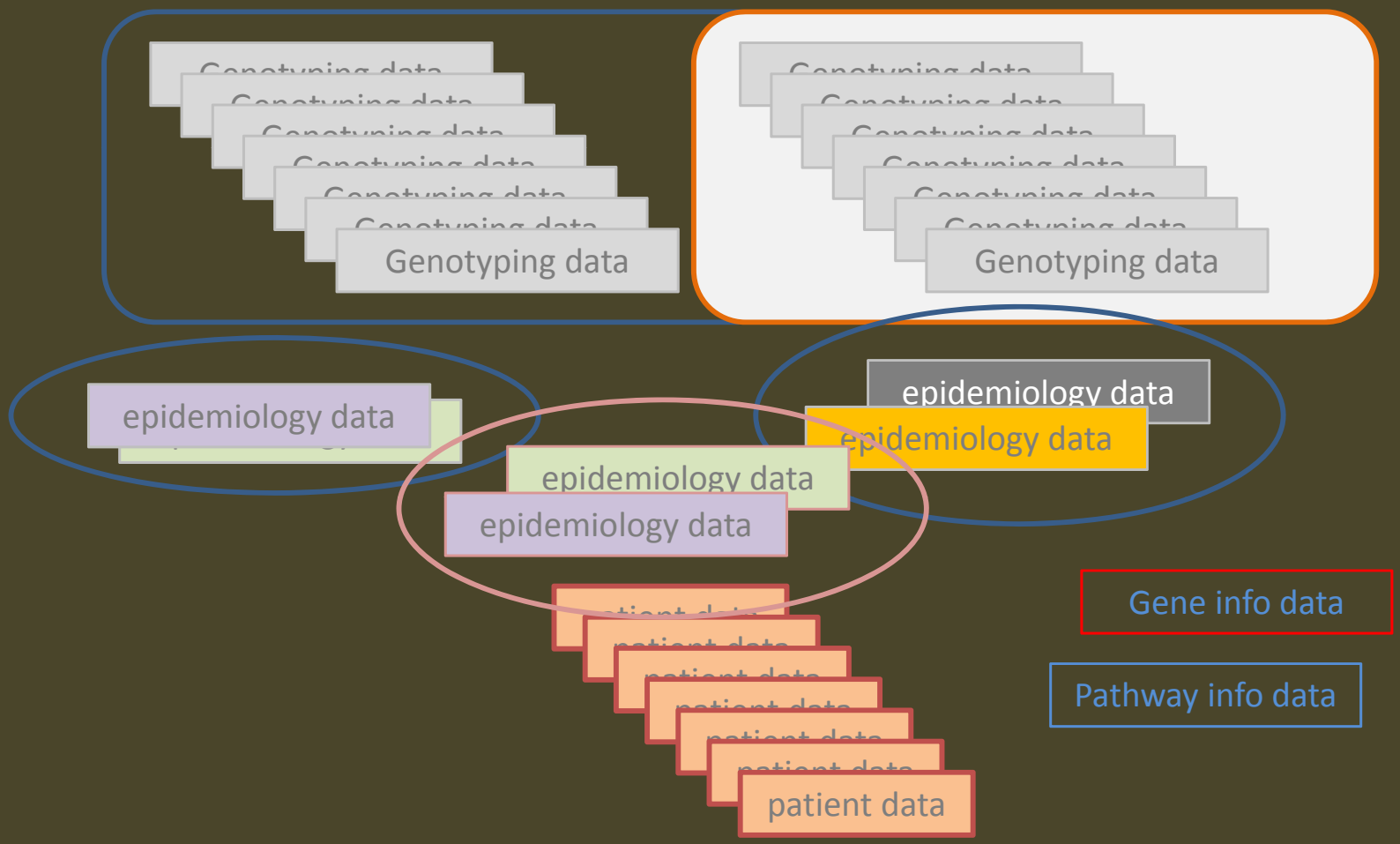


Analytical Processing of Data

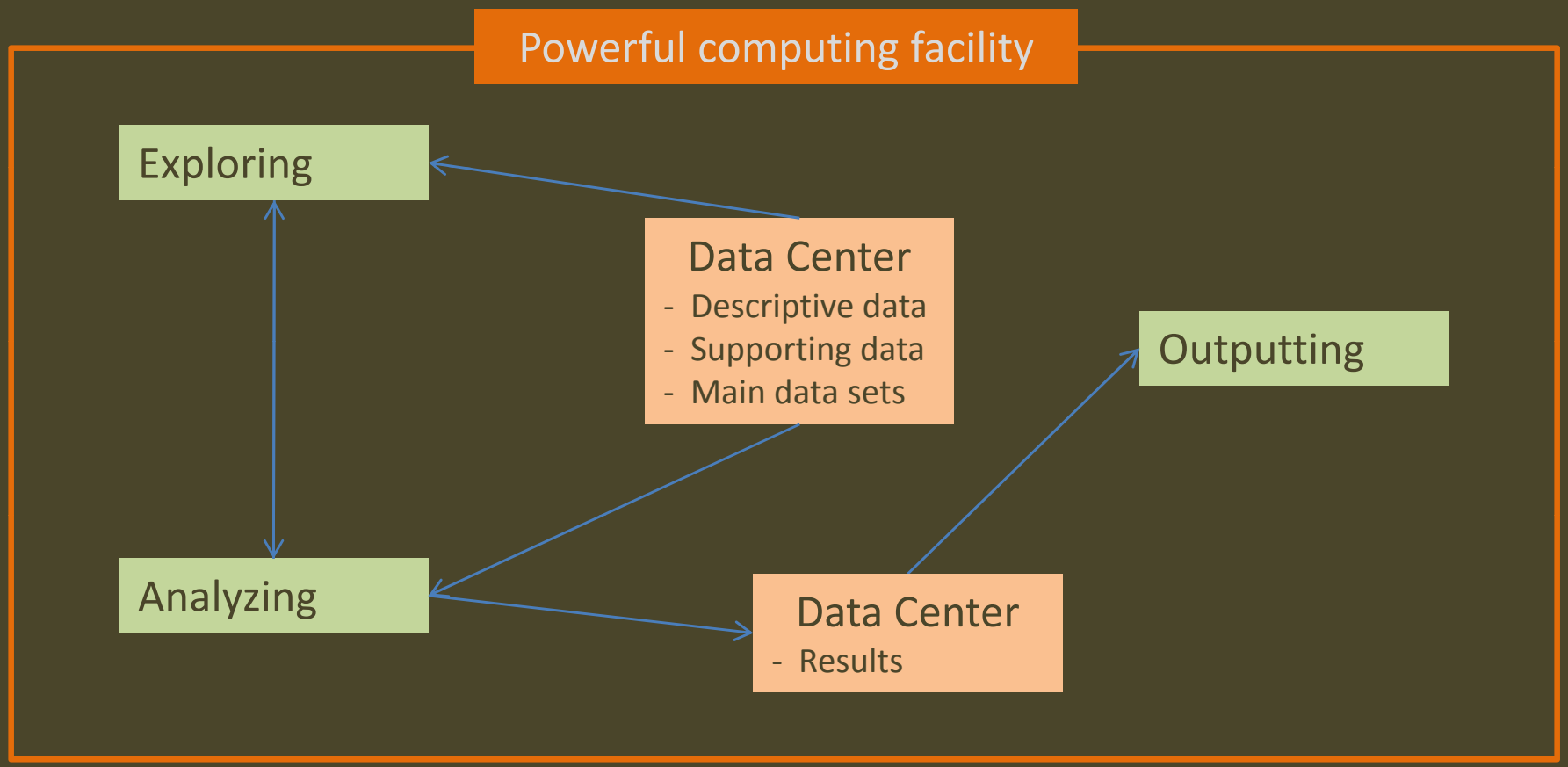


Analytical Processing of Data

data of various sources and types

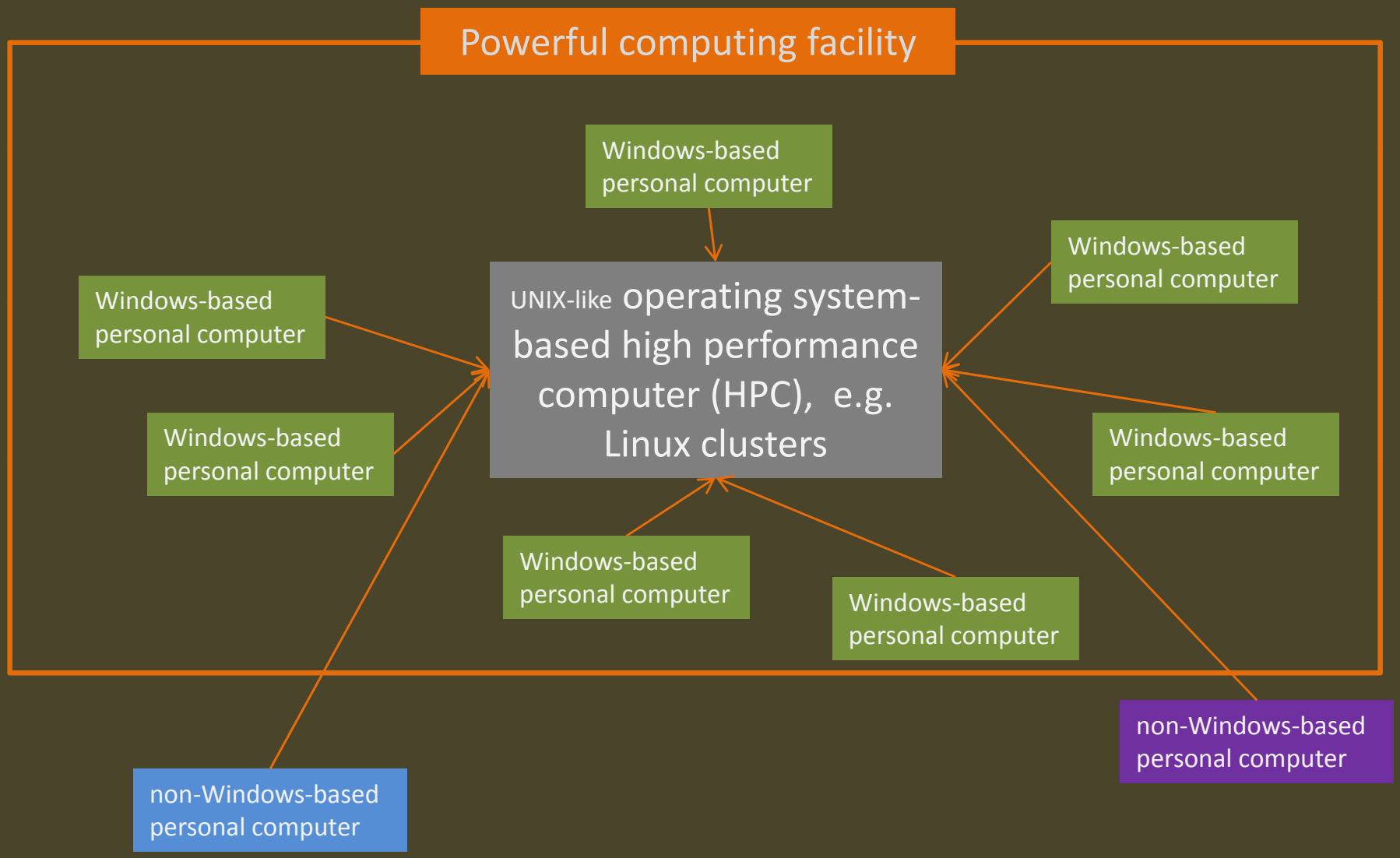


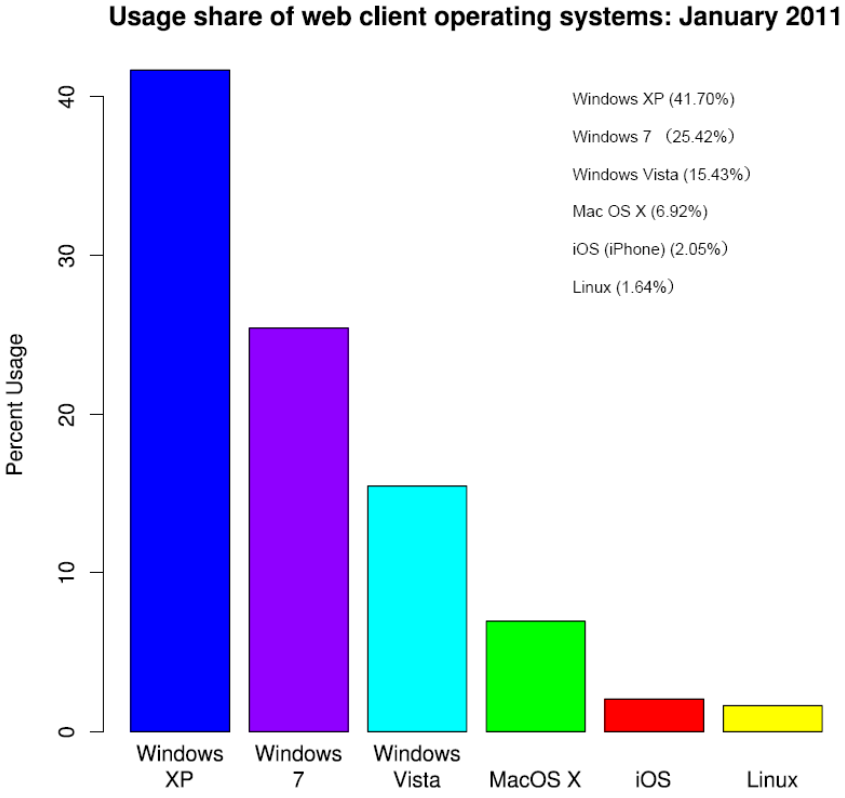
Analytical Processing of Data



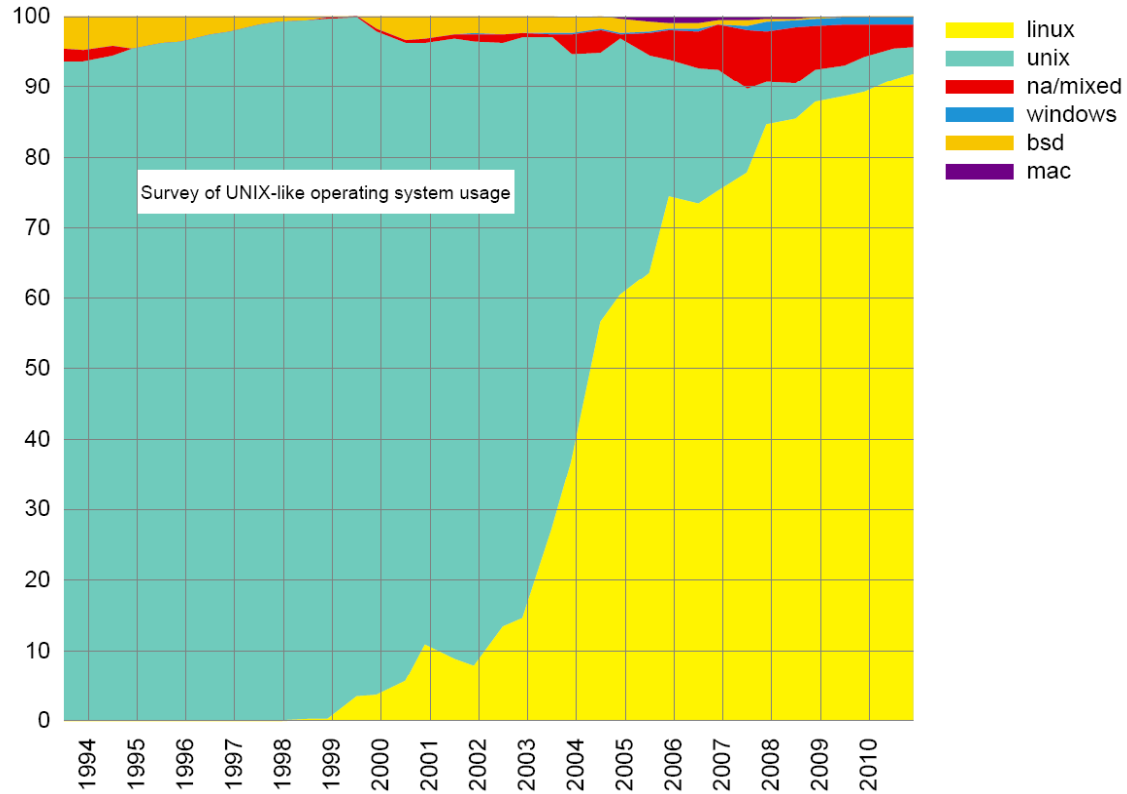
Analytical Processing of Data

a heterogeneous computing facility



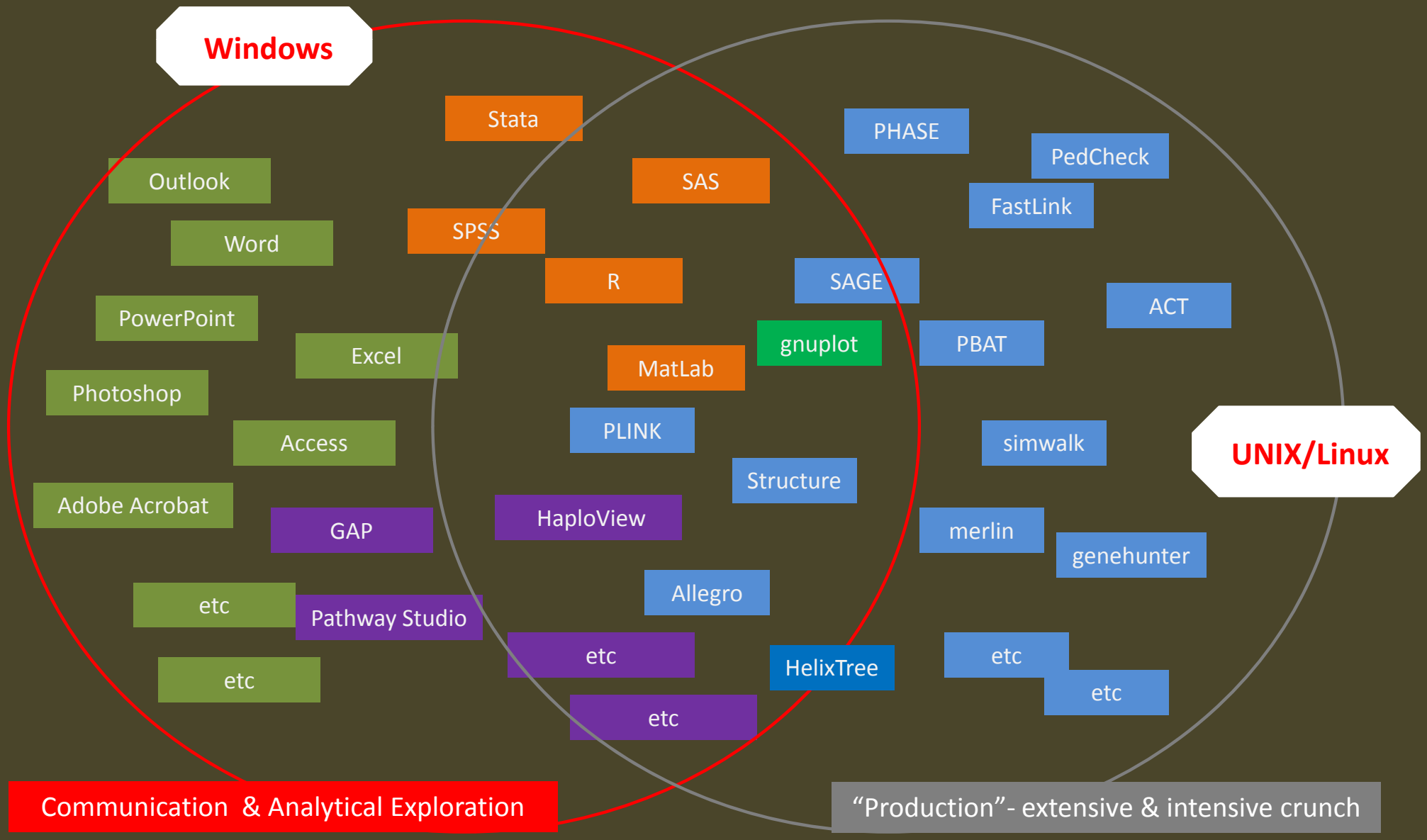


Graph of supercomputer OS market share from around 1994 to 2010 according to TOP500.



Analytical Processing of Data

Software oriented computing facility



Analytical Processing of Data

Software oriented computing facility

Windows

More than 75% of the time, we are not doing real analyses but cleaning and preparing data. Efficient and effective tools are essential.

Besides analytical software, programming tools are critical.

UNIX/Linux

Analytical Processing of Data

Software oriented computing facility

Windows

A good analyst or research scientist invests his/her skills using integrated computing system where all tools are handy.

Windows are accumulating more tools. EXPLORING!

UNIX is still the major scientific computing platform!

UNIX/Linux

Various Computing Platforms

Personal Computer (Windows, etc) vs Server-based Computer (UNIX/Linux HPC)

Windows-based personal computer is a *more complicated system.*

- *more heterogeneous of processes (programs)*
- *more burdensome (complicated installation, memory management*
- *less tolerable to continuously stable running*
- *single user, frequently "interrupted"*

UNIX-like computing system is more powerful and efficient.

- *extremely stable, "constantly" running*
- *homogeneous*
- *computing / programming extremely friendly*
- *less visual, less "social" (less Internet-attacked)*
- *multi-user, multi-terminals*

a case example of using UNIX

collecting files in Windows – Step 0

Receiving or generating data.

- *data in Excel sheets, text files, zip packages, etc.*
- *small files: sample info, epidemiology data*
- *large files: genotype data*
- *other supporting files, e.g. matching information, etc.*

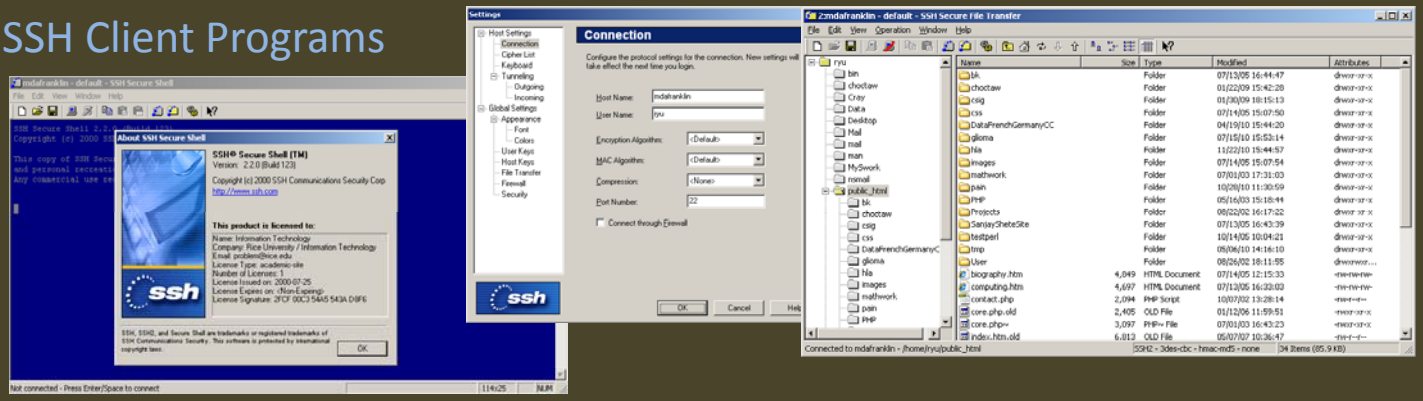
Preparation for analyses.

- *preliminary exploration and visualization of data*
- *descriptive statistics collection*
- *formation of basic analyses*
- *transferring data to UNIX / LINUX*

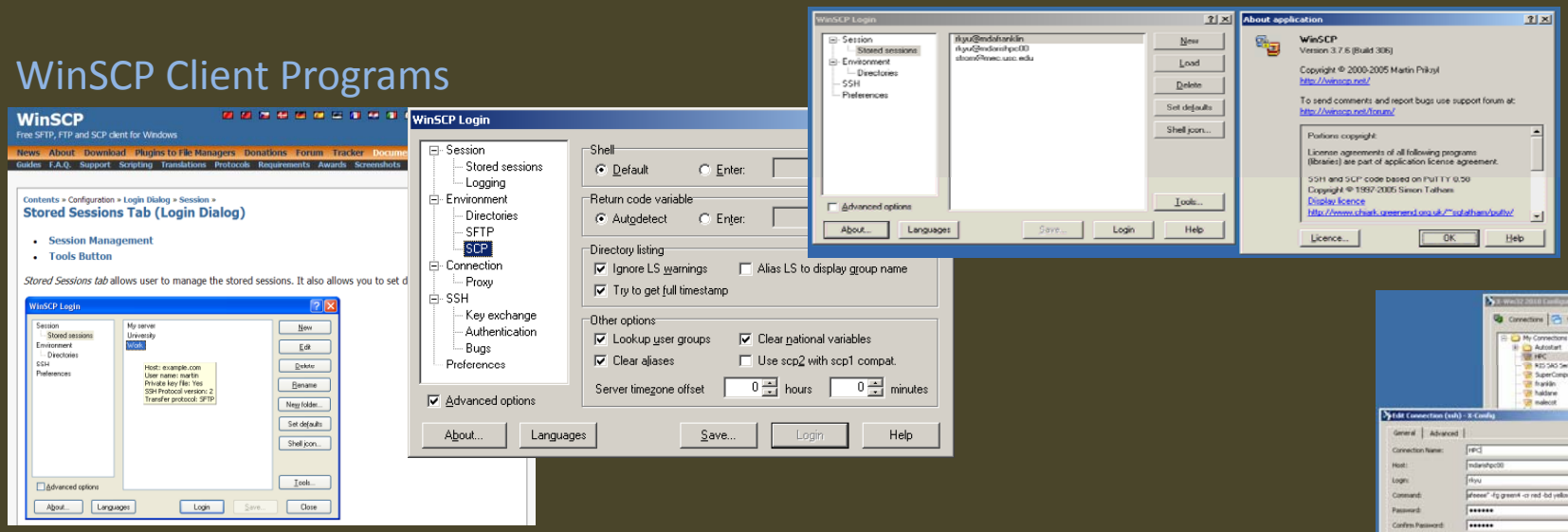
a case example of using UNIX

getting into UNIX, transferring data from Windows to UNIX – Step 1a

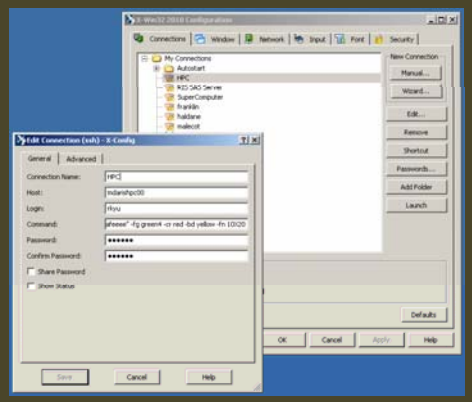
SSH Client Programs



WinSCP Client Programs



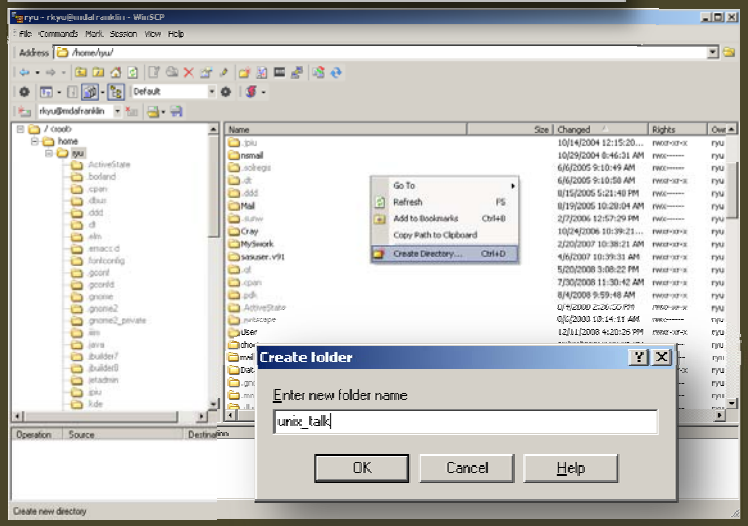
X-Win Terminal Program

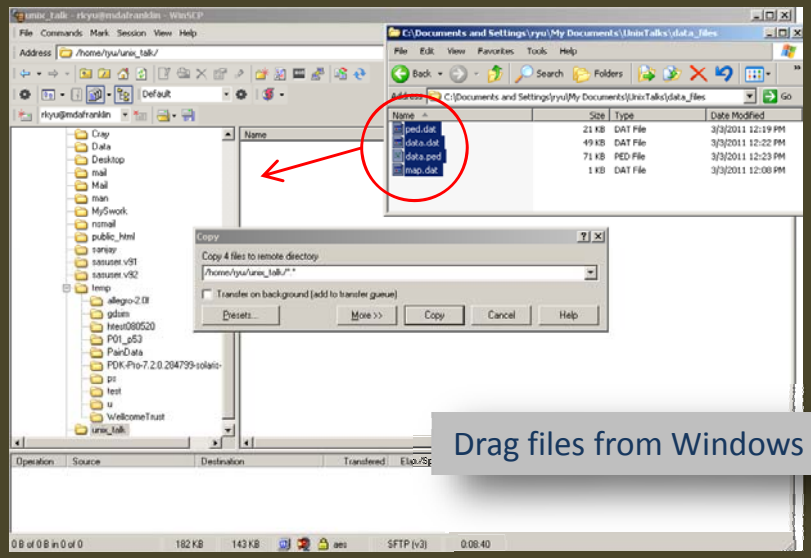


a case example of using UNIX

getting into UNIX, transferring data from Windows to UNIX – Step 1b

Launch WinSCP from Windows Desktop

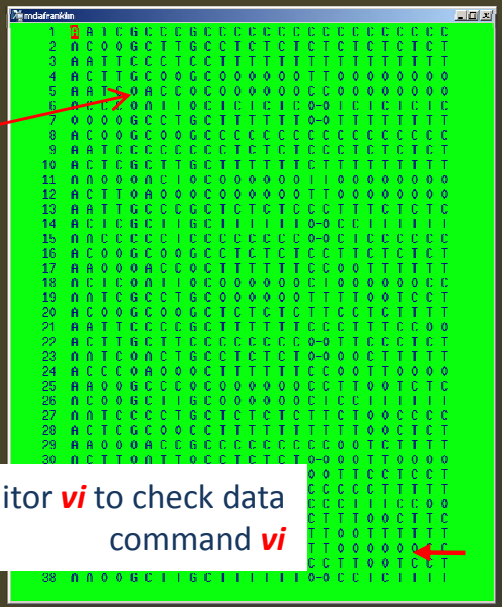




Drag files from Windows to UNIX

```
mdafranklin
-bash-3.00$ pwd
/home/ryu/unix_talk
 bash 3.00$ ls -l
total 152
-rw-r--r-- 1 ryu adusers 49765 Mar  3 12:22 data.dat
-rw-r--r-- 1 ryu adusers 71990 Mar  3 12:23 data.ped
-rw-r--r-- 1 ryu adusers   256 Mar  3 12:08 map.dat
-rw-r--r-- 1 ryu adusers 21287 Mar  3 12:19 ped.dat
-bash-3.00$
```

```
mdafranklin
-bash-3.00$ more map.dat
rs122032 12 2002183
rs122033 22 112023
rs122034 12 19220022
rs122040 4 1202392
rs122041 2 102001292
rs122042 1 11192019
rs122038 5 103239203
rs122039 4 23902432
rs122035 12 823902
rs122036 6 5023455
rs122037 6 730292
rs122043 9 2390293
rs122044 16 3499341
-bash-3.00$
```

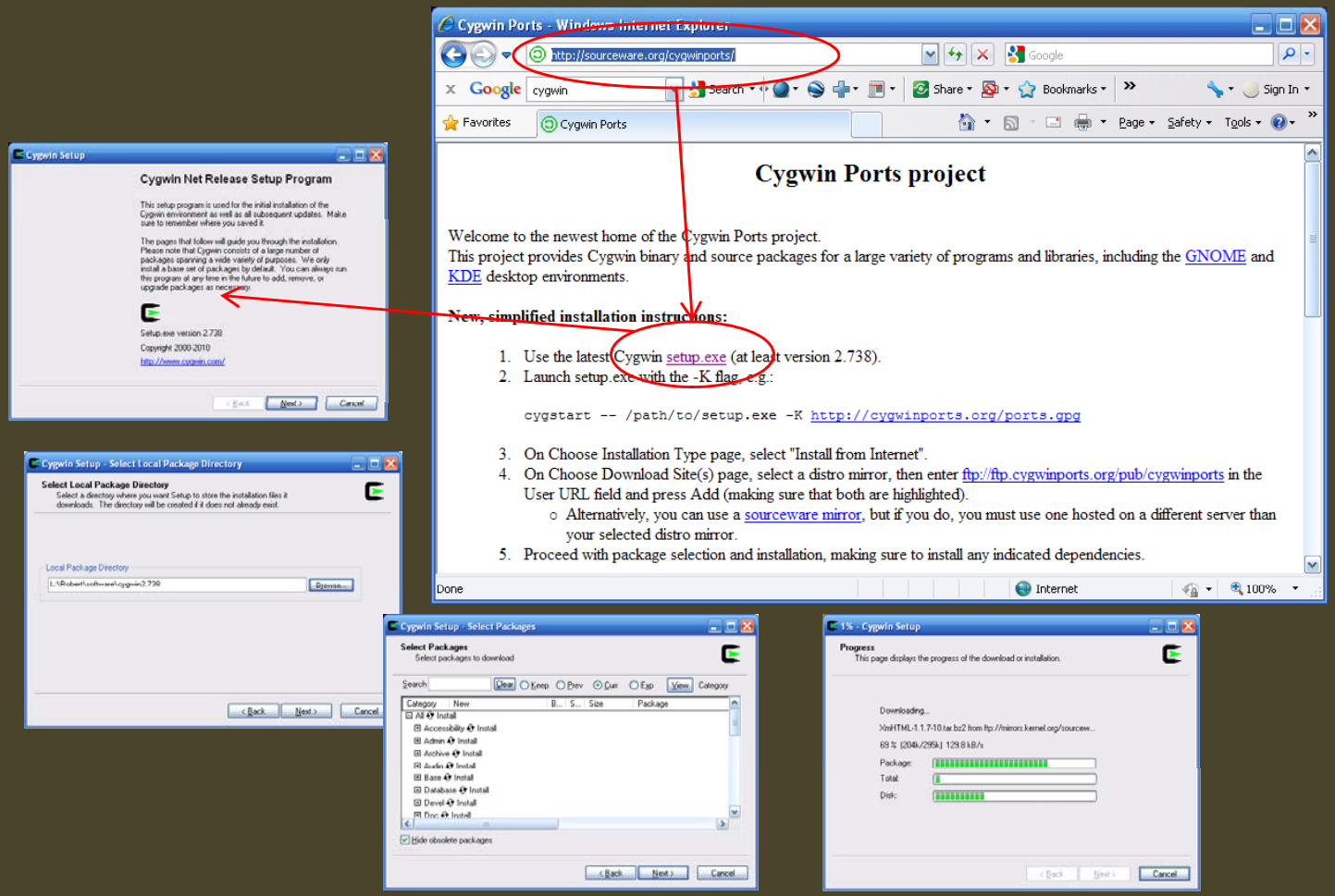


Check transferred files in UNIX

Using editor ***vi*** to check data
command ***vi***

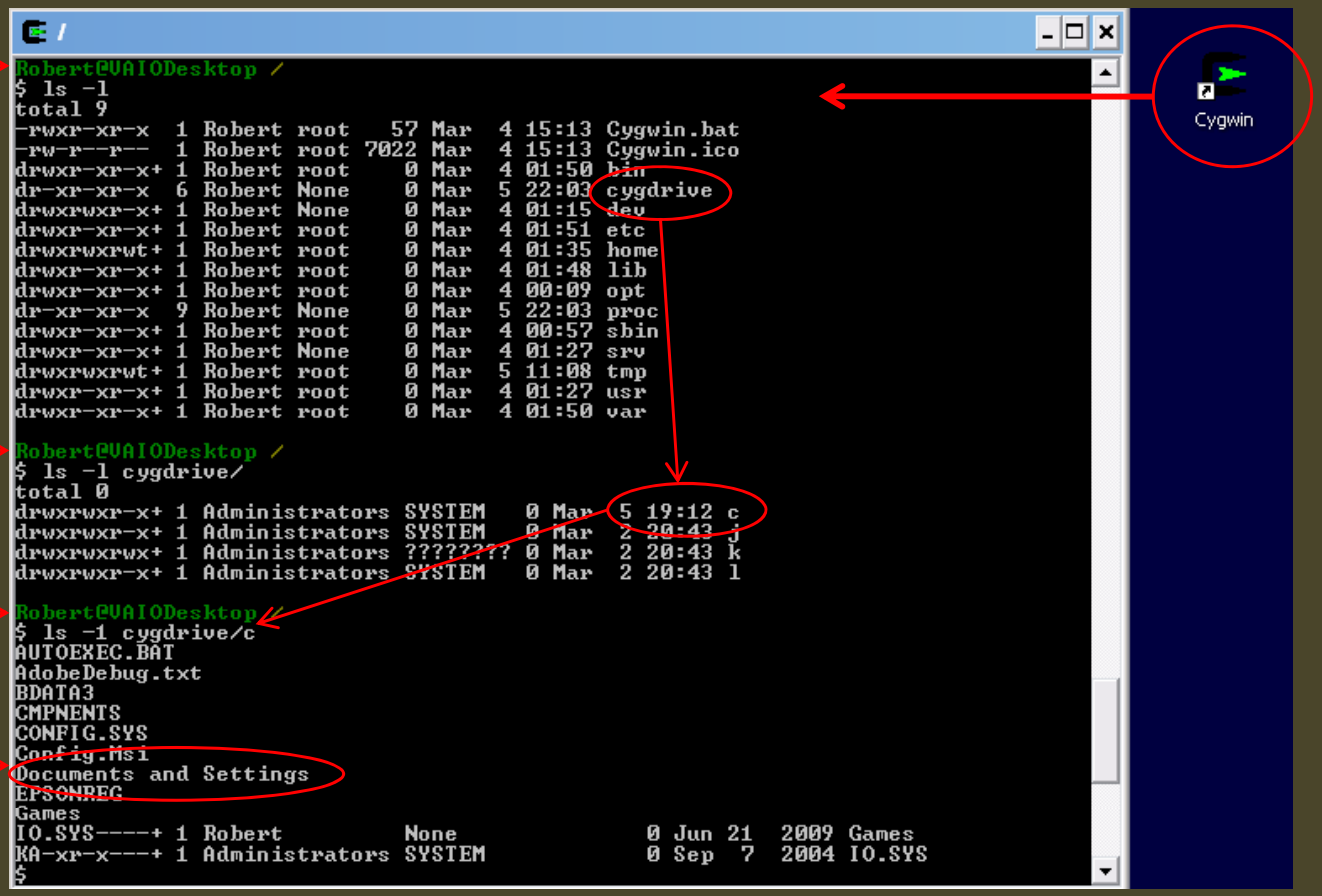
a Windows-based UNIX—cygwin

obtaining cygwin



a Windows-based UNIX—cygwin

launching and exploring cygwin



a Windows-based UNIX—cygwin

compiling “allegro”, C++ source code

/usr/src/allegro-2.0f

```
Robert@VAIODesktop /usr/src/allegro-2.0f
$ ls -l
total 23
-rwxr-xr-x  1 Robert None 3017 Oct 25  2005 DISTRIBUTION_NOTES
-rwxr-xr-x  1 Robert None  733 Oct 25  2005 INSTALL
-rwxr-xr-x  1 Robert None 5853 Oct 25  2005 LICENSE
-rwxr-xr-x  1 Robert None   56 Oct 25  2005 Makefile
-rwxr-xr-x  1 Robert None  137 Oct 25  2005 Makefile.in
-rwxr-xr-x  1 Robert None 1252 Oct 25  2005 README
-rwxr-xr-x  1 Robert None   70 Oct 25  2005 configure
drwxr-xr-x+ 1 Robert None    0 Mar  5 22:31 doc
drwxr-xr-x+ 1 Robert None    0 Mar  5 22:31 examples
drwxr-xr-x+ 1 Robert None    0 Mar  5 22:31 src

Robert@VAIODesktop /usr/src/allegro-2.0f
$ wc -l src/*.*
```

/usr/src/allegro-2.0f

```
    66 src/trait.h
    61 src/traitdata.cc
    53 src/traitdata.h
    40 src/utils.h
    42 src/varcompmodel.cc
    19 src/varcompmodel.h
   358 src/vecutil.cc
   197 src/vecutil.h
   403 src/viterbidist.cc
    95 src/viterbidist.h
    56 src/warning.cc
    19 src/warning.h
 35399 total

Robert@VAIODesktop /usr/src/allegro-2.0f
$
```

/usr/src/allegro-2.0f

```
Robert@VAIODesktop /usr/src
$ ls -l
total 23
-rwxr-xr-x  1 Robert None 3
-rwxr-xr-x  1 Robert None
-rwxr-xr-x  1 Robert None 5
-rwxr-xr-x  1 Robert None
-rwxr-xr-x  1 Robert None
-rwxr-xr-x  1 Robert None 1
-rwxr-xr-x  1 Robert None
drwxr-xr-x+ 1 Robert None
drwxr-xr-x+ 1 Robert None
drwxr-xr-x+ 1 Robert None

Robert@VAIODesktop /usr/src
$ ./configure
```

/usr/src/allegro-2.0f

```
-rwxr-xr-x  1 Robert None  137 Oct 25  2005 Makefile.in
-rwxr-xr-x  1 Robert None 1252 Oct 25  2005 README
-rwxr-xr-x  1 Robert None   70 Oct 25  2005 configure
drwxr-xr-x+ 1 Robert None    0 Mar  5 22:31 doc
drwxr-xr-x+ 1 Robert None    0 Mar  5 22:31 examples
drwxr-xr-x+ 1 Robert None    0 Mar  5 22:31 src

Robert@VAIODesktop /usr/src/allegro-2.0f
$ ./configure
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes
checking for gawk... gawk
checking whether make sets $(MAKE)... yes
checking for g++... g++
checking for C++ compiler default output file name... a.exe
checking whether the C++ compiler works...
```

/usr/src/allegro-2.0f

```
checking CFLAGS for gcc -malign-double... -malign-double
configure: creating ./config.status
config.status: creating Makefile
config.status: creating cudd-2.4.0/Makefile
config.status: creating cudd-2.4.0/cudd/Makefile
config.status: creating cudd-2.4.0/dddmp/Makefile
config.status: creating cudd-2.4.0/epd/Makefile
config.status: creating cudd-2.4.0/mtr/Makefile
config.status: creating cudd-2.4.0/obj/Makefile
config.status: creating cudd-2.4.0/st/Makefile
config.status: creating cudd-2.4.0/util/Makefile
config.status: creating config.h
config.status: executing depfiles commands

Robert@VAIODesktop /usr/src/allegro-2.0f
$ make
```

/usr/src/allegro-2.0f

```
if g++ -DHAVE_CONFIG_H -I. -I. -I. -Icudd-2.4.0/cudd -Icudd-2.4.0/obj -Icudd-2.4
.0/st -Icudd-2.4.0/mtr -Icudd-2.4.0/epd -Icudd-2.4.0/dddmp -Icudd-2.4.0/util  -g
 -O3 -DDEBUG_ASSERT -DDECODE -DHAVE_IEEE_754 -malign-double   -MT SPGraph.o -MD
-MP -MF ".deps/SPGraph.Tpo" -c -o SPGraph.o SPGraph.cc; \
        then mv -f ".deps/SPGraph.Tpo" ".deps/SPGraph.Po"; else rm -f ".deps/SPG
raph.Tpo"; exit 1; fi
In file included from /usr/lib/gcc/i686-pc-cygwin/4.3.4/include/c++/backward/has
h_map:64,
                 from basic.h:116,
                 from SPGraph.hh:4,
                 from SPGraph.cc:1:
/usr/lib/gcc/i686-pc-cygwin/4.3.4/include/c++/backward/backward_warning.h:33:2:
warning: #warning This file includes at least one deprecated or antiquated heade
r which may be removed without further notice at a future date. Please use a non
-deprecated interface with equivalent functionality instead. For a listing of re
placement headers and interfaces, consult the file backward_warning.h. To disabl
```

a Windows-based UNIX—cygwin

compiling “allegro”, C++ source code

/usr/src/allegro-2.0f/examples/ex1

```
Robert@VAIODesktop /usr/src/allegro-2.0f
$ ./allegro-2_v0f.exe -v
allegro 2.0f

Usage:  allegro [ -l <logfile> ] [-t] [-n] [-m] <optionsfile>

Robert@VAIODesktop /usr/src/allegro-2.0f
$ cd examples/ex1/

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ ./../../allegro-2_v0f.exe ex1.opt
allegro 2.0f - fast multipoint linkage analysis

Using options file ex1.opt

Seed is 19826 7437 13070

Using linkage style input files:
PREFILE ex1.pre
DATFILE ex1.dat

The following analyses will be performed:
MODEL mpt par param.mpt fparam.mpt
MODEL mpt exp pairs equal exppairs.mpt
MODEL spt exp pairs equal exppairs.spt
MODEL mpt lin all power:1.00 exppairs.1.mpt
HAPLOTYPE haplo.out ihaplo.out founder.out inher.out
CROSSOVERRATE xover.out fxover.out

SWAPDIRNAME ./5144

Analysing 1 family (f1, 2 bits)
Keeping all calculations in memory (~1Mb)
Processing family f1 (2 bits)

All families processed

Run completed in 00:00:00

Robert@VAIODesktop /usr/src/allegro-2.0f/
$ _
```

/usr/src/allegro-2.0f/examples/ex1

```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ ./../../allegro-2_v0f.exe ex1.opt
allegro 2.0f - fast multipoint linkage analysis

Using options file ex1.opt

Seed is 19826 7672 13070

Using linkage style input files:
PREFILE ex1.pre
DATFILE ex1.dat

The following analyses will be performed:
MODEL mpt par param.mpt fparam.mpt
MODEL mpt exp pairs equal exppairs.mpt
MODEL spt exp pairs equal exppairs.spt
MODEL mpt lin all power:1.00 exppairs.1.mpt
HAPLOTYPE haplo.out ihaplo.out founder.out inher.out
CROSSOVERRATE xover.out fxover.out

SWAPDIRNAME ./13526

Analysing 1 family (f1, 2 bits)
Keeping all calculations in memory (~1Mb)
Processing family f1 (2 bits)

All families processed

Run completed in 00:00:01

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ _
```

/usr/src/allegro-2.0f/examples/ex1

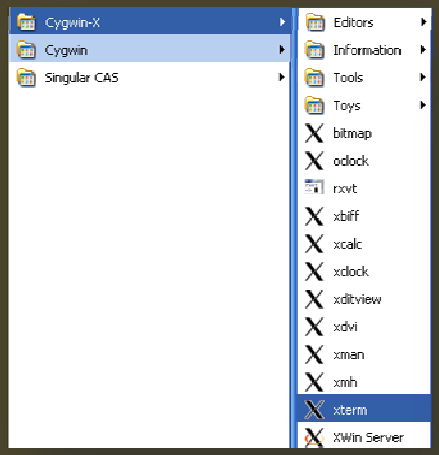
```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ ./../../allegro-2_v0f.exe ex1.opt  > log.txt
allegro 2.0f - fast multipoint linkage analysis

Using options file ex1.opt

Seed is 19826 7784 13070

Using linkage style input files:
PREFILE ex1.pre
DATFILE ex1.dat

The following analyses will be performed:
MODEL mpt par param.mpt fparam.mpt
MODEL mpt exp pairs equal exppairs.mpt
MODEL spt exp pairs equal exppairs.spt
MODEL mpt lin all power:1.00 exppairs.1.mpt
HAPLOTYPE haplo.out ihaplo.out founder.out inher.out
CROSSOVERRATE xover.out fxover.out

SWAPDIRNAME ./15557

Analysing 1 family (f1, 2 bits)
Keeping all calculations in memory (~1Mb)
Processing family f1 (2 bits)

All families processed

Run completed in 00:00:00

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ _
```

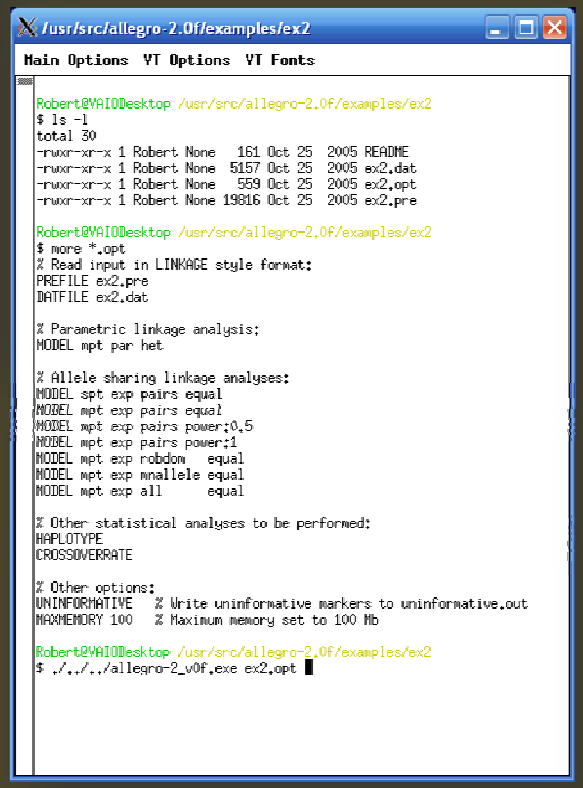
/usr/src/allegro-2.0f/examples/ex1

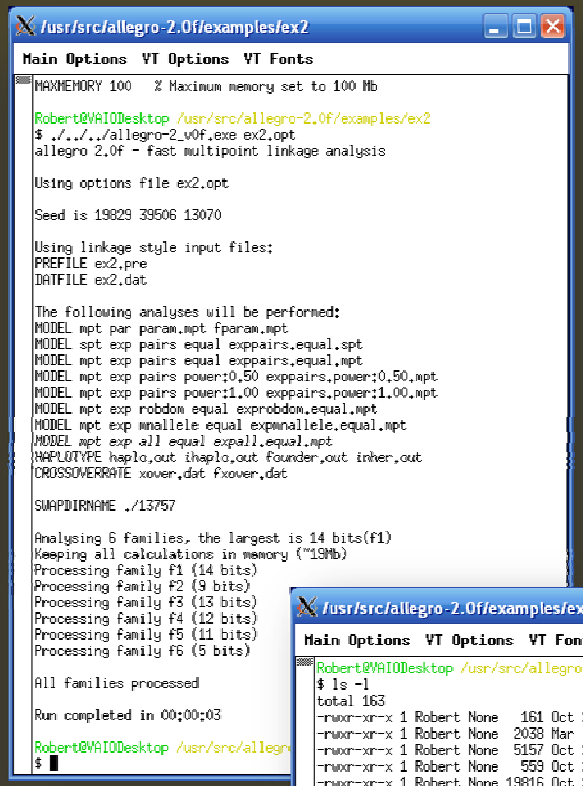
```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ ./../../allegro-2_v0f.exe ex1.opt 1&>2 log.txt

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex1
$ _
```

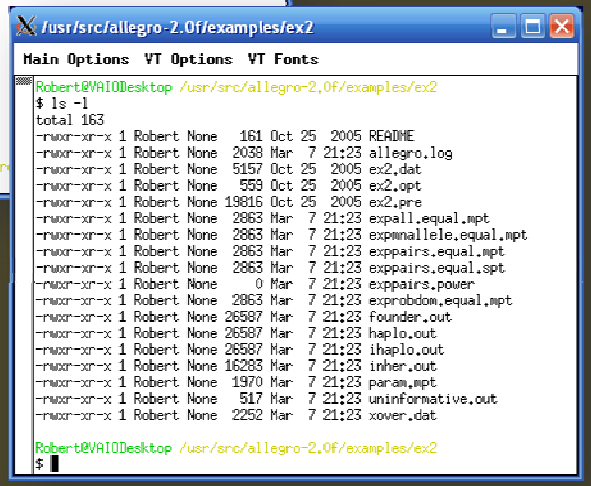
a Windows-based UNIX—cygwin

working and running analysis in xterm



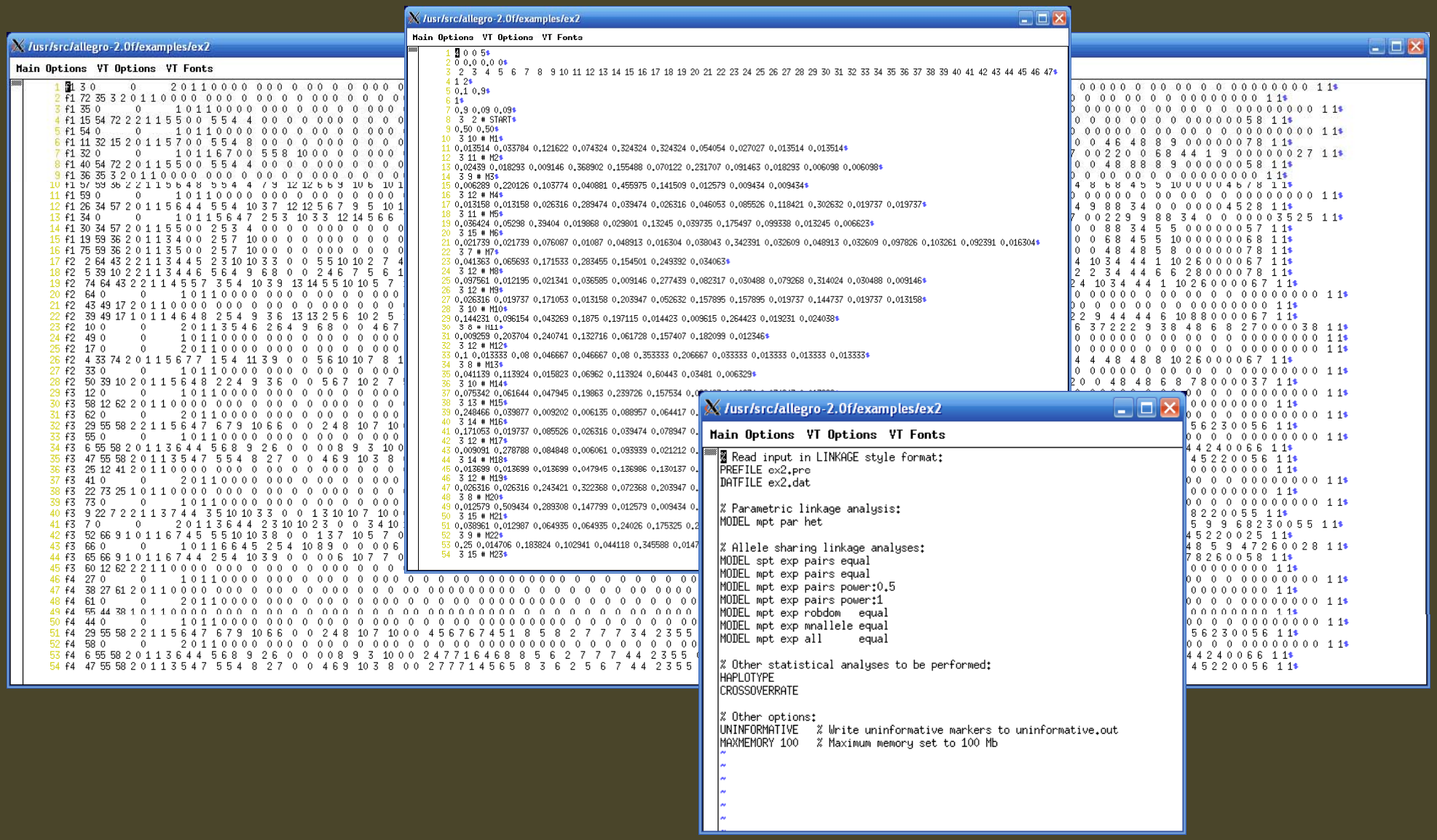






a Windows-based UNIX—cygwin

viewing linkage files for allegro



a Windows-based UNIX—cygwin

checking and plotting linkage analysis results

/usr/src/allegro-2.0f/examples/ex2

Main Options VT Options VT Fonts

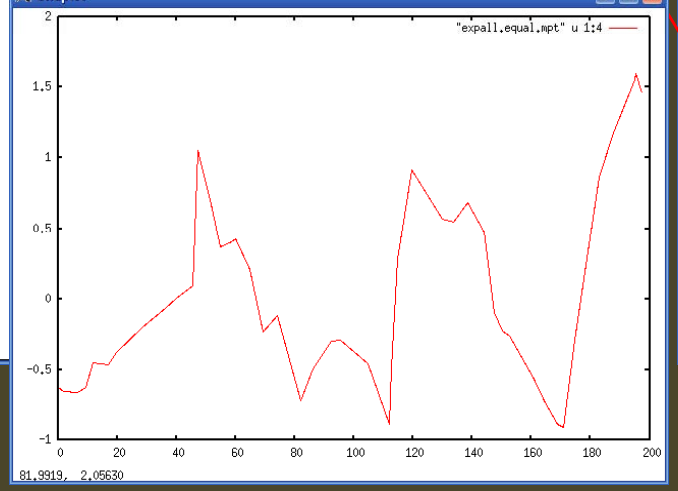
```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ more *.spt
location     LOD     dhat      NPL      Zlr     info   marker
   0.000   0.0000   0.0000   0.0000   0.0000   0.0000    START
   1.720   0.0547  -0.5984  -0.2295  -0.5020   0.1935       M1
   6.670   0.0066   0.4223   0.0105   0.1740   0.0194       M2
   9.410   0.3921  -1.7879  -0.6881  -1.3437   0.3406       M3
  11.850   0.8984   1.1639   0.8049   2.0341   0.3031       M4
  16.720   0.3728 -21.9443  -0.4817  -1.3102   0.1756       M5
  19.670   0.2195  10.8541   0.1007   1.0054   0.0331       M6
  28.760   0.0873  -0.4807  -0.4020  -0.6340   0.4363       M7
  36.250   0.0703  -0.6371  -0.2266  -0.5688   0.2256       M8
  39.990   0.0692  -0.5268  -0.2927  -0.5645   0.2986       M9
  45.340   0.0024   0.1237   0.0361   0.1060   0.1093      M10
  47.090   0.0486   0.2999   0.2752   0.4732   0.3158      M11
  51.990   0.0022   0.0762   0.0531   0.1011   0.2740      M12
  54.790   0.0104   0.1255   0.1465   0.2185   0.4502      M13
  58.550   0.0365   0.7835   0.0605   0.4103   0.0259      M14
  59.850   0.0613   0.2750   0.3719   0.5313   0.4837      M15
  64.670   0.0559   0.2494   0.3804   0.5074   0.5491      M16
  69.230   0.0046  -0.1317  -0.0681  -0.1448   0.2266      M17
  74.070   0.0163  -0.1873  -0.1757  -0.2737   0.4204      M18
  81.950   0.1936  -0.8050  -0.6023  -0.9443   0.4408      M19
  86.260   0.0111  -0.2481  -0.0842  -0.2256   0.1714      M20
  92.380   0.0517   0.3700   0.2362   0.4881   0.2077      M21
  95.400   0.0152  -0.1772  -0.1728  -0.2643   0.4339      M22
 104.760   0.0081  -0.1343  -0.1191  -0.1932   0.3889      M23
 111.970   0.0228  -0.2666  -0.1794  -0.3237   0.3106      M24
 112.520   0.0406  -0.3431  -0.2429  -0.4324   0.3565      M25
 114.750   0.0590   0.2615   0.3746   0.5212   0.5213      M26
 119.500   0.1841   0.6099   0.4581   0.9207   0.2296      M27
 129.830   0.0007   0.0374   0.0366   0.0584   0.3915      M28
 133.650   0.1046 -10.8541  -0.1334  -0.6939   0.0493      M29
 138.640   0.0193   0.1354   0.2557   0.2981   0.7143      M30
 144.060   0.5755   0.9585   0.8473   1.6279   0.2713      M31
 147.490   0.0610  -0.4336  -0.2933  -0.5300   0.3609      M32
 150.340   0.3150  -1.2819  -0.6886  -1.2044   0.3909      M33
 152.620   0.0081   0.1557   0.0912   0.1937   0.2237      M34
 156.470   0.0025   0.1241   0.0375   0.1081   0.1131      M35
 160.870   0.2675  -2.2322  -0.5118  -1.1099   0.1911      M36
 164.190   0.0551  -0.4568  -0.2504  -0.5038   0.2994      M37
 168.680   0.0389  -0.3892  -0.2058  -0.4231   0.2755      M38
 171.060   0.3029  -1.0773  -0.7193  -1.1812   0.4654      M39
 174.800   0.0573  -0.3221  -0.3591  -0.5136   0.5608      M40
 182.890   0.8236   1.2677   0.7763   1.9475   0.2449      M41
 187.810   0.0754   0.7639   0.1537   0.5894   0.0565      M42
 194.880   0.0000   0.0000   0.0000   0.0000   0.0000      M43
 195.490   1.1976   1.3192   1.1533   2.3484   0.3374      M44
 197.540   0.0000   0.0000   0.0000   0.0000   0.0000      END

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ xterm &
[2] 11392

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$
```

/usr/src/allegro-2.0f/examples/ex2

Main Options VT Options VT Fonts

```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ ls -l
total 163
-rwxr-xr-x 1 Robert None   161 Oct 25  2005 README
-rwxr-xr-x 1 Robert None  2038 Mar  7 21:23 allegro.log
-rwxr-xr-x 1 Robert None  5157 Oct 25  2005 ex2.dat
-rwxr-xr-x 1 Robert None   559 Oct 25  2005 ex2.opt
-rwxr-xr-x 1 Robert None 19816 Oct 25  2005 ex2.pre
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 expall.equal.mpt
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 expmnallele.equal.mpt
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 exppairs.equal.mpt
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 exppairs.equal.spt
-rwxr-xr-x 1 Robert None     0 Mar  7 21:23 exppairs.power
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 exprobdom.equal.mpt
-rwxr-xr-x 1 Robert None 26587 Mar  7 21:23 founder.out
-rwxr-xr-x 1 Robert None 26587 Mar  7 21:23 haplo.out
-rwxr-xr-x 1 Robert None 26587 Mar  7 21:23 ihaplo.out
-rwxr-xr-x 1 Robert None 16283 Mar  7 21:23 inher.out
-rwxr-xr-x 1 Robert None  1970 Mar  7 21:23 param.mpt
-rwxr-xr-x 1 Robert None   517 Mar  7 21:23 uninformative.out
-rwxr-xr-x 1 Robert None  2252 Mar  7 21:23 xover.dat

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$
```

Gnuplot



/usr/src/allegro-2.0f/examples/ex2

Main Options VT Options VT Fonts

```
 58.550   0.0365   0.7835   0.0605   0.4103   0.0259    M14
 59.850   0.0613   0.2750   0.3719   0.5313   0.4837    M15
 64.670   0.0559   0.2494   0.3804   0.5074   0.5491    M16
 69.230   0.0046  -0.1317  -0.0681  -0.1448   0.2266    M17
 74.070   0.0163  -0.1873  -0.1757  -0.2737   0.4204    M18
 81.950   0.1936  -0.8050  -0.6023  -0.9443   0.4408    M19
 86.260   0.0111  -0.2481  -0.0842  -0.2256   0.1714    M20
 92.380   0.0517   0.3700   0.2362   0.4881   0.2077    M21
 95.400   0.0152  -0.1772  -0.1728  -0.2643   0.4339    M22
104.760   0.0081  -0.1343  -0.1191  -0.1932   0.3889    M23
111.970   0.0228  -0.2666  -0.1794  -0.3237   0.3106    M24
112.520   0.0406  -0.3431  -0.2429  -0.4324   0.3565    M25
114.750   0.0590   0.2615   0.3746   0.5212   0.5213    M26
119.500   0.1841   0.6099   0.4581   0.9207   0.2296    M27
129.830   0.0007   0.0374   0.0366   0.0584   0.3915    M28
133.650   0.1046 -10.8541  -0.1334  -0.6939   0.0493    M29
138.640   0.0193   0.1354   0.2557   0.2981   0.7143    M30
144.060   0.5755   0.9585   0.8473   1.6279   0.2713    M31
147.490   0.0610  -0.4336  -0.2933  -0.5300   0.3609    M32
150.340   0.3150  -1.2819  -0.6886  -1.2044   0.3909    M33
152.620   0.0081   0.1557   0.0912   0.1937   0.2237    M34
156.470   0.0025   0.1241   0.0375   0.1081   0.1131    M35
160.870   0.2675  -2.2322  -0.5118  -1.1099   0.1911    M36
164.190   0.0551  -0.4568  -0.2504  -0.5038   0.2994    M37
168.680   0.0389  -0.3892  -0.2058  -0.4231   0.2755    M38
171.060   0.3029  -1.0773  -0.7193  -1.1812   0.4654    M39
174.800   0.0573  -0.3221  -0.3591  -0.5136   0.5608    M40
182.890   0.8236   1.2677   0.7763   1.9475   0.2449    M41
187.810   0.0754   0.7639   0.1537   0.5894   0.0565    M42
194.880   0.0000   0.0000   0.0000   0.0000   0.0000    M43
195.490   1.1976   1.3192   1.1533   2.3484   0.3374    M44
197.540   0.0000   0.0000   0.0000   0.0000   0.0000    END

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ xterm &
[2] 11392

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ gnuplot

        G N U P L O T
        Version 4.4 patchlevel 0
        last modified March 2010
        System: CYGWIN_NT-5.1 1.7.8(0.236/5/3)

        Copyright (C) 1986-1993, 1998, 2004, 2007-2010
        Thomas Williams, Colin Kelley and many others

        gnuplot home:     http://www.gnuplot.info
        faq, bugs, etc:   type "help seeking-assistance"
        immediate help:   type "help"
        plot window:      hit 'h'

Terminal type set to 'x11'
gnuplot> plot "expall.equal.mpt" u 1:4 w l
gnuplot>
```

a Windows-based UNIX—cygwin

using gnuplot to make a comprehensive plot

/usr/src/allegro-2.0f/examples/ex2

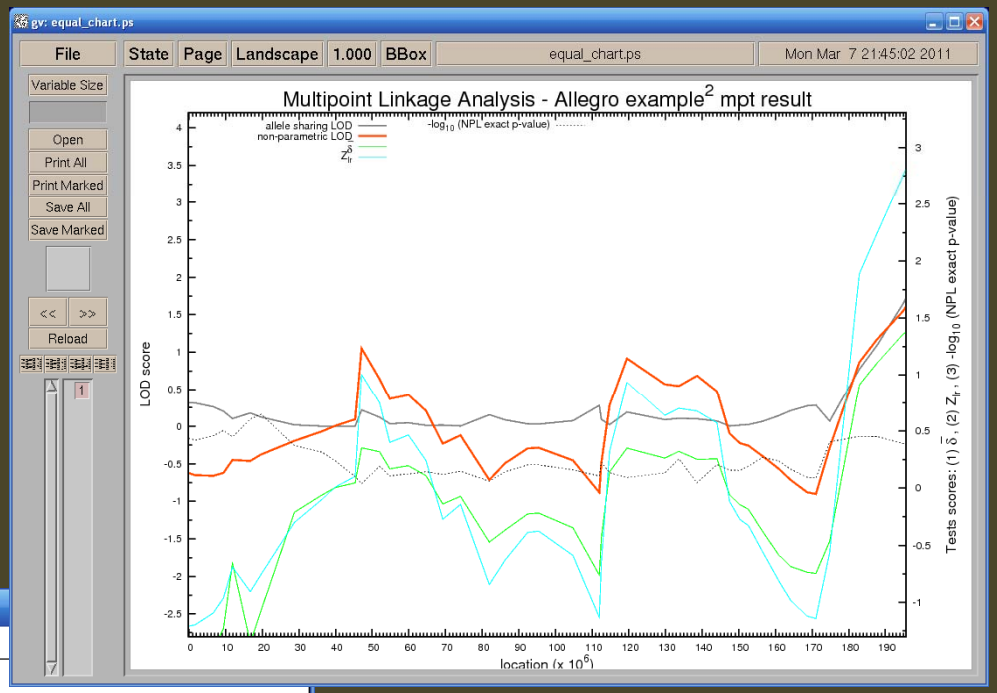
Main Options VT Options VT Fonts

```
#!/usr/bin/perl

use strict;

my $_program = "gplot_mpt.pl";
# Describe commandline args:
my @argv = qw(datafile charttitle);

my $version = "1.0.0 allegro_mpt - June 2006";
#-----------------------------------------------------------------
# $Revision$
#################################################################
# $Author$ Robert K. Yu
#                rkyu@mdanderson.org
#                ryu@cedric.mdacc.tmc.edu
#################################################################
# Template of parameter file:
# This is listed here for simple copy
# and paste use if needed.
#################################################################
# Description:
my  $Task =      "This program is to plot Allegro mpt output. This
\tprogram is based on previous gplot300.pl. It takes a datafile and create
\ta gnuplot script to plot a 2D chart off the data.
\tData file contains columns of numeric data separated by space
\tor tab. If the first line contains header for each column, the
\tcorresponding header to a column will be used as a line title
\tin the plotted chart. Otherwise a default title from gnuplot will
\tbe given. Note: the header for each column should not be containing
\tany space.
\tThe 2nd argument is the title for the chart, a string in quotes if
\tspace exists.
\t-----------------------------------------------------\n
\tNOTE: this program is currently suitable for plotting the output
\tof nonparametric multipoing linkage analysis from running Allegro
\tprogram. For example, currently only two lines are designed in the
\tplotting, one representing the \"allele-sharing LOD\" and another
\t\"non-parametric LOD\".
\tVersion: $version
\t=====================================================\n";
#   Dependency:  UNIX/LINUX version
#   Children:
#   Pre-cond:
#   Post-cond:
#   Algorithm:
# Package:       n/a
#-----------------------------------------------------------------
# $Date$
# $Keyword$
# $Id$
#
# $Log$
#
#-----------------------------------------------------------------
# $Source$
#################################################################

my $_usage =
"\n\t$Task\n
\tUsage: $_program @argv
\te.g. perl $_program data.cht \"charttitle\"\n\n";

###################### Testing piece ############################
system("cls");
print "\n$_program is now running ...\n\n";
#################### Testing piece done #########################
sub em {                # to generate error messages
        my $text = "";
        $text .= "ERROR: ".(pop)."\n";
        return $text;
}
sub em_abort {  # to generate error messages before program aborted.
```

/usr/src/allegro-2.0f/examples/ex2

Main Options VT Options VT Fonts

```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ perl /home/Robert/gplot_mptNegLogTen.pl expall.equal.mpt "Allegro example^2 mpt result"

gplot_mpt.pl is now running ...

x: max = 195.490, min = 0.000
total y1's = 92
y1: max = 1.7093, min = -0.9015
total y2's = 138
y2: max = 2.8057, min = -1.6209

"gplot_mpt.pl expall.equal.mpt Allegro example^2 mpt result" exits successfully.

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ gv equal_chart.ps &
[2] 7064

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$
```



a Windows-based UNIX—cygwin

viewing result files in Windows

/usr/src/allegro-2.0f/examples/ex2

Main Options VT Options VT Fonts

```
Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ perl /home/Robert/gplot_mptNegLogTen.pl expall.equal.mpt "Allegro example^2 mpt result"

gplot_mpt.pl is now running ...

x: max = 195.490, min = 0.000
total y1's = 92
y1: max = 1.7093, min = -0.9015
total y2's = 138
y2: max = 2.8057, min = -1.6209

"gplot_mpt.pl expall.equal.mpt Allegro example^2 mpt result" exits successfully.

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ gv equal_chart.ps &
[3] 7260
[2]   Done                    gv equal_chart.ps

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ ps2pdfwr equal_chart.ps equal_chart.pdf
[3]+  Done                    gv equal_chart.ps

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$ ls -l
total 223
-rwxr-xr-x 1 Robert None   161 Oct 25  2005 README
-rwxr-xr-x 1 Robert None  2038 Mar  7 21:23 allegro.log
-rw-r--r-- 1 Robert None 10916 Mar  7 21:48 equal_chart.pdf
-rw-r--r-- 1 Robert None 32946 Mar  7 21:47 equal_chart.ps
-rw-r--r-- 1 Robert None   611 Mar  7 21:47 equal_gplot.log
-rwxr-xr-x 1 Robert None  5157 Oct 25  2005 ex2.dat
-rwxr-xr-x 1 Robert None   559 Oct 25  2005 ex2.opt
-rwxr-xr-x 1 Robert None 19816 Oct 25  2005 ex2.pre
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 expall.equal.mpt
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 expmnallele.equal.mpt
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 exppairs.equal.mpt
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 exppairs.equal.spt
-rwxr-xr-x 1 Robert None     0 Mar  7 21:23 exppairs.power
-rwxr-xr-x 1 Robert None  2863 Mar  7 21:23 exprobdom.equal.mpt
-rwxr-xr-x 1 Robert None 26587 Mar  7 21:23 founder.out
-rwxr-xr-x 1 Robert None 26587 Mar  7 21:23 haplo.out
-rwxr-xr-x 1 Robert None 26587 Mar  7 21:23 ihaplo.out
-rwxr-xr-x 1 Robert None 16283 Mar  7 21:23 inher.out
-rwxr-xr-x 1 Robert None  1970 Mar  7 21:23 param.mpt
-rw-r--r-- 1 Robert None  1587 Mar  7 21:47 plot_equal.plt
-rw-r--r-- 1 Robert None  2754 Mar  7 21:47 trns_expall.equal.mpt
-rwxr-xr-x 1 Robert None   517 Mar  7 21:23 uninformative.out
-rwxr-xr-x 1 Robert None  2252 Mar  7 21:23 xover.dat

Robert@VAIODesktop /usr/src/allegro-2.0f/examples/ex2
$
```

ex2

File Edit View Favorites Tools Help Back

File and Folder Tasks
- Rename this file
- Move this file
- Copy this file
- Publish this file to the Web
- E-mail this file
- Print this file
- Delete this file

Other Places
- examples
- My Documents
- Shared Documents
- My Computer
- My Network Places

Details

Name		
ex2.opt		
ex2.pre		
README		
ex2.dat		
allegro.log		
expall.equal.mpt		
expmnallele.equal.mpt		
exppairs.equal.mpt		
exppairs.equal.spt		
exppairs.power		
exprobdom.equal.mpt		
founder.out		
haplo.out		
ihaplo.out		
inher.out		
param.mpt		
uninformative.out		
xover.dat		
equal_chart.pdf	0 KB	Adobe Acrob
equal_chart.ps	33 KB	VLC media fil
equal_gplot.log	1 KB	Text Docume
plot_equal.plt	2 KB	PLT File
trns_expall.equal.mpt	3 KB	MPT File

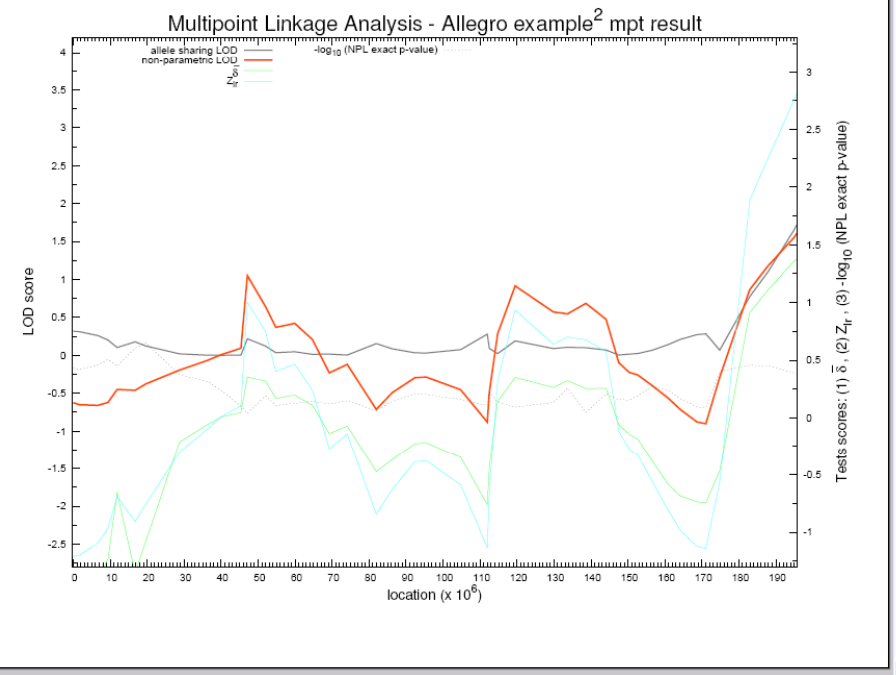
Adobe Acrobat Professional - [equal_chart.pdf]

File Edit View Document Comments Tools Advanced Window Help

Search Create PDF Comment & Markup Send for Review Secure Sign Forms

Select 85% Help

Bookmarks Pages Model Tree Signatures Attachments Comments



1 of 1

UNIX Commands Summary

a starting set of UNIX commands

- exploring directories and files, running a program

  cd (change directory): cd ../ (go back upper level) ls -l (listing files in a directory)

  ./my-own-program & (run a program in the current directory, the program you created, in background)

  perl *my_perl_script.pl* (run a perl script) df (show disk usage) du (show dir space)

  nohup "program_name argument" (running a program in background to avoid terminated)

  Ctrl+c (suspend current command) Ctrl+z (stop current command) !! Repeat the last command
- viewing and editing files, changing file mode, delete files

  more, less, head, tail, cat *filename* (view a file) vi (most powerful text editor) emacs (text editor)

  egrep 'pattern' **.txt* (extract 'pattern' from all *.txt files) mkdir *dirname* create a dir

  chmod 777 *filename* (make this file accessible to public) mv *f1 f2* (rename f1 to f2)

  rm **.txt* (delete all files of "txt" extension in the current directory) tar / gzip (packaging and zip files)

  rm -rf *directory_name* (force delete a directory with all files in it without question)

  ln -s *file link* create a shortcut (symbolic link) *link* to *file*. cp *f1 f2* (copy f1 to f2) cp -r *d1 d2* (copy dirs)
- line / word counting

  wc -lw *filename*(counting lines and word in the file) wc -l **.dat* (counting lines in each file)
- merging files

  paste *f1 f2 > file-merged* (merge two files (by column)) cat *f1 f2 > file-appended* (append f2 below f1)
- checking upon system

  top (checking currenting running processes (programs)) pwd (checking current directory position)

  ps (view current running process (id)) kill *pid* (terminate running of a process with *pid*

  uname -a (checking info on node name, operating system and its version, platform, etc.)

  which *program-name* (checking if this program is installed/available): which *perl*
- most useful tools

★ man *program-name* (open help file of the program, to learn detailed usage of the program)

★ GOOGLE your request of any UNIX programs and commands, …, to become a UNIX guru ☺

a hands on case

a case/control association study of disease “UNIX-sick”

1. Receive SNP data in Excel & text files
2. Check data files
3. Plan of analyses: using PLINK
4. Transfer data into UNIX
5. Data preparation
6. Run PLINK analyses
7. View results
8. Get result out of UNIX
9. Result annotation and further study

1. raw data verification
2. data cleaning
3. data assembly in PLINK format
4. preliminary run of PLINK
5. modification

SNP annotation, gene pathway analysis, meta-analysis, … Beyond this scope.

Q & A

Thank You.