Welcome to MAPMAKER distribution 3.0. In this package, you will find:
- MAPMAKER/EXP Version 3.0 - A program for genetic linkage analysis
- MAPMAKER/QTL 1.1 - A program for mapping genes underlying complex traits
- A complete manual for the above with tutorial and reference section
- Sample data sets, which are used in the tutorials
Collectively, we refer to this package as "MAPMAKER".

This "Release Notes" document describes:
(0) What is MAPMAKER?
(1) How to Get MAPMAKER
(2) How to Run MAPMAKER on a PC Compatible Running DOS
(3) How to Run MAPMAKER on a Sun SPARCStation Running SunOS
(4) How to Run MAPMAKER on a Apple Macintosh Running A/UX
(5) License Agreement
(6) GNU Readline and GhostScript License Information
(7) Where to Go From Here
(8) References

(0) WHAT IS MAPMAKER?

MAPMAKER/EXP is a linkage analysis package designed to help construct primary linkage maps of markers segregating in experimental crosses. MAPMAKER/EXP performs full multipoint linkage analysis (simultaneous estimation of all recombination fractions from the primary data) for dominant, recessive, and co-dominant (e.g. RFLP-like) markers. MAPMAKER/EXP is an experimental-cross-only successor to the original MAPMAKER program.

MAPMAKER/QTL is a companion program to MAPMAKER/EXP which allows
one to map
genes controlling polygenic quantitative traits in F2 intercrosses and BC1
backcrosses relative to a genetic linkage map. More information on MAPMAKER/QTL
can be found in the technical report (included with MAPMAKER/QTL).

For more information on these programs, see the list of references, provided at
the end of this document. Also, be sure to read the technical reports, which
provide tutorials and reference manual for the two programs.

New features in this release include:

- Many many bug-fixes, feature, and user-interface improvements.
- A sophisticated algorithm for detecting typing errors in data from
  experimental crosses (see Lincoln and Lander, "Systematic
  Detection of Errors
  in Genetic Linkage Data" Genomics 14: 604-610)
- The ability to draw genetic maps (in MAPMAKER/EXP) and LOD-score
  plots (in
  MAPMAKER/QTL) as PostScript files.
- Support for additional cross types, including F2 intercross, BC1 backcross,
  F3(self) intercross, and sib and self mated Recombinant Inbreds in
  MAPMAKER/EXP.
- Many features for automating analysis and storing results, particularly
  useful with very large data sets. An outline of a database interface is
  provided, for sites who wish to integrate MAPMAKER into their informatics
  systems.
- New "three point" and "join haplotypes" features for speeding lengthy
  analyses.
- A new license agreement which allows free redistribution of
  MAPMAKER.Under
specific conditions, you may even distribute modified versions
of MAPMAKER.
See the license agreement (below) for details.

(1) HOW TO GET MAPMAKER

We distribute ready-to-run executables for any of the following:

- 386 and 486 based PC-compatible computers running DOS 5.0
- High-end Apple Macintoshes running A/UX 3.0, Apple's Unix
- Sun SPARCStations running SunOS 4.x (Sun's Unix)

We will send 3-1/2" high-density (1.44 MB) floppy disks with a
photocopied
manual if you send your name, title, organization, address, Internet E-mail
address (if available and if you really use it), FAX (otherwise), to:

MAPMAKER

c/o Dr. Eric Lander
Whitehead Institute for Biomedical Research
9 Cambridge Center
Cambridge, Massachusetts 02142 USA
FAX 617-252-1902
Internet: mapmaker@genome.wi.mit.edu <= NOTE NEW EMAIL ADDRESS!

Be sure to specify whether you want the PC, SUN, or A/UX version.
Do not send blank disks. We prefer lab heads or PI's to request the program,
simply because these individuals tend to move less often, and contacting
the lab becomes a bit easier for us. Due to the expense involved, please
do not request extra copies of the manual or floppy disks: the license agreement
allows to make extra copies for yourself. An order form is included at the
Alternatively, you can retrieve the software yourself over the Internet via anonymous FTP from host "genome.wi.mit.edu" in the /distribution/mapmaker directory. Fetch the FTP.ME (text) file there for further instructions. If you do get MAPMAKER this way (or already have), please "register" by sending us the information requested above to the address above, mentioning that you already have the software. In return, we will send you a printed copy of the manual. Source code (in "C") is also available by anonymous FTP which you may be able to compile and run on other platforms.

MAPMAKER for Macintosh, also called MAPMAKER-II (not to be confused with MAPMAKER Version 2.0) is also available. This program is actually a port of MAPMAKER 1.0 (circa 1988) to the native Macintosh operating system (that is, it does not require A/UX) and it is extended with additional graphics capabilities. This program is the result of a collaboration between The Whitehead Institute and Dupont Co., and it is distributed by Dupont. MAPMAKER/QTL is not included. For information, contact:

    Mapmaker for Macintosh
    c/o Dr. Scott Tingey
    E 402/4249
    Dupont Experimental Station
    Wilmington, Delaware 19898 USA

Below, we describe what sort of computer you will need to run MAPMAKER 3.0 and MAPMAKER/QTL 1.1.
In the last 1-2 years, extremely powerful IBM PC compatible computers have become very inexpensive and widely available. These computers are now an excellent choice for running MAPMAKER and MAPMAKER/QTL.

To run MAPMAKER on a PC with DOS, your PC must have a 386 or 486 processor, and should be running MS-DOS 5.0 (that is, we have not tested the program on any other versions of DOS). We strongly recommend using a math coprocessor - 486DX and 486DX2 based systems always have such a coprocessor built in, all other systems (386SX, 386DX, 486SX) require this as an option. For performance reasons, we do not recommend using a 386SX or SLC. MAPMAKER works correctly with, but does not make much use of (and does not require) Windows 3.1.

MAPMAKER will need at least 5MB (megabytes) or more of EXTENDED (not EXPANDED) memory available. More memory is better. You will also need up to 20MB of free disk space on your hard drive. While the MAPMAKER executable programs and sample data files should only fill up about 2MB, running the program will require a large amount (about 16 MB) of "swap space" on your hard disk while it is running. Your data files and output will take up additional disk space also.

MAPMAKER is sent on 3-1/2 inch high-density (1.44MB) floppy disks. You will need a computer with this type of drive to install MAPMAKER. Of
course, this does not have to be the computer you eventually run MAPMAKER on, if you have some other way of transferring the files. MAPMAKER is distributed as an executable program: you do NOT need a compiler to install it.

Please ask your computer support people if your PC is appropriate. Our test configuration is a DELL 433P (33MHz 486DX) with 16Mb memory, a 105Mb hard disk, and a VGA display. We run DOS 5.0 as shipped by Dell, using only the included utilities, except for Sun's PC-NFS with a 3Com ethernet board. MAPMAKER should run fine on most PC's (including laptops) with the required features.

MAPMAKER 3.0 draws graphic images in the standard PostScript (Level 1) format. For your convenience, we have included a copy of the Free Software Foundation's "GhostScript" package -- a PostScript interpreter which allows you to display these graphics under Windows 3.1 (GhostScript can also output directly to a EGA or VGA monitor, although the type is so small as to be illegible). These PostScript files should also print as-is on any PostScript printer, such as an Apple LaserWriter, and GhostScript claims it can print these files on a HP LaserJet or Deskjet or Epson 9-pin or 24-pin compatible printer. We cannot vouch for these capabilities nor can we provide any support for using GhostScript as it is not our product. Some commercial products (such as "Freedom of Press") also claim to accomplish the same thing.

Typical mail order prices for a system like ours are around US
$2500 as of the
fall of 1992. Most users will not need quite as fancy (or as
expensive) a
computer, however. We cannot attest to MAPMAKER's ability to run
on any other
hardware or software configuration.

MAPMAKER is incompatible with some TSRs and device divers. Among
others, it
will not work correctly with STACKER.

(3) HOW TO RUN MAPMAKER ON A SUN SPARCSTATION RUNNING SUNOS

Most of our development is done on Sun and DEC Unix-based
workstations. The
"RISC" technology they employ makes these machines extremely fast,
and many
models are well under $10,000 in the US. The newest low-end
systems start at
less than $5,000, and are even cheaper if you are eligible for
educational or
US government pricing. Moreover, a good deal of other genome
related software
and databases are becoming available for these machines. However,
they are more
difficult to set up and maintain than PCs or Macs.

To run MAPMAKER on a Sun Workstation, you will need a SPARC based
system
(SPARCStation or Sun-4 system) running SunOS 4.1.x, also known as
Solaris 1.0
or 1.1. We have not tested the programs on any other versions of
SunOS,
including SunOS 4.0.x or Solaris 2.0 or 2.1, although Sun *claims*
they are
binary compatible. Note that some of the new Sun Workstations
REQUIRE Solaris
2.1. We also have no experience with non-Sun SPARC compatibles.

MAPMAKER itself requires between 10-30MB (megabytes) of swap space
(virtual memory), depending on the size of your data sets and the number of other programs you wish to run at the same time. 8MB of physical memory is usually adequate for MAPMAKER, although 16MB is often recommended. In our experience, if you run MAPMAKER with Sun's OpenWindows product, you will need *much more* memory and swap space - we usually recommend 32MB of swap space with at least 16MB of physical memory. Ask a Unix system administrator or Sun technical support if your computer is appropriate.

MAPMAKER is sent on 3-1/2 inch high-density (1.44MB) "bar" format floppy disks. You will need a Sun with this type of drive to install MAPMAKER. Of course, this does not have to be the Sun you eventually run MAPMAKER on, if you have some other way of transferring the files. MAPMAKER is distributed as an executable program -- you do NOT need a compiler to install it.

The executable program and sample data files should only fill up 2MB of disk space, although your data files and output will take up additional disk space. Unfortunately, SunOS itself uses a lot of disk space: Sun's 400MB drives provide more than adequate room, although the 200MB drives are a bit of a squeeze if you actually want to *do* anything with the computer (and you have no networked file server available).

MAPMAKER is a text based program which runs using a standard terminal (including a Mac or PC acting as a terminal, connected to the Sun either using
Ethernet or a standard serial line - consult your computer support people or Sun technical support for details). In principle, this way one SPARCStation could provide analysis services for an entire lab of Macs and PCs. MAPMAKER also works in a Command Tool, Shell Tool, or xterm window under SunView, OpenWindows, or The X Window System.

MAPMAKER draws graphic images in the standard PostScript (Level 1) format. For your convenience, we have included a copy of the Free Software Foundation's "GhostScript" package -- a PostScript interpreter which allows you to display these graphics under X-Windows and OpenWindows. GhostScript works either on the SPARCStation graphics console itself, or remotely over Ethernet using X-Windows from a PC, Mac, X-Terminal, or another workstation: ask a Unix system administrator or Sun technical support for details. These PostScript files should also print as-is on any PostScript printer, such as an Apple LaserWriter. However, we have no experience with any other type of printer, including the Sun "SPARCprinter" or others driven by Sun's "NewsPrint" package.

(4) HOW TO RUN MAPMAKER ON AN APPLE MACINTOSH RUNNING A/UX

MAPMAKER 3.0 and MAPMAKER/QTL 1.1 do not presently work correctly with the standard Macintosh operating system. The MAPMAKER programs are computationally intensive large memory model programs which, when ported naively, frequently crash the stock Macintosh operating system. Unfortunately, this
is a difficult problem to solve (any volunteers out there?). As we mentioned above, a well ported version of MAPMAKER Version 1.0 is available from Dupont, which will fill some users' needs.

It is possible, however, to run the newest versions of MAPMAKER (3.0) and MAPMAKER/QTL (1.1) on Macintoshes running Apple's Unix Operating System, A/UX 3.0. A/UX 3.0 is a merger of the ordinary Macintosh System 7 Finder with a nearly-invisible (to the user) set of Unix internals. In fact, A/UX users may almost never know that their computer is running Unix -- they will see only the ordinary Macintosh Finder and will have access to almost all standard System 7 compatible programs and files. At the same time, A/UX provides the necessary underlying features for big programs like MAPMAKER and MAPMAKER/QTL to work without extensive modifications.

In our experience, we found A/UX fairly easy to set up, well documented, and robust. Moreover, Apple provides telephone support to help install A/UX. Thus, we can certainly recommend this platform for running MAPMAKER and MAPMAKER/QTL, with the only caveats that (i) it requires a relatively expensive Macintosh and other hardware, (ii) A/UX itself is not cheap; and (iii) even the top of the line Macintoshes cannot compete in price-to-performance with either PC clones, or most dedicated Unix workstations.

A/UX places significant demands on a Mac. The minimum A/UX 3.0 configuration
needed to run MAPMAKER (as well as System 7 and most other Mac programs) will take up over 60 megabytes (Mb) of disk space (a full A/UX installation requires 160Mb, although you will likely not need all of these features). Fortunately, it is possible to load A/UX (and MAPMAKER) onto a second external disk drive.

A/UX requires 8Mb of memory, although 16Mb is preferable for running MAPMAKER on typical data sets. A/UX only runs on MacII and better class machines (and original MacIIs will require a hardware upgrade), and A/UX will not run on PowerBooks. We have run MAPMAKER under A/UX on a Mac IIci (with a minimal A/UX configuration on an external 80Mb disk, leaving about 20Mb free) and on a Quadra 700 with 230Mb of disk (full setup, leaving about 100Mb free). Both have 20Mb of memory and Radius monitors and video cards, as well as third-party disk drives (both worked, although the Quadra was noticeably faster). We cannot vouch for any other configuration, so consult your Apple dealer (Classic-II's, LC-II's and IIsi's are probably not a good idea, both because they have no math coprocessors, and because they have other performance bottlenecks internally).

Most third party hardware is compatible, although you should check with the vendor. Notorious for compatibility problems are some Ethernet boards and a few third party CD-ROM drives (in particular, those with NEC mechanisms).

A/UX is available directly from Apple to US Customers (1-800-795-1000) for $649, and comes with one year of free phone support. A/UX is also
available (at a somewhat lower price actually) from authorized Apple dealers, both inside and outside of the US. A/UX comes on a CD-ROM, and thus a CD-ROM drive is required to install it (although you do not need the CD-ROM to subsequently run A/UX – you can simply borrow a CD-ROM drive to do the installation). A/UX is also available pre-installed on new Macs. Installing A/UX will require you to back up all of your files, as it must re-initialize your hard disk (although, if you have multiple hard disks, it needs only to reinitialize the disk that A/UX is installed on). The entire installation process took us an afternoon.

MAPMAKER for A/UX is sent on 3-1/2 inch high-density (1.4MB) Mac floppy disks. You will need a Mac with this type of drive to install MAPMAKER. Of course, this does not have to be the Mac you eventually run MAPMAKER on, if you have some other way of transferring the files. MAPMAKER is distributed as an executable program -- you do NOT need a compiler to install it.

MAPMAKER is a text based program which runs using a standard terminal window (including the A/UX CommandShell application, which runs under A/UX's System 7 Finder). In principle, you can use one A/UX Mac to serve an entire lab, with other Macs or PCs acting as terminals, connected to the A/UX Mac either using Ethernet or a standard serial lines - consult your computer support people or Apple dealer for details. MAPMAKER does not require the use of MacX or A/UX's X-Windows implementation, although it will work with it.
MAPMAKER draws graphic images in the standard PostScript (Level 1) format. These PostScript files should print as-is on any PostScript printer, such as an Apple LaserWriter NTR (A/UX prints to LaserWriters via AppleTalk, which can be shared with other Macs as usual). They will not print on an non-PostScript laser-printer (including the Apple LS) or on an ImageWriter. We do not presently provide software to view these graphics on the screen or to paste these graphics into other Mac software.

(5) LICENSE AGREEMENT

The MAPMAKER package, including both the MAPMAKER version 3.0 and MAPMAKER/QTL version 1.1 programs, all associated files, source code, and documentation (herein referred to collectively as MAPMAKER) are distributed under the following license terms at no charge. Installation of the program on any computer or any use of the program implies that the user and the user's organization (herein referred to as "you") agree to the following terms:

(1) Warranty, or lack thereof: These programs are provided on an "as is" basis, with no warranty of any type, including warranty of suitability for any particular purpose or ability to function correctly on any type of computer. No technical support can be guaranteed.

(2) Right to Use: You are provided with a license to use MAPMAKER for "basic
research purposes" as defined by the Whitehead Institute for Biomedical Research. Generally speaking, most mapping efforts are considered "basic research" unless the sale of either mapped markers or (putative) genes or the sale of mapping services using the MAPMAKER programs is involved. Also generally speaking, the sale of particular lines or strains developed through the indirect use of the MAPMAKER programs is granted. Commercial groups should consult us as to the specific the legalities covering the use of MAPMAKER for their project(s). We will work out licensing such efforts on a case by case basis, and our intention is to see such agreements worked out and to do so quickly.

(3) Redistribution Rights: The Whitehead Institute grants you permission to copy MAPMAKER, both for distribution to individuals within your organization and to those outside the organization. However, all of the software, files, and documentation must be provided and the software must be copied in its entirety preserving, among other things, copyright notices, credits, and license agreement. (One reason behind this is that MAPMAKER and MAPMAKER/QTL are a synchronized distribution, and only versions of the software, documentation, and other files delivered together from the Whitehead Institute are guaranteed to work with each other.) You may charge a small fee for the media and the physical act of copying the software and documentation, not to exceed US$250, but all persons who receive the software do so under this license
agreement alone and thus you may not charge for the software itself or restrict any recipient's right to further distribute the version you give to them.

(4) Modification Rights: The Whitehead Institute grants you permission to modify MAPMAKER and to distribute modified versions, both to individuals within your organization and to those outside your organization. However, you must (a) preserve all of the original copyright notices, license agreement, and credits in both the software and documentation, (b) add your own notice, making it immediately apparent upon running the program that it's a modified version, (c) include the unmodified version in its entirety (as described above) along with the modified version; (d) distribute the modified version under the same licensing conditions as the original (e.g. under this agreement); and (e) notify us in writing that you are distributing a modified version and provide us with full source code to the modified version immediately upon request. These restrictions may be waived in some cases by The Whitehead Institute -- contact us for details. Note that this agreement prohibits selling even modified versions of the MAPMAKER package without our permission. Modified versions of MAPMAKER distributed for internal use only within a specific organization are not subject to terms (c), (d), and (e), above.

Other software may be included with MAPMAKER, which may have its own copyrights and license restrictions. Check the documentation for details.
GNU READLINE AND GHOSTSCRIPT

GNU Readline is a product of the Free Software Foundation (FSF) which allows other programs to include advanced command line editing features. We compile GNU Readline into the MAPMAKER/EXP and MAPMAKER/QTL executables for Sun workstations and for A/UX. If you retrieve and compile the MAPMAKER source code on a Unix computer, you may, at your option, also compile GNU Readline in. The GNU Readline source we use (included with the MAPMAKER source available by FTP) has been very slightly modified from the current FSF-distributed version: we have sent these modifications on to The Free Software Foundation in the hope that they will be included in a future release. GNU Readline does not at present work on PC's.

We also distribute portions of the Free Software Foundation's GhostScript package with MAPMAKER (for DOS and Sun computers) in the hope that it will help provide screen display of PostScript graphic output generated by MAPMAKER and MAPMAKER/QTL, including maps and LOD-score plots. GhostScript also provides drivers for non-PostScript printers and other devices. We cannot provide any general support for the use of GhostScript -- how you get the PostScript files displayed or printed is a technical problem your computer support people can help you address. We include only portions of the GhostScript package strictly for disk-space reasons: the complete FSF distribution is available
with the MAPMAKER source code available by FTP (or from the FSF's server, prep.ai.mit.edu).

Redistribution and use of Free Software Foundation packages is covered by a separate copyright and license agreement from that described above -- this file is named COPYING and is included with MAPMAKER in the GSCRIPT or "GhostScript" directory. Like the MAPMAKER license, it allows free distribution of the FSF software but prohibits its sale. Note that MAPMAKER and MAPMAKER/QTL themselves are NOT covered by the FSF's copyright or license agreement.

We thank the Free Software Foundation for doing such an excellent job in developing freely distributed programming tools. We also make extensive use of the GNU C compiler and debugger (gcc/gdb) and GNU Emacs editor, tools which have certainly made the development of the MAPMAKER programs much easier for us.

(7) WHERE TO GO FROM HERE

In the previous pages, we described in general terms what the MAPMAKER packages do and what you need to run them. If you now chose to use these programs (and you agree to the license terms!), the next sections of the MAPMAKER documentation describe in detail how to install the program on your computer and how to use it. After you have installed the software, we suggest that you first open the manuals to the tutorial sections (for both MAPMAKER and...
MAPMAKER/QTL) and try out the analyses it describes on the sample data sets, included on the computer. A separate section describes how exactly to get your own data into MAPMAKER, which you of course should read to make real use of MAPMAKER and MAPMAKER/QTL. Finally, to learn about more advanced features than those described in the tutorials, a reference section is provided, which you can read on paper or via the on-line "help" commands.

If you fetched the MAPMAKER programs off of the Internet, some (not all) of the documentation is included in text files. The files include:

<table>
<thead>
<tr>
<th>File</th>
<th>Manual Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>READ.ME</td>
<td>Release notes (this document)</td>
</tr>
<tr>
<td>COVER.ME</td>
<td>Cover letter from Eric Lander</td>
</tr>
<tr>
<td>INSTALL.ME</td>
<td>Installation guide</td>
</tr>
<tr>
<td>FEED.ME</td>
<td>Data preparation guide</td>
</tr>
<tr>
<td>CHANGE.ME</td>
<td>List of changes since last release, and To-Do list</td>
</tr>
</tbody>
</table>

We do not provide the tutorials on-line. As we mentioned above, printed manuals are available for free from us if you register. Alternatively, if you need a manual, the license permits photocopying one from your colleagues.

To some extent, we may be able to provide help with MAPMAKER, if you need it. However, we strongly recommend that you ask your computer support people first, as almost all problems turn out to be system configuration issues which we really can't help you with. Also, you may be able to get help from your colleagues who are experienced with MAPMAKER. If all else fails, you should contact:
Please understand that our resources are extremely limited, and that we cannot guarantee much help.

(8) REFERENCES FOR MAPMAKER AND MAPMAKER/QTL:


A Few Examples:


How to cite MAPMAKER/EXP 3.0 or MAPMAKER/QTL 1.1:

Please use Lander et al. 1987 for MAPMAKER/EXP, and Paterson et al. 1988 for MAPMAKER/QTL. Please also cite:


Ver 3b: S. Lincoln 12/92

MAPMAKER/EXP 3.0 and MAPMAKER/QTL 1.1 Request:

Print Name
______________________________________________________________
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Title
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_______
Organization
______________________________________________________________
_______
Address
______________________________________________________________
_______
Select Either:

____ (1) Version for Sun SPARCStations Running SunOS 4.1.

____ (2) Version for IBM PC-Compatibles Running DOS 5.0.


____ (4) Manual Only (for those who retrieved the software by FTP).

All formats include 3-1/2" high density (1.44Mb) floppy disks with executable code and printed documentation. Source code is available by anonymous FTP.
Dear Colleague,

Thank you for your interest in MAPMAKER. We are currently distributing a package which includes: