Izx

Jonathan Forbes

COLLABORATORS

	TITLE : lzx		
ACTION	NAME	DATE	SIGNATURE
WRITTEN BY	Jonathan Forbes	November 11, 2024	

REVISION HISTORY

NUMBER	DATE	DESCRIPTION	NAME

Contents

Chapter 1

lzx

1.1 LZX Documentation

```
                    LZX - The New Amiga Archiver

                          Version 1.21

              Copyright © 1995 Data Compression Technologies


 Introduction
 System requirements
 Compatibility
 LHA and LZH files
 Commands
 Options
 Environment variables
 Limitations
 Suggestions
 Benchmarks
 Registration and the future
 Development Plan

 Glossary
```

1.2 Introduction

```
INTRODUCTION

LZX is a brand new data compression program developed on and for the Amiga,
sporting mind-blowing compression rates, and brain-staggering speed.

LZX is a co-development between  Jonathan Forbes  (author of the LZ and LX
archivers, as well as the commercial Bulletin Board Software package
Xenolink), and  Tomi Poutanen .

LZX uses compression technology that is absolutely state of the art, and
offers a compression/performance ratio superior to that of all other programs
```

for the Amiga, as well as to all programs for MS-DOS.

1.3 About Jonathan

ABOUT JONATHAN

Jonathan is 22 years of age, and is a fourth year Computer Engineering student
at the University of Waterloo. The Computer Engineering curriculum is a
continuous 5 year co-op programme (no holidays) including 6 four month terms
of employment and the standard 4 academic years.

Jonathan has worked on contract for Communications Canada, where he developed a
real-time head and eye tracking software library, and for Northern Telecom for
16 months, where he was involved with the development of Northern Telecom's
Meridian IVR (Interactive Voice Response) Fax Response software.

Jonathan was born in the United Kingdom, but moved to Canada in 1986, where
he abandoned his BBC Microcomputer 32K for an Amiga 1000. In 1988 he learned
C, and in 1989 he learned 68000 assembly language, and he has participated
heavily in the evolution of Amiga data compression programs ever since; see
the archiver chronology for details.

Jonathan is the author of the Lhunarc LZ and LX compression programs, as
well as Xenolink, the commercial Bulletin Board Software package.

Jonathan currently owns an Amiga 3000 with a 35 MHz 68040 card (and not much
else), and his original Amiga 1000.

1.4 About Tomi

ABOUT TOMI

Tomi is a Finnish citizen currently residing in Canada. He was born into a
Swedish speaking family in Finland in 1972. Besides Finland and Canada, Tomi
has lived in Germany, Austria, Kuwait, Cameroon and the U.S. He emmigrated
to Canada in 1985 and has resided in Toronto ever since.

Tomi is a fourth year Computer Engineering student at the University of
Waterloo. As part of the co-operative work programme, he has worked for
Reuters, Honeywell, and as a Software Design Engineer and a Program Manager
for Microsoft.

Since its inception, LZX has been developed simultaneously on the Amiga and
the PC. The compression related research was conducted by both Jonathan and
Tomi in portable C, and once complete, was separated for the two platforms.
Jonathan is responsible for development on the Amiga platform, and Tomi is
responsible for the PC platform.

As of the release of this Amiga version, Tomi is trying to negotiate the
hardships of the MS-DOS platform, such as the 64K segments and the lack
of usable RAM. The Amiga has proved to be a much more efficient and flexible
platform to develop under. As a result, the PC version is several months

behind, requires the development of new technology, and as a result, may
ultimately have to sacrifice performance to operate efficiently under the
platform restrictions. Fortunately, the Win95 and WinNT platforms have
overcome the aforementioned shortcomings and as a consequence, the archiver
will first be built around Win32 technology, while providing a DOS
decompressor. A DOS archiver will follow at a later date.

For development, Tomi uses a 486/50DX2 with 24 MB RAM running Windows NT
3.51.

1.5   System Requirements

SYSTEM REQUIREMENTS

LZX will run on an Amiga with any 680x0 CPU and AmigaDOS 1.2 or later,
although it prefers AmigaDOS Release 2 or later. If running on AmigaDOS
1.2 or 1.3, LZX will attempt to open arp.library to emulate functionality
missing from the early versions of AmigaDOS; if arp.library is then not
available, some functionality will be missing from LZX.

By default, LZX requires approximately 500K of RAM to archive files, and this
includes the size of the LZX executable and the stack. To decompress files,
LZX requires approximately 175K of RAM, and this also includes the size of
the LZX executable and the stack. LZX's command line options allow it to be
configured to use less memory , however.

Three versions of LZX are provided, to support the 6 different CPU's in the
Motorola 680x0 series. Each version has been hand-crafted to provide optimal
performance for two particular CPUs.   More CPU Info

1.6   More information on CPU dependent versions of LZX

CPU INFO

Versions are provided for the 68000/68010, the 68020/68030, and the
68040/68060, and are named LZX_68000EC, LZX_68020, and LZX_68040,
respectively. In addition, only the 68000/68010 version supports AmigaDOS
1.3; the 68020/68030 and 68040/68060 versions do not.

Users with a 68000 or 68010 CPU can run only the 68000/68010 version, while
users with a 68020-68060 CPU can run any version if they have AmigaDOS
Release 2 or later. LZX has been carefully hand-crafted for each CPU;
performance will be degraded somewhat if running a version not optimised for
your CPU.

Unlike most programs which provide CPU depdendent versions, LZX was designed
around the instruction set of the 68020-68060, which required that the
68000/68010 version be specially written to use only 68000/68010 instructions.

The 68000/68010 version has all of the functionality of the other versions,
but receives the "EC" (economy) designation to identify it as being somewhat
different internally. The 68000/68010 version runs a little more slowly than

the other versions, but not much more slowly.

1.7   arp.library

ARP.LIBRARY

The arp.library was created by individuals as part of the AmigaDOS Resource
Project (but not affiliated with Commodore in any way) for AmigaDOS Release 1
(versions 1.2 and 1.3). Its intent was to provide additional functionality
not present in AmigaDOS at that time, including the developer-friendly
wildcarding functions and date<->string functions that LZX uses.

All of these features (and more) were added in AmigaDOS Release 2, making
arp.library redundant there. However, for users running AmigaDOS 1.2 or 1.3,
arp.library provides very useful functionality for software developers.

1.8   Missing functionality due to lack of arp.library

MISSING FUNCTIONALITY

If running AmigaDOS 1.2 or 1.3 and arp.library is not present, LZX will not
support wildcarding or directory recursion. For example, the following
commands would not work:

lzx a cdir.lzh c:#?
lzx -x -r a test.lzh #?.info

1.9   Lower memory usage

LOWER MEMORY USAGE

The -bi and -bo options allow one to set LZX's input and output buffer
sizes, respectively, and the -w parameter allow one to specify LZX's work
directory, which defaults to "T:", which is usually assigned to "RAM:T".

Portions of LZX are currently being improved to use significantly less
memory.

1.10   Glossary

GLOSSARY

Glossary of terms and archiving programs:

 ARJ
 Compression
 Compression ratio

```
CRC
Decompression
File merging
Lharc (Amiga)
LHARC (DOS)
LharcA
LhA (Amiga)
LHA (DOS)
Lhunarc
LX
LZ
LZX
PKZIP
```

1.11   ARJ (DOS)

ARJ

ARJ is an archiving program for MS-DOS. Its main attractions are its huge
array of features, and easy-to-use implementation of multi-volume archiving.

It is generally slower and less compressive than PKZIP.

There is no ARJ archiver for the Amiga, although there is an UNARJ program
which can decompress ARJ archives.

Author: Robert Jung

1.12   Compression

COMPRESSION

The process by which data is represented in a more compact fashion by
eliminating redundancies.

1.13   Compression ratio

COMPRESSION RATIO

There are two popular ways of representing a compression ratio as a
percentage; either as the size of the input divided by the size of the
output (times 100), or as 100% minus the aforementioned ratio.

LZX uses the former method, since it is more intuitive; if a file has
a compression ratio of 35%, then it was compressed to 35% of its
original size. A program which didn't compress at all will have a
compression ratio of 100%.

Note that programs such as LZ and LhA use the second type of ratio, so a
file which compressed to 35% of its original size would be represented

by a compression ratio of 65%.

1.14   CRC

CRC

CRC stands for Cyclic Redundancy Check, and is generally superior to a
checksum for checking data integrity. LZX uses a 32-bit CRC for greater
error detection, rather than the 16-bit CRC used by the LHA programs.

1.15   Decompression

DECOMPRESSION

Decompression is the process of converting compressed data back into its
original form.

1.16   File merging

FILE MERGING

File merging is a feature of LZX which enables compression to be increased,
often very significantly, by allowing data from one file to be compressed
using the knowledge of previous files in the archive. This feature, unique to
LZX on the Amiga, often improves compression by 300% or more!   Example

This feature is very useful when compressing text files and source files,
where there is often a large amount of text common to many files.   Example

There is also a significant advantage to this feature when compressing
a large number of small files, since the data overhead of re-starting
compression for each file is now removed. This is particularly true when
compressing ".info" files.   Example

Even decompression time is improved, since there is now much less compressed
data to procress.

There are only minor disadvantages to file merging, which appear when deleting
files from a merged group, or extracting only some (but not all) files from a
merged group.

To see the advantages of file merging first-hand, try recompressing the LZX
distribution archive with LZX; LZX will compress the three executables (for
the 68000/68010, 68020/68030, and 68040/68060) down to a tiny size because
they are fairly similar.

1.17   File merging disadvantages

FILE MERGING DISADVANTAGES

When extracting only some files (but not all) from a merged group, all of the
files in the merged group up to the last one to be extracted, must be
decompressed internally. Luckily, LZX is obscenely quick at decompressing
files, so this is not a significant setback.   Example

When deleting files from a merged group, the whole group must be decompressed
internally, and the files which are not to be deleted must be recompressed.
Deleting a small file from a very large merged group can be time consuming,
which is why LZX, by default, limits the maximum size of a merged group.

1.18   Deleting from a merged file group

EXAMPLE OF DELETING FROM A MERGED FILE GROUP

Assume that the following files were merged into a single group within the
archive:

File1
File2
File3
File4

In order to delete File3, the whole group (File1, File2, File3, File4) would
have to be decompressed internally, and then File1, File2, and File4 would
be recompressed. The decompression and recompression (if necessary) is
performed transparently by LZX when deleting from archives.

1.19   File merging example

EXAMPLE OF FILE MERGING

For example, in the archive "XPRZ31.LHA" (xprzmodem.library, version 3.1),
4 versions of the xprzmodem.library are distributed, comprising a total
of 90932 bytes:

* One for the 68000/68010 with AmigaDOS Release 1.x
* One for the 68000/68010 with AmigaDOS Release 2.x
* One for the 68020-68040 with AmigaDOS Release 1.x
* One for the 68020-68040 with AmigaDOS Release 2.x

While LhA 1.50r compresses these four files to 52985 bytes, LZX compresses
all four to an unbeliveable 17148 bytes, only marginally more than the
12758 bytes it took to compress just one of the four files. This is due to
LZX's ability to transparently look for compressible data across multiple
files, before adding them to an archive.

1.20   File merging example

EXAMPLE OF FILE MERGING

For example, all of the header (".h") files in the SAS/C 6.5x include
directory, comprising 980K of data, compress to 345K with LhA 1.50r, and to
254K with LZX.

1.21   File merging example

EXAMPLE OF FILE MERGING

For example, when compressing the icons as part of the Magic Workbench
distribution, LhA 1.50r compresses 352K of icon data to 90K, while LZX
compresses the data down to 62K.

1.22   PKZIP (DOS)

PKZIP

PKZIP is an archiving program for MS-DOS. Its main attractions are its
speed and good compression. It has long been the market leading program for
DOS.

InfoZip, a PKZIP-compatible archiver, is available for the Amiga, as is
Unzip, a decompressor for ZIP files.

Author: Phil Katz (PKWare Inc.)

1.23   LHARC (DOS)

LHARC

LHARC is one of the original archiving programs for DOS. LHARC compression
is supported on the Amiga in the form of the "-lh1-" compression format,
which is supported by Lharc, LZ, LX, and LhA.

The second version of LHARC was renamed LHA.

Author: Haruyasu Yoshizaki

1.24   Lharc

LHARC (Amiga)

Lharc was the first program to support the -lh1- (LZH) format on the Amiga,
and started the rapid move away from .arc and .zoo files. Although Lharc was

later superseded by other compatible utilities, it deserves credit as the
first LZH program for the Amiga.

Author: Paolo Zibetti

1.25   LhArcA

LHARCA

LhArcA is an archiving program supporting the -lh1- (LZH) format. When
released, it was far faster than its only competition, Amiga Lharc. It was
later supplanted in its position by LZ.

Author: Stefan Boberg

1.26   LHA (DOS)

LHA

LHA is the second version of LHARC for DOS. The LHA format is supported
on the Amiga in the form of the "-lh5-" compression modes supported by LZ,
LX, and LhA.

Most popular compression programs in use today were originally based on the
source code or ideas of "AR002" (an LHA compatible program), although most
programs have advanced since then.

Author: Haruyasu Yoshizaki

1.27   LhA

LHA

LhA is an archiver for the Amiga, supporting both the -lh1- (LZH) and -lh5-
(LHA) compression formats.

Since its inception in late 1991, LhA has been the fastest archiver for -lh1-
and -lh5- files, although it was supplanted by LX in 1993 for the fastest
decompression of these files.

Author: Stefan Boberg

1.28   Lhunarc

LHUNARC

Lhunarc is a decompressor for -lh1- (LZH) files, and was the first program

to provide high speed decoding (for that era) on the Amiga. Lhunarc was the
precursor to LZ 0.80.

Author: Jonathan Forbes

1.29 LX

LX

LX is a decompression only utility, supporting both the -lh1- (LZH) and -lh5-
(LHA) compression formats.

LX's claims to fame are a small code size (16K) (ideal for installation
applications), asynchronous disk i/o (ideal for floppy drive applications),
and fast decompression (the fastest available for LZH or LHA files).

Author: Jonathan Forbes

1.30 LZ

LZ

LZ is an archiver for the Amiga, supporting both the -lh1- (LZH) and -lh5-
(LHA) compression formats. It was the first program for the Amiga to support
the -lh5- format.

When it was first released in early 1990, LZ was far faster and more
compressive than its competition, Lharc and LharcA, and retained this position
throughout its development history, until the end of 1991.

Author: Jonathan Forbes

1.31 LZX

LZX

LZX is the latest and greatest archiver for the Amiga. LZX is the most
compressive utility available, sporting some revolutionary new ideas in data
compression technology. It also decompresses data faster than any other
popular Amiga program, including LX and LhA.

Authors: Jonathan Forbes and Tomi Poutanen

1.32 Archiver chronology

ARCHIVER CHRONOLOGY

The chronology of the popular archivers is most interesting, consisting of
programs continuously improving in performance and in compression. To date,
all programs which became popular on the Amiga originated on the PC. It would
be quite the irony if the PC port of LZX, an Amiga program, took over from the
market leaders of the PC!

```
Program name    Platform    Date     Formats  Author(s)

PKZIP 1.x       DOS       ?Q 1989 ZIP1     Phil Katz
Lharc 1.x       DOS       2Q 1989 LH1      Haruyasu Yoshizaki
Lharc 0.50      Amiga     3Q 1989 LH1      Paolo Zibetti
Lhunarc 0.90    Amiga     1Q 1990 LH1      Jonathan Forbes
LharcA          Amiga     1Q 1990 LH1      Stefan Boberg
LZ 0.80         Amiga     2Q 1990 LH1      Jonathan Forbes
LHA 2.02a       DOS       4Q 1990 LH1,LH5  Haruyasu Yoshizaki
ARJ 1.x         DOS       4Q 1990 ARJ      Robert Jung
LZ 1.80         Amiga     1Q 1991 LH1,LH5  Jonathan Forbes
ARJ 2.x         DOS       3Q 1991 ARJ      Robert Jung
LhA 1.00        Amiga     4Q 1991 LH1,LH5  Stefan Boberg
PKZIP 2.x       DOS       4Q 1992 ZIP2     Phil Katz
LX 1.00         Amiga     1Q 1993 LH1,LH5  Jonathan Forbes
LZX 1.00        Amiga     1Q 1995 LZX      Jonathan Forbes and Tomi Poutanen
```

1.33 Commands

COMMANDS

LZX supports commands standard on most Amiga archivers.

Entering "LZX" by itself from the command line provides a list of available
commands and options (Example).

Each option will have one or two letters beside it in parentheses; either
"(ax)", "(a)", or "(x)". These denote whether the option is used when
archiving and extracting, only when archiving, or only when extracting,
respectively. Note that in this case, archiving means adding, updating,
freshening, or replacing.   Example

Command Descriptions

```
 a   Add file(s) to archive
 af  Fast add file(s) to archive
 c   Concatenate archive(s)
 d   Delete file(s) from archive
 e   Extract file(s) from archive
 f   Freshen file(s) in archive
 l   List file(s) in archive
 p   Print file(s) in archive to screen
 r   Replace file(s) in archive
 t   Test file(s) in archive
 u   Update file(s) in archive
```

```
v   List file(s) in archive [Verbose]
x   Extract file(s) from archive [With full path]
```

1.34   Example command line display

```
LZX 1.00 (Evaluation) Archive/Extract utility – 68040/68060 Version
Copyright © 1995 Data Compression Technologies.  All rights reserved.
Commercial use of this unregistered program is prohibited

Usage: LZX [-<options>] <command> <archive> [<file>...] [<destdir>]

<command>:
  a  Add file(s) to archive            r    Replace file(s) in archive
  d  Delete file(s) from archive       t    Test file(s) in archive
  e  Extract file(s)                   u    Update file(s) in archive
  f  Freshen file(s) in archive        v[n] List file(s) [verbose]
  l  List file(s) [terse]              x    Extract file(s) with full path

<options>:
 -a (ax) Preserve file attributes     -q (ax) Configure console output
 -bi(ax) Set input buffer size (Kb)   -r (a ) Recurse into subdirectories
 -bo(ax) Set output buffer size (Kb)  -R (ax) Collect archives recursively
 -c (ax) Confirm files/archives       -s (a ) Add only files with no A bit
 -C ( x) Clear arc (A) bit on extract -S (a ) Set A bit on added files
 -e (a ) Archive empty directories    -u (ax) Make file names upper case
 -E ( x) Touch extracted files        -U (ax) Set update rate (Kb)
 -f (ax) Ignore filenotes             -w (a ) Set work directory
 -F (ax) Fast progress display        -x (a ) Preserve path names
 -k ( x) Keep partial extractions     -X (ax) Control .LZX suffixing
 -l (ax) Make file names lower case   -y (a ) Store files with ratio >= x%
 -m (ax) Disable interactivity        -Y (a ) Compress archives
 -M (a ) Set merge group size limits  -0 (a ) Store files
 -o (ax) On or after date (yyyy/mm/dd) -1 (a ) Fast compression
 -O (ax) On or before date (yyyy/mm/dd) -2 (a ) Default compression
 -p (ax) Pause after loading          -3 (a ) Maximum compression
 -P (ax) Set task priority            -- (ax) Stop further option parsing
```

1.35   Example

For example, the "-C" option (Clear arc (A) bit on extract) has "(x)"
beside it, indicating that the option is meaningful only when extracting
(or testing) files.

The "-1" option (Fast compression) has "(a)" beside it, indicating that
it is meaningful only when compressing files.

The "-P" option (Set task priority) has "(ax)" beside it, meaning that
it is meaningful both when extracting and when compressing.

1.36   Option Usage

OPTION USAGE

LZX options may be specified anywhere on the command line, and begin with the
dash (-) character. The option letter(s) and any optional parameter(s) should
follow the dash character.

Example   Comment

LZX a testfile.lzx dh0:test   No options

LZX -x x testfile.lzx   -x option

LZX x -x testfile.lzx   -x option (same effect as above)

LZX x testfile.lzx -x   -x option (same effect as above)

LZX -bi32 x testfile.lzx   -bi option with parameter "32"

LZX -x -a0 a testfile.lzx dh0:test -x and -a0 options

LZX a -x testfile.lzx dh0:test -a0 -x and -a0 options (same as above)

Since LZX allows options to appear anywhere on the command line, the following
command could be considered ambiguous: "LZX a testfile.lzx -testfile2". In
this case one is actually trying to add a file which has a name starting with
the dash (-) character. LZX would take "-testfile2" to be the "-t" option
with "estfile2" as a parameter.

To solve this problem, the double dash (--) option exists; LZX will not parse
any options on the command line after a double dash. To correctly perform
the above command, one would use: "LZX -- a testfile.lzx -testfile2". The
double dash, like any other option, can be placed anywhere on the command
line, but must appear before the "-testfile2" parameter.

1.37 Options

COMMAND LINE OPTIONS

 Option usage
 Option descriptions

1.38 Option Descriptions

 -a   Preserve file attributes
 -bi   Set input buffer size
 -bo   Set output buffer size
 -c   Confirm files/archives
 -C   Clear arc (A) bit on extract
 -e   Archive empty directories

```
-E     Touch extracted files
-f     Ignore file notes
-F     Fast progress display
-k     Keep partially extracted files
-l     Make file names lower case
-m     Disable interactivity
-M     Set maximum merge group size
-o     On or after date (yyyy/mm/dd)
-O     On or before date (yyyy/mm/dd)
-p     Pause after loading
-P     Set task priority
-q     Set quiet mode
-Qf    Faster compression
-r     Recurse into subdirectories
-R     Collect archives recursively
-s     Add only files with no arc (A) bit
-S     Set arc (A) bit on added files
-u     Make file names uuper case
-U     Set console update rate
-w     Set work directory
-x     Preserve path names
-X     Control '.LZX' suffixing
-y     Store files with ratio > x%
-Y     Compress archives
-0     Store all files
-1     Fast compression
-2     Default compression
-3     More compression
-9     Maximum compression
```

1.39   Preserve file attributes

'-a' - PRESERVE FILE ATTRIBUTES

If this option is enabled, LZX will store (when archiving) and restore (when extracting) file attributes .

This option is ENABLED by default. To disable it, enter '-a0' on the command line. When this option is disabled, files added to, or extracted from archives will have the '----rw-d' attributes.

In order to ensure that file attributes are properly preserved, preservation of file attributes must be active both when the files were archived and when they are extracted.

File attributes will be properly preserved and translated across all platforms for which LZX is available.

Note that by default LZX will clear the archive attribute ('a') for any file extracted; enter '-C0' on the command line to disable this feature.

VALIDITY

This option is valid with the following commands:

```
   a (add)
   e (extract)
   f (freshen)
   r (replace)
   u (update)
   x (extract)
```

1.40   Set input buffer size

'-bi' - SET INPUT BUFFER SIZE

This option sets LZX's input buffer size. The input buffer size affects decompression only.

The input buffer size determines the amount of compressed data which LZX will read from disk at one time. For example, if the input buffer size were 8K, then LZX would read compressed data from disk 8K at a time.

Larger buffer sizes yield faster performance, but require more memory. The default buffer size is 64K, which is quite sufficient for almost all systems. Users with exceptionally fast CPU's and hard drives may wish to increase the buffer size further, while users with much slower CPU's and hard drives can probably lower the buffer size without significantly affecting performance.

VALIDITY

This option is valid with the following commands:

```
   e (extract)
   t (test)
   x (extract)
```

1.41   Set output buffer size

'-bo' - SET OUTPUT BUFFER SIZE

This option sets LZX's output buffer size. The output buffer size affects both compression and decompression performance.

DECOMPRESSION

For decompression (extraction), the output buffer size determines the amount of data which LZX will buffer in memory before writing to disk; for example, if the output buffer size were 8K, then LZX would write decompressed data to disk in 8K pieeces.

Because of the way in which decompression is done, using a larger output buffer will always improve the speed of decompression (up to the point where the buffer size equals the size of the largest file or solid file group;

increasing the input buffer size beyond this size will have no effect on
speed).

Buffer sizes as low as 8K are generally quite inefficient and should be used
only when the amount of available memory is very low. Buffer sizes above
256K are highly excessive. LZX's default output buffer size is 64K.

COMPRESSION

For compression (archiving), the output buffer size determines the amount of
compressed data which LZX will buffer in memory before writing to disk. For
example, if the output buffer size were 8K, then LZX would write compressed
data to disk 8K at a time.

Larger buffer sizes yield faster performance, but require more memory. The
default buffer size is 64K, which is sufficient for most systems. Increasing
the output buffer size can have a significant positive effect on compression
time, if you can spare the extra memory.

VALIDITY

This option is valid with the following commands:

    a (add)
    e (extract)
    f (freshen)
    r (replace)
    t (test)
    u (update)
    x (extract)

1.42 Confirm files

'-c' - CONFIRM FILES

If this option is enabled, LZX will ask for confirmation for operation on
any file or archive.

For example, if extracting files with a command such as
'lzx -c x archive.lzx', then LZX will prompt you for each file in the archive
'archive.lzx', asking whether you wish to extract the file; for example:

  Extract 'testfile'? (Yes/No/All/Quit):

In response to the question, you may enter 'Y' (extract the file), 'N' (do
not extract the file), 'A' (extract all further files in this archive), or
'Q' (quit extracting from this archive).

If operating on multiple archives, LZX will also prompt for which archives
should be operated on; for example, if the command 'lzx -c x *.lzx' was used
(which tells LZX to extract files from all archives ending in '.lzx') then
you might be confronted with something similar to the following:

```
Extract files in ARCHIVE 'testarc.lzx'? (Yes/No/All/Quit): n
Extract files in ARCHIVE 'johns_archive.lzx'? (Yes/No/All/Quit): y
  Extract 'file001'? (Yes/No/All/Quit): n
  Extract 'testing'? (Yes/No/All/Quit): n
  Extract 'hello.txt'? (Yes/No/All/Quit): y
```

Note that when extracting from multiple archives, there are two levels of
prompts; the prompts which ask whether any files should be extracted from a
particular archive (the 'archive prompt'), and the prompts which ask which
files to extract from that archive (the 'file prompt').

If at a 'file prompt', the 'A' (extract all) and 'Q' (quit) commands affect
only the current archive; these responses would cause all files from the
current archive to be extracted, or quit processing of the current archive,
respectively.

If at an 'archive prompt', the 'A' (extract all) prompt will cause LZX to
assume a 'Y' (yes) response for all further archives. However, you will
still receive the 'file prompt' for files in these archives. Entering 'Q'
(quit) will cause LZX to terminate immediately.

This option is disabled by default.

VALIDITY

This option is valid with the following commands:

```
    a (add)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)
```


1.43   Clear arc (A) bit on extract

'-C' - CLEAR ARCHIVE BIT ON EXTRACT

If this option is enabled, LZX will unset the archive ('a') protection bit
for all files extracted. This feature is provided for use with hard drive
backup programs, which assume that any file with the archive protection bit
has not been changed since the last backup.

This option is ENABLED by default; therefore, by default, the archive
protection flag is not preserved on extraction even if the '-a' option is
used.

To disable this option, enter '-C0'.

VALIDITY

This option is valid with the following commands:

```
e (extract)
x (extract)
```

1.44   Archive empty directories

'-e' - ARCHIVE EMPTY DIRECTORIES

If this option is enabled, LZX will archive empty directories. An empty
directory is a directory with no files or subdirectories in it.

This option is disabled by default; empty directories will not be added to
archives.

VALIDITY

This option is valid with the following commands:

```
a (add)
f (freshen)
r (replace)
u (update)
```

1.45   Touch extracted files

'-E' - TOUCH EXTRACTED FILES

If this option is enabled, LZX will set the file modification date of all
extracted files to the current date and time.

This option is useful if you perform hard drive backups using the file date
as an indicator of whether has been changed, as opposed to using the archive
('a') protection bit.

This option is disabled by default.

VALIDITY

This option is valid with the following commands:

```
e (extract)
x (extract)
```

1.46   Ignore filenotes

'-f' - IGNORE FILENOTES

If this option is enabled when compressing, then LZX will not store filenotes
in the archive. If enabled when extracting, then LZX will not restore
filenotes to the extracted files.

There is no need to disable filenotes, even if archiving for other platforms;
if the other platform does not support filenotes, LZX (on the other platform)
will simply ignore the filenote.

This option is disabled by default.

VALIDITY

This option is valid with the following commands:

    a (add)
    e (extract)
    f (freshen)
    r (replace)
    u (update)
    x (extract)

1.47   Fast progress display

'-F' - FAST PROGRESS DISPLAY

If this option is enabled, then LZX will not output a line feed (ASCII 10)
on the console after each file has been compressed or decompressed. Since
scrolling the display can take a substantial amount of time (often more than
the amount of time required to compress or decompress the file, for small
enough files or fast enough CPU's!) this option can greatly decrease the
time required for LZX to perform its operations.

LZX will still emit line feeds when listing the archives processed, so that
all processed archives can be seen.

If errors occur on any file, LZX will emit a line feed for that file so that
its information remains visible.

This option is disabled by default, but is highly recommended.

VALIDITY

This option is valid with the following commands:

    a (add)
    e (extract)
    f (freshen)
    r (replace)
    t (test)
    u (update)

```
   x (extract)
```

1.48 Keep partially extracted files

'-k' - KEEP PARTIALLY EXTRACTED FILES

This option causes LZX to keep as much as it can of files which are only
partially extracted. A file may be partially extracted because of a
corrupted archive, a disk full error, or a user abort.

VALIDITY

This option is valid with the following commands:

```
   e (extract)
   x (extract)
```

1.49 Make file names lower case

'-l' - MAKE FILE NAMES LOWER CASE

This option causes all file names to be converted to lower case.

If adding files to archives, the names of all files added will be stored in
lower case. If extracting from archives, all files will be extracted using
lower case file names. If viewing or listing archives, all files will be
shown as having lower case file names even if this is in fact not the case.

VALIDITY

This option is valid with the following commands:

```
   a (add)
   e (extract)
   f (freshen)
   l (list)
   r (replace)
   t (test)
   u (update)
   v (view)
   x (extract)
```

1.50 Disable interactivity

'-m' - DISABLE INTERACTIVITY

This option causes LZX to not prompt for the response to a question; instead,
LZX will default to a sensible response.

When LZX would normally prompt asking whether a file should be overwritten,
this option will cause the answer to automatically be "yes".

This option is enabled automatically if LZX detects that standard input is
not interactive (for example, if it is run in the background).

VALIDITY

This option is valid with the following commands:

    a (add)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)

1.51   Set maximum merge group size

'-M' - SET MAXIMUM MERGE GROUP SIZE

This option sets the maximum size of a merged file group when adding files
to an archive. This sets an upper limit on the amount of file data that can
be merged together.

The only reason a maximum merge group size exists is to prevent the
situation where one may wish to delete or update one file in a very large
merged group (e.g. 10 MB of merged files). Since all undeleted data must
be compacted (recompressed) after a deletion, it is advantageous to make
the merged group size not too large. On the other hand, if the merged group
size is too small, then compression suffers.

The default merged group size is 260K. The minimum allowable is 8K, and the
maximum allowable is just over 8000K (8 Megabytes).

The parameter to this option is specified in 1000's of bytes (not 1024); for
example, -M500 would specify a maximum merged group size of 500,000 bytes.

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    f (freshen)
    r (replace)
    u (update)

1.52   On or after date (yyyy/mm/dd)

'-o' - ON OR AFTER DATE

This option puts a date constraint on the files on which LZX will operate;
LZX will ONLY operate on any files which have a modification date equal to or
later than that specified as a parameter to this option, in the form
"yyyy/mm/dd".

For example, if extracting files and using the option "-o 1994/04/20", then
only files which have a modification date on or after April 4, 1994 in the
archive will be extracted.

Similarly, if adding files to an archive, only files with a date on or after
the one supplied as a parameter wlil be added.

This option works in conjunction with other constraints, so the command
"LZX -o 1994/01/01 x test.lzx *.c" would extract from the archive "test.lzx"
all files which had the extension ".c" AND which also had a modification date
of January 1, 1994 or later.

If updating, freshening, or replacing files already existing in an archive,
then the "on or after" date refers to the date of the physical file, rather
than the date of the file in archive.

As a sidenote, the format of the date parameter was chosen as "yyyy/mm/dd"
because this format is unambigious; European countries all use different date
formats, which are often different from those used in North America and the
rest of the world.

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)

1.53   On or before date (yyyy/mm/dd)

'-O' - ON OR BEFORE DATE

This option puts a date constraint on the files on which LZX will operate;
LZX will ONLY operate on any files which have a modification date equal to or
before than that specified as a parameter to this option, in the form
"yyyy/mm/dd".

Otherwise, this option behaves in an analagous fashion to the -o
(On or after date) option.

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)

1.54   Pause after loading

'-p' - PAUSE AFTER LOADING

This option causes LZX to pause and wait for the user to press a key, after
it has loaded. This feature is provided for users with floppy drive systems
only, who may wish to swap disks before allowing LZX to start operating.

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)

1.55   Set task priority

'-P' - SET TASK PRIORITY

This option sets the priority of the LZX process for the duration of its
running. The priority may be any value from -127 to +127, although only
values between -5 and +5 should be used.

The higher the priority, the more CPU time will be used by LZX. Because
of the way in which the Amiga's process priority system works, and because
LZX is very processor intensive, setting LZX to a high priority will probably
stop (or at least slow to a very slow crawl) any lower priority processes.

The one time LZX does not use much CPU is when it is waiting for disk i/o to
complete (from an actual physical disk; RAM drives do not count).

By default LZX inherits its task priority from the shell it was run from.

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)

1.56 Set quiet mode

'-q' - SET QUIET MODE

This option tells LZX to not output anything to standard output. Two modes
are supported:

'-q 0' - Normal output (the default)
'-q 1' - Disable all output

Entering '-q' as an option is equivalent to entering '-q 1', which disables
all LZX output to the console.

1.57 Faster compression

'-Qf' - FASTER COMPRESSION

[REGISTERED VERSION ONLY]

The '-Qf' option causes LZX to increase the speed of compression, without
affecting the degree of compression. Of course, this option has a price;
it also causes LZX to use 32K more RAM.

The '-Qf' option doesn't improve compression speed for all files; text
files, for example, generally see little improvement in speed, while
Amiga executables compress about 5% faster.

1.58   Recurse into subdirectories

'-r' - RECURSE INTO SUBDIRECTORIES

This option is used in conjunction with wildcarding, and causes LZX to search
all subdirectories (in addition to the current directory) for matching
file names (and directories, if applicable).

Note that the '-x' (preserve path names) option is automatically enabled when
the '-r' option is used. If you do not wish to preserve path names, enter
the '-x0' option after '-r' on the command line.

VALIDITY

This option is valid with the following commands:

    a (add)
    f (freshen)
    r (replace)
    u (update)

1.59   Collect archives recursively

'-R' - COLLECT ARCHIVES RECURSIVELY

This option causes LZX to recurse into subdirectories (in addition to the
current directory) to look for matching archives.

For example, to view all files ending in ".h" in all LZX archives in the
current directory and its subdirectories, one would type:
"LZX -R v #?.lzx #?.h".

To add the file "MYBBS.ADV" to all LZX archives in the current directory and
its subdirectories, one would type: "LZX -R a #?.lzx MYBBS.ADV".

Similarly, to delete the file "zzzendpad.foo" from all LZX archives in the
current directory and its subdirectories, one would type:
"LZX -R d #?.lzx zzzendpad.foo"

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)

```
    x (extract)
```

1.60   Add only files with no arc (A) bit

'-s' - ADD ONLY FILES WITH NO ARC (A) BIT

This command causes LZX to add only files without the arc (A) protection bit.

This option is useful for performing incremental backups, and is most often used in combination with the -S (Set A bit on added files) option.

VALIDITY

This option is valid with the following commands:

```
    a (add)
```

1.61   Set arc (A) bit on added files

'-S' - SET ARC (A) BIT ON ADDED FILES

This option causes LZX to set the A protection bit on all files which are added to an archive.

This option is used primarily in incremental hard drive backups, and is most commonly used with the -s (add only files with no arc (A) bit set) option.

VALIDITY

This option is valid with the following commands:

```
    a (add)
```

1.62   Make file names upper case

'-u' - MAKE FILE NAMES UPPER CASE

This option causes all file names to be converted to upper case.

If adding files to archives, the names of all files added will be stored in upper case. If extracting from archives, all files will be extracted using upper case file names. If viewing or listing archives, all files will be shown as having upper case file names even if this is in fact not the case.

VALIDITY

This option is valid with the following commands:

```
a (add)
e (extract)
f (freshen)
l (list)
r (replace)
t (test)
u (update)
v (view)
x (extract)
```

1.63 Set console update rate

'-U' - SET CONSOLE UPDATE RATE

This option sets the update rate of the console when compressing data
(archiving files, or compacting a merged file group when deleting files);
LZX will update the console each time the supplied number of Kilobytes is
compressed. Due to LZX's file merging, it currently uses a percentage
display to update the console, but the calculation of when to update the
console is still perform in bytes.

LZX checks the CPU on your system to set the default rate to something
sensible for your system, be it a 68000 or a 68060.

As mentioned previously, the parameter should be specified in Kilobytes.
For example "-U4" will cause LZX to update the display for each 4K of
data compressed.

This parameter only affects the update rate for encoding; the update rate for
decoding is determined solely by the output buffer size.

VALIDITY

This option is valid with the following commands:

```
a (add)
d (delete)
f (freshen)
r (replace)
u (update)
```

1.64 Set work directory

'-w' - SET WORK DIRECTORY

This option specifies the work directory of LZX. The work directory is used
to hold temporary files when adding, updating, freshening, replacing, or
deleting files from archives.

The default work directory is "T:", which is usually assigned logically to
"RAM:T". For systems with a small amount of memory, there may not be enough
memory to compress data using "RAM:T" as the work directory. This can also
be the case if compressing very large files.

The name of the work directory supplied must end in either a colon (:) or a
slash (/); if it does not, LZX will complain.

VALIDITY

This option is valid with the following commands:

       a (add)
       d (delete)
       f (freshen)
       r (replace)
       u (update)

1.65   Preserve path names

'-x' - PRESERVE PATH NAMES

This option tells LZX to preserve the full path name (excluding the device
name) of any file added to (if adding) or extracted from (if extracting)
the archive. This is useful if one wishes to preserve a complete directory
structure.

By default this option is not set. In order to preserve the directory
structure, this option must be used both when creating the archive, and when
extracting it.

This option is set automatically when the '-r' (recurse into subdirectories)
option is used; to use '-r' without activating this option (preserve path
names), enter '-x0' after the '-r' on the command line; i.e. "-r -x0".

VALIDITY

This option is valid with the following commands:

       a (add)
       e (extract)
       f (freshen)
       r (replace)
       u (update)
       x (extract)

1.66   Control '.lzx' suffixing

'-X' - CONTROL '.LZX' SUFFIXING

This option tells LZX to append '.lzx' to an archive name if it does not
already end in '.lzx'.

This option is enabled by default; that is, the following command will add
the file 'somefile' to 'myarc.lzx': "lzx a myarc somefile".

To disable this behavior, use the -X0 option. For example, the following
command will add 'somefile' to 'myarc': "lzx -X0 a myarc somefile".

VALIDITY

This option is valid with the following commands:

    a (add)
    e (extract)
    f (freshen)
    l (list)
    r (replace)
    t (test)
    u (update)
    v (view)
    x (extract)

1.67   Store files with ratio > x%

'-y' - STORE FILES WITH RATIO > X%

This option causes LZX to store files which have a compression ratio of
greater than the specified percentage. For example '-y95' would cause LZX to
store all files which compressed to 95% or more of their original size.

Specifying a number greater than or equal to 100 makes no sense; LZX will
always store any file which compressed to more than its original size.

This option is a carry-over from the other Amiga archivers which often
decompress poorly compressed files very slowly. LZX is very fast at
decompressing any type of file, but it must be said that decompressing
a stored file is quicker (it's all disk i/o and very little CPU usage;
for a stored file, the disk i/o will be the bottleneck).

Note that merged file groups are treated as one file for all intents and
purposes; therefore, the whole merged group will be stored if the
compressed group is greater than the group's combined original size.

VALIDITY

This option is valid with the following commands:

    a (add)
    d (delete)
    f (freshen)
    r (replace)

```
   u (update)
```

1.68   Compress archives

'-Y' - COMPRESS ARCHIVES

This option forces LZX to compress files which are known by their extension
to already be compressed. By default, LZX will simply store these files
without attempting to compress them, the reason being that attempting to
compress one of these types of files yields very little (invariably 0-3%)
in the way of additional compression.

The following file extensions are treated as indicating an archive:

AIN ARC ARJ DMS GIF HAP JPG LHA LHW LZH LZX PAK PP RAR UC2 WRP ZAP ZIP ZOO

Additional file extensions will be added as more archive types become
available.

VALIDITY

This option is valid with the following commands:

```
   a (add)
   u (update)
```


1.69   Store all files

'-0' - STORE ALL FILES

This option causes LZX to store (i.e. not compress) all new files added to an
archive. This option is useful if one wishes to make use of LZX only as an
archiving tool, rather than as a compressive tool.

If updating an archive, existing files will be recompressed with whatever
compression mode they were originally compressed.

VALIDITY

This option is valid with the following commands:

```
   a (add)
   u (update)
```


1.70   Fast compression

'-1' - FAST COMPRESSION

This option causes LZX to use its "fast compression" mode; this mode is
completely output compatible with LZX's other compression modes, except that
the compression parameters have been tweaked to favour speed over
compression.

The loss in compression is not very significant; usually about 1-2%.

VALIDITY

This option is valid with the following commands:

   a (add)
   u (update)

1.71 Default compression

'-2' - DEFAULT COMPRESSION

This option causes LZX to use its "default compression" mode; this mode is
completely output compatible with LZX's other compression modes. In this
case, the compression parameters have been selected to provide a fairly
optimal balance between compression speed and degree of compression.

VALIDITY

This option is valid with the following commands:

   a (add)
   u (update)

1.72 More compression

'-3' - MORE COMPRESSION

This option causes LZX to use its "more compression" mode; this mode is
completely output compatible with LZX's other compression modes. In this
case, the compression parameters have been tweaked to provide a greater
degree of compression at the expense of speed.

This option provides the maximum amount of compression available on the
evaluation version of LZX; however, the registered version's -9
(Maximum compression) option provides still better compression.

VALIDITY

This option is valid with the following commands:

```
   a (add)
   u (update)
```

1.73 Maximum compression

'-9' - MAXIMUM COMPRESSION

[68020/68030 and 68040/68060 REGISTERED VERSIONS ONLY]

This option causes LZX to use its "maximum compression" mode; this mode is
completely output compatible with LZX's other compression modes. In this
case, the compression parameters have been tweaked to provide the maximum
possible compression, at the complete and utter expense of speed.

The improvement in compression from the -3 to the -9 mode is invariably
1.5 to 3 times larger than the improvement from the -2 (the default) to
the -3 mode.

However, the -9 mode is between 2 and 8 times as slow as the default
compression rate, depending on the type of file being compressed. The
decompression speed is unaffected, and is as fast as ever for files
compressed with the -9 mode.

The -9 version is provided for distribution-type applications, where the
data is compressed once (usually on a fast machine!) and is then
distributed online or on disk. The -9 mode is slow enough that it is
impractical for casual day-to-day use, but is useful when the absolute
maximum degree of compression must be attained.

Typical applications for the -9 mode are recompressing BBS file
directories to save disk space and make files smaller for users to
download; to distribute online magazines; to distribute FidoNet
nodelists; or to cram as much software as possible onto a disk.

The Benchmarks section contains test data using the -9 option.

VALIDITY

This option is valid with the following commands:

```
   a (add)
   u (update)
```

1.74 Add

'a' - ADD FILES TO ARCHIVE(S)

The add command adds one or more files to one or more archives, although
typically it is used to add files to only one archive.

If the archive specified does not already exist, it will be created.
Otherwise, files will be appended to the archive. LZX will not add files to an
archive if they are aleady present in the archive; attempting to do so will
elicit a warning message from LZX, although it will continue to add any other
files you may have specified.

By default, only the file name component of the file is stored in the archive;
that is, any preceding path name is not stored. In order to preserve the path
name as well, use the -x option. If you specify the -r option to recurse into
subdirectories, then the -x option is set automatically.

To preserve empty directories (directories containing no files or
subdirectories), select the -e option.

The -x, -r, and -e options can be used to preserve a directory structure.

  Examples

1.75 Examples of the ADD command

EXAMPLES OF THE ADD COMMAND

'LZX a myarchive.lzx testfile.txt' would add the file 'testfile.txt' to the
archive 'myarchive.lzx'. However, if 'testfile.txt' were already present in
the archive, then it would not be added. If 'myarchive.lzx' didn't exist at
the time the command was invoked, then 'myarchive.lzx' would be created as a
new archive.

'LZX a myarchive newfile.txt' would perform exactly the same operation as the
above, since LZX would automatically append the '.lzx' extension onto the
archive name 'myarchive'. To alter this behavior, the -X option can be used.

'LZX a myarchive *.txt *.doc test.tmp' would add to the archive
'myarchive.lzx' all files ending in '.txt', '.doc', and the file 'test.tmp'.

'LZX a myarchive.lzx subdir/newfile.txt' would add the file
'subdir/newfile.txt' to the archive 'myarchive.lzx'. The file would be stored
as 'newfile.txt' within the archive; that is, the 'subdir/' prefix would not
be preserved. In order to have the file stored as 'subdir/newfile.txt' within
the archive, the -x option would be required: 'LZX -x a myarchive.lzx
subdir/newfile.txt'

1.76 FastAdd

'af' - FAST ADD FILES TO ARCHIVE(S)

[REGISTERED VERSION ONLY]

The fast add command is almost identical to the add command in that it
adds one or more files to one or more archives.

The only difference is that the fast add command does not check the

existing archive (if it does already exist) for duplicate files. Therefore,
if one is not careful, one can add the same file to the archive multiple
times.

For example: lzx af test.lzx testfile
             lzx af test.lzx testfile

The above case is allowed, and will result in two "testfile" files being
in the archive. The add ('a') command, on the other hand, will not allow
a file to be added twice.

The fast add command is useful if you know that there will be no duplicate
files in the archive. This command would typically be used in a FidoNet
mail setup, where new mail packets are added to existing mail archives and
the mail packets are all guaranteed to have unique names. In this
situation, the fast add command can speed up mail processing dramatically.

1.77 Concatenate

'c' - CONCATENATE ARCHIVE(S)

[REGISTERED VERSION ONLY]

The concatenate command either appends one or more archives to an existing
archive, or creates a new archive by appending one or more archives together.

For example: lzx c dest.lzx arc1.lzx arc2.lzx

If "dest.lzx" exists, the archives "arc1.lzx" and "arc2.lzx" will be appended
to it. "arc1.lzx" and "arc2.lzx" will be unchanged.

If "dest.lzx" does not exist, it will be created, and will consist of
"arc2.lzx" appended onto "arc1.lzx". "arc1.lzx" and "arc2.lzx" will be
unchanged.

This command is provided to append compressed data from one archive to
another without having to recompress the archive.

NOTE: LZX performs no checking for duplicate files; it simply concatenates
      the archives together blindly.

1.78 Delete

'd' - DELETE FILES FROM ARCHIVE(S)

The delete command deletes files from one or more archives, although typically
it is used to delete files from only one archive.

LZX requires temporary storage in the current directory in order to condense
the remaining files in the archive.

If any of the files to be deleted were part of a merged file group, then LZX

will recompress the undeleted files in the affected groups. The files will
be recompressed using the default compression mode, or the selected one if one
is specified via one of the options '-1', '-2', '-3', or '-9' on the command
line.

1.79 Extract

'e' - EXTRACT FILES FROM ARCHIVE(S) [NO PATH PRESERVATION]

This extract command is used to extract files from an archive. It differs
from the 'x' extract command in that path names and directory structure will
not be preserved by default.

For example, if one were to extract files from an archive, and a file named
"mydir/subdir/myfile" were present in the archive, then the file 'myfile'
would be created in the current directory.

Note that using the -x1 parameter with this command causes this command to
behave in exactly the same was as the 'x' extract command.

1.80 Extract

'x' - EXTRACT FILES FROM ARCHIVE(S) [PATH PRESERVATION]

This extract command is used to extract files from an archive. It differs
from the "e" extract command in that path names and directory structure are
preserved by default.

For example, if one were to extract files from an archive, and a file named
"mydir/subdir/myfile" were present in the archive, then the file
"mydir/subdir/myfile" would be created. If the "mydir/subdir" directory did
not already exist, then it would first be created.

Note that using the -x0 parameter with this command causes this command to
behave in exactly the same was as the 'e' extract command.

1.81 Freshen

'f' - FRESHEN FILES IN ARCHIVE(S)

The freshen command freshens one or more files in one or more archives,
although typically it is used to freshen files in only one archive. The
freshening process replaces older files which already exist in the archive.
When replacing files, the 'last modification dates' of the files in the
archive are compared with those of their counterparts specified at the command
line, and the earlier modification date is assumed to represent the older
file.

As with the add command, only the file name component of the file is stored
by default. The -x or -r options should be used to preserve path names.

The freshen command is almost identical to the update command, except that
the freshen command does not add any new files to the archive; it will only
freshen existing ones. The replace command is similar to the freshen command,
except that it always replaces files in the archive, regardless of their
modification dates.

1.82 Update

'u' - UPDATE FILES IN ARCHIVE(S)

The update command updates one or more files in one or more archives, although
typically it is used to update files in only one archive. The updating
process adds files which are not yet in the archive, and replaces older files
which already exist in the archive. When replacing files, the 'last
modification dates' of the files in the archive are compared with those of
their counterparts specified at the command line, and the earlier modification
date is assumed to represent the older file.

As with the add command, only the file name component of the file is stored
by default. The -x or -r options should be used to preserve path names.

Two commands similar to update are the freshen and replace commands. The
freshen command is almost identical to the update command, except that no new
files will be added to the archive; only existing files in the archive may be
updated, depending on their last modification date. The replace command is
almost identical to the freshen command, except that all specified files are
always updated, regardless of their last modification date.

1.83 Replace

'r' - REPLACE FILES IN ARCHIVE(S)

The replace command replaces one or more files in one or more archives,
although typically it is used to replace files in only one archive. The
replacing process replaces files which already exist in the archive with
those specified at the command line.

As with the add command, only the file name component of the file is stored
by default. The -x or -r options should be used to preserve path names.

The replace command is similar to the freshen command.

1.84 Test

't' - TEST FILES IN ARCHIVE(S)

The test command is used to test the integrity of files in archives. This is
done by extracting the file data and throwing it away (i.e. no files are
created).

If no file names are specified on the command line, then all files in the
archive(s) are tested; otherwise, only the specified files are tested.

If any of the tested files are corrupted, or a problem is encountered in any
archive(s), LZX will exit with an error code.

1.85 List

'l' - LIST FILES IN ARCHIVE(S) [TERSE]

The list command is used to display the contents of archives. The list
command displays the following information for each file in an archive:

File name
Original file size
Packed file size
Compression ratio (packed/original as a percentage)
File modification date and time

In addition, similar statistics for the whole archive itself are tallied
and displayed.

Sample output might be:

Viewing archive 'testarchive.lzx':

Original Packed Ratio   Date   Time   Name
-------- -------- ----- --------- -------- -----------
  156492   78826 50.3% 10-Mar-94 22:29:14 test
  419328   164352 39.1% 19-May-93 09:25:12 book1
-------- -------- ----- --------- --------
  575820   243178 42.2% 09-Nov-94 17:17:06 2 file(s)

1 archive(s) viewed

The information under the second dotted line is for the archive itself.
For example, the archive contains a total of 575820 bytes worth of data,
compressed down to 243178 bytes, for an average compression ratio of 42.2%,
and the modification date of the archive is 09-Nov-94 17:17:06. Two files
were present the archive.

Note that one can list only some of the files in the archive, if desired;
these files can be specified on the command line, either explicitly, or as
wildcards. For example, in the above case, if one were to enter
'lzx l testarchive.lzx book1', the following would be displayed:

Viewing archive 'ram:blah.lzx':

Original Packed Ratio   Date   Time   Name
-------- -------- ----- --------- -------- -----------
  419328   164352 39.1% 19-May-93 09:25:12 book1
-------- -------- ----- --------- --------
  419328   164352 39.1% 09-Nov-94 17:17:06 1 file(s)

1 archive(s) viewed

Note that in this case, the information tallied under the second dotted line
is only for the files listed, and not for the complete archive; that is,
419328 bytes worth of uncompressed file data was listed, and this data was
compressed to 164352 bytes, for a compression ratio of 39.1%, and 1 file
was listed.

When solid file groups are present in the archive, the situation is slightly
different, as multiple files have been compressed together as if they were
one large file. In this situation, LZX estimates the compressed file size
of each of the solid files by giving it a compressed size proportional to
that of its actual size when compared to the solid group.

An asterisk will appear between the original file size and compressed file
size of any file which is a member of a solid file group, to inform you that
the packed file size is an estimated value.

1.86   Print

'p' - PRINT FILES IN ARCHIVE(S) TO SCREEN

[REGISTERED VERSION ONLY]

The print command is used to display text files stored in archives, to the
screen. For example: "lzx p archive.lzx readme.txt". This features allows
one to read "readme" and ".diz" files in archives without having to
extract the files first.

To read any "readme" type files in a newly obtained archive, one can use a
command similar to: "lzx p archive.lzx #?read#?".

If no file names are specified on the command line, then all files in the
archive(s) are printed; otherwise, only the specified files are tested. A
short banner appears before each file listed, providing its name and file
length.

This command should be used to view text files only; viewing binary files
will result in garbage being displayed to the screen. If this should
happen, a ^C (control-C) will abort the operation.

If any of the tested files are corrupted, or a problem is encountered in any
archive(s), LZX will exit with an error code.

1.87   View

'v' - LIST FILES IN ARCHIVE(S) [VERBOSE]

The view command is similar to the list command, in that it is used to display
the contents of archives. The difference is that the view command displays
more information than the list command.

There are in fact two view commands (not counting the 'list' command); the
ordinary view command ('v') and the verbose view command ('v1'). The 'v1'
command displays even more information than the 'v' command, as is explained
below.

The list command ('l') displays the following information:

File name
Original file size
Packed file size
Compression ratio (packed/original as a percentage)
File modification date and time

The view command ('v') displays the following additional information:

 File attributes
 File CRC
 Compression mode

If the verbose view command ('v1') is used, then the following additional
information is also displayed:

 Host operating system

Note that the information in the verbose view ('v1') command will not fit on
an 80 column display.

The sample output of the view command ('v') might be:

Viewing archive 'test.lzx':

Original Packed Ratio Date   Time   FileAttr CRC-32   M Name
-------- -------- ----- --------- -------- -------- -------- - -----------
  151496   76854 50.7% 15-Nov-94 02:17:15 --p-rwed 8CA65049 1 testfile
-------- -------- ----- --------- --------
  151496   76854 50.7% 15-Nov-94 02:17:21 ----rwed 1 file(s)

1 archive(s) viewed

The sample output of the verbose view command ('v1') might be:

Viewing archive 'test.lzx':

Original Packed Ratio Date   Time   FileAttr CRC-32   Host OS M Name
-------- -------- ----- --------- -------- -------- -------- ------- - -----------
  151496   76854 50.7% 15-Nov-94 02:17:15 --p-rwed 8CA65049 Amiga   1 testfile
-------- -------- ----- --------- --------
  151496   76854 50.7% 15-Nov-94 02:17:21 ----rwed 1 file(s)

1 archive(s) viewed

1.88 Host operating system

```
HOST OPERATING SYSTEM
```

In order to ensure easy transportation of files across platforms, LZX records
a Host OS (Operating System) for each file added to the archive, so that file
attributes can be translated compatibly across platforms.

LZX currently is aware of the following operating systems:

```
Amiga
MS-DOS
Windows
OS/2
UNIX
```

1.89   Compression Modes

```
LZX COMPRESSION MODES
```

LZX currently supports only one compression mode ("1"); files in LZX
archives are either compressed using this compression mode, or stored as
uncompressed data ("s").

The "-1" "-2" "-3" and "-9" compression options simply alter LZX's search
depth parameters to trade speed for degree of compression, or vice versa;
the output of the four compression modes is completely compatible.

1.90   File attributes

```
AMIGADOS FILE ATTRIBUTES
```

The following file attributes are supported by AmigaDOS and LZX:

```
h
s
p
a
r
w
e
d
```

1.91   Hidden

```
THE AMIGADOS 'HIDDEN' ('h') FILE ATTRIBUTE
```

The 'hidden' attribute is not used under AmigaDOS; setting it does not cause
files to be hidden from directory listings. In fact, the AmigaDOS 3.1
'protect' command does not recognise the 'h' bit.

1.92 Script

THE AMIGADOS 'SCRIPT' ('s') FILE ATTRIBUTE

The 'script' attribute indicates that the file is an AmigaDOS shell script
file.

1.93 Pure

THE AMIGADOS 'PURE' ('p') FILE ATTRIBUTE

The 'pure' attribute indicates that the file is residentable and re-entrant,
and can be made resident with the AmigaDOS 'resident' command, or equivalent
command if operating under a different shell.

1.94 Archived

THE AMIGADOS 'ARCHIVED' ('a') FILE ATTRIBUTE

The 'archived' attribute is used by most backup programs as a way of
determining which files have been changed since the last backup; any write
to a file with the 'a' attribute set will unset the 'a' attribute.

1.95 Readable

THE AMIGADOS 'READABLE' ('r') FILE ATTRIBUTE

The 'readable' attribute is used to indicate that a file can be read; a
file without this attribute cannot be read. Almost all files have the
'readable' attribute set.

1.96 Writeable

THE AMIGADOS 'WRITEABLE' ('w') FILE ATTRIBUTE

The 'writeable' attribute is used to indicate that a file can be written to;
a file without this attribute cannot be written to, although it can be
deleted (the 'delete' attribute must be unset in order to prevent deletion).

1.97 Executable

THE AMIGADOS 'EXECUTABLE' ('e') FILE ATTRIBUTE

The 'executable' attribute is used to indicate that the file is a binary
load file, which can be executed from the shell, for example.

1.98 Deleteable

THE AMIGADOS 'DELETE' ('d') FILE ATTRIBUTE

The 'deletable' attribute is used to indicate that a file can be deleted
using the AmigaDOS 'delete' command (or any other command or operating
system call which provides the same functionality). If the 'deletable'
attribute is not set, then the file cannot be deleted.

1.99 Limitations

LIMITATIONS

LZX's limitations are as follows:

* Path names are limited to a maximum 255 characters in length.

* The size of a single archive must not exceed 2 Gigabytes.

* The maximum number of files that can be compressed in one invocation
  is limited only by available memory.

1.100 Suggestions

SUGGESTIONS

If compression speed is your number one priority and you have large amounts
of memory to spare, then increasing the output buffer size (-bo) to a very
large size (256K+) will dramatically down on disk usage.

On the other hand, if you have a low memory situation, set the output
buffer size to a small value, such as 8K. You should also set the work
directory to something other than the default, which is "T:", since T: is
generally assigned to "RAM:".

1.101 Environment Variables

ENVIRONMENT VARIABLES

The evaluation version of LZX does not support environment variables, or
a set of environment-specified default options.

1.102 Registration and The Future

REGISTRATION AND THE FUTURE

LZX was developed over the period of approximately one and a half years. A
lot of thought went into every component of LZX, and countless brainstorming
sessions kept us up until 5 AM for weeks on end, while our university marks
nose-dived due to all of our missed classes.

A PC version of LZX is being developed in parallel with the Amiga version,
although the PC version is several months behind the Amiga version, due to
MS-DOS's numerous architectural problems. We dearly hope that LZX, an Amiga
program, will oust the market leaders on the PC, but it will be a tough
battle; PKZIP is heavily entrenched in the PC market.

The LZX project needs your support! LZX is fairly inexpensive as shareware
programs go, especially when you consider what you get:

The current (1.21r) registered versions of LZX support the following:

    Faster compression
    New "maximum compression" (-9) option
    New "faster compression" (-Qf) option
    Decompression of LHA and LZH files (25-35% faster than LhA!)
    Asynchronous disk i/o
    More options (fast add, archive concatenation)

Multi-volume archiving is under development, and will probably be included
in version 1.30r.

If you have a feature you would like added, feel free to let us know, and
drop us a line either by Email , Snail-mail , fax , or even
 telephone .

PAYMENT DETAILS

The registration fee for LZX is US$ 25, which can be paid by either cheque
or money order if in the U.S. or Canada, or by postal money order if
elsewhere. The address to send the above to is:

    Data Compression Technologies
    383 Lawrence Avenue West
    Toronto, Ontario
    M5M 1B9
    Canada

Alternatively, you may send cash; the cash may be either US$ 25, or its
equivalent at the current exchange rate to the currencies of the following
countries:

    Canada
    U.K.
    Germany
    Sweden
    Denmark

This alternative payment scheme is available so that one does not have to

make the trek down to the post office and pay an extra fee for the
creating of a money order; now all one has to do is hide cash in the
envelope and send it off.

For example, if you wished to send Canadian dollars, you would look up the
current exchange rate (currently 1 US$ ~= CDN$ 1.39) and then send the
equivalent amount (CDN$ 34.96, or CDN$ 35). Note: Only bills/notes are
accepted. Foreign coins are not accepted, because they cannot be exchanged
at a local bank.

A note about sending cash in the mail; make absolutely sure that it is
disguised; if it is not, you can bet that along the way someone will
open it and take the money out – it happens. Enclose the cash in two
pieces of non-white paper to disguise it. We cannot take responsibility
for cash lost in the mail; if you think this may happen, send a money
order instead.

To check the status of your order, you can contact the authors as described
above.

You will receive a disk with the registered versions of LZX, as well as
your personalised keyfile, which will enable you to use any of the
publicly distributed registered version archives.

1.103   Contacting the authors via Email

CONTACTING THE AUTHORS VIA EMAIL

Please Email us with your comments, questions, and suggestions!

Jonathan Forbes:
    jonathan.forbes@canrem.com   (always)
    jadforbe@electrical.watstar.uwaterloo.ca   (Jan 4 – Apr 18, 1996)

Tomi Poutanen:
    tjpoutan@elecom2.watstar.uwaterloo.ca   (Jan 4 – Apr 18, 1996)

1.104   Contacting the authors via Fax

CONTACTING THE AUTHORS VIA FAX

The authors can be faxed at the number below, which is located at the address
of Jonathan Forbes. The fax machine resides on a dedicated line, and is
available 24 hours a day. If appropriate, please indicate who the fax is for.

FAX: (416)-781-1502 (Toronto, Ontario, Canada)

1.105   Contacting the authors via Telephone

CONTACTING THE AUTHORS VIA TELEPHONE

Jonathan Forbes can be reached at the number below:

Voice: (416)-781-1501 (Toronto, Ontario, Canada: EST)

1.106   Contacting the authors via Snail Mail

CONTACTING THE AUTHORS VIA SNAIL MAIL

Please mail us your comments, questions, and suggestions!

The authors can be contacted via snail mail at the following address:

Data Compression Technologies
383 Lawrence Avenue West
Toronto, Ontario
M5M 1B9
Canada

1.107   Benchmarks

BENCHMARKS

The benchmarks were performed on the following setup:

    Amiga 3000/25
    35 MHz 68040 Accelerator
    8 Megabytes of 60 ns FAST RAM
    4 Megabytes of 80 ns FAST RAM
    2 Megabytes of CHIP RAM

The following programs were benchmarked; LZX, LhA, Shrink, and InfoZip.
Details on the programs are as follows:

    Program   Version Comments
    ========= ======= ===========
    LZX   *1.20   Best compression of all, very fast
    LhA   *1.38e   Poor compression, but very fast
    Shrink   1.1   Excellent compression, but very very slow
    InfoZip   2.0.1   Good compression, slow, but portable

* The evaluation version of LZX 1.20 for the 68040/68060 was used
* The evaluation version of LhA 1.38 was used. Since only a 68000 version
  of LhA is provided for evaluation, that was used.

All tests were performed in the RAM: drive, and all programs and files were
loaded into RAM: beforehand.

Two sets of tests were run; a single file test, and a multiple file test.
As one might guess, the single file test involves compressing only a single

file; while this nullifies the effect of LZX's file merging capability, the
results clearly demonstrate that LZX, even on single files, is far superior to
all other compression programs on the Amiga.

The multiple file test involves compressing many files at once. Here,
LZX's file merging capability allows it to compress data far more effectively
than the other programs.

One interesting result of note is borne out; not only does LZX compress
better than all other Amiga archivers, but it also decompresses faster, and,
in many cases, compresses faster!

   Single File Test
 Multiple File Test

1.108 Single File Test

SINGLE FILE TEST

Two of the files tested ("book1" and "obj2") were taken from the Calgary
Corpus, a popular benchmark for compression programs. These are a text
file and a binary object file, respectively.

Also tested was "xenomsgs" (a capture file from a BBS, consisting of
highly compressible information).

All files are sorted in order of best compression to worst compression.

[============================== "book1" ==============================]

                    (From the Calgary Corpus - text taken from a book)

                         Original size: 768771 bytes

Program	Compressed size	Compression time (s)	Decompression time (s)
*LZX-2	265870	N/A	N/A
LZX 1.20r -9	287230	33.55	0.75
LZX 1.20 -3	297568	12.11	0.77
LZX 1.20 -2	298232	11.64	0.77
LZX 1.20 -1	306744	8.75	0.77
Shrink 1.1	307320	33.61	18.63
Zip -9	312588	18.35	2.52
LhA 1.38e -2	338934	10.42	1.15

*available late 1995

[============================== "obj2" ==============================]

                        (From the Calgary Corpus - object file)

```
                          Original size: 246814 bytes

Program              Compressed        Compression       Decompression
                        size            time (s)           time (s)
------------        ---------------    ---------------    --------------
*LZX-2                  70290              N/A                N/A
LZX 1.20r -9            73431             14.24               0.26
LZX 1.20 -3             75223              2.91               0.26
LZX 1.20 -2             75959              2.44               0.26
LZX 1.20 -1             78549              2.20               0.27
Shrink 1.1             79462              6.00               5.47
Zip -9                 81170              7.04               0.72
LhA 1.38e -2           84943              3.55               0.32




[ ============================= "xenomsgs" ============================= ]

                         (Capture file from a BBS)

                          Original size: 876135 bytes

Program              Compressed        Compression       Decompression
                        size            time (s)           time (s)
------------        ---------------    ---------------    --------------
*LZX-2                 178434             N/A                N/A
LZX 1.20r -9           206909            79.07               0.67
LZX 1.20 -3            212423             9.97               0.67
LZX 1.20 -2            213681             8.99               0.67
LZX 1.20 -1            217239             7.45               0.67
Shrink 1.1            224354            19.13              15.03
Zip -9                241759            12.07               2.20
LhA 1.38e -2          301480             8.65               1.09
```

1.109 Multiple File Test

```
MULTIPLE FILE TEST
```

The files in "lha_e138.run" (the distribution archive of LhA 1.38e) were
extracted and recompressed with various archivers.

Also tested were compressing the complete INCLUDE directory of SAS/C
6.51 (C and ASM header files), and compressing the C directory of SAS/C
6.51 (containing all the compiler's command-line tools).

The appropriate commands were used for each archiver in order for it
to preserve path names and recurse into subdirectories. For LZX, the
"-M5000" option was also used to allow large merged file groups.

These results demonstrate that not only is LZX by far the most compressive
utility for the Amiga, but that it is, astoundingly, also one of the
fastest!

[=================== "LhA 1.38 Distribution Archive" ===================]

```
                    Original size: 240262 bytes

Program          Compressed       Compression       Decompression
                    size            time (s)           time (s)
------------    ---------------   -----------------   --------------
LZX 1.20r -9       87524            13.52               0.28
LZX 1.20 -3        89024             2.99               0.28
LZX 1.20 -2        89330             2.70               0.28
LZX 1.20 -1        90720             2.32               0.28
Shrink 1.1         97294             8.29               6.80
Zip -9             99905             6.53               0.84
LhA 1.38e -2      102399             3.64               0.38
```

[================== "SAS/C 6.51 Include Directory" ====================]

```
              Original size: 993828 bytes (361 *.h files)

Program          Compressed       Compression       Decompression
                    size            time (s)           time (s)
------------    ---------------   -----------------   --------------
LZX 1.20r -9      258611            81.82               1.20
LZX 1.20 -3       265233            22.74               1.20
LZX 1.20 -2       267633            20.90               1.20
LZX 1.20 -1       271915            19.46               1.20
LhA 1.38e -2      365269            23.35               2.18
Shrink 1.1        368966            40.26              29.16
```

NOTE: Zip's "-r" option was unable to recurse into all directories and
      collect only "*.h" files, so Zip has been excluded from this test.

[====================== "SAS/C 6.51 C Directory" =======================]

```
                    Original size: 1580029 bytes

Program          Compressed       Compression       Decompression
                    size            time (s)           time (s)
------------    ---------------   -----------------   --------------
LZX 1.20r -9      717950            72.32               1.95
LZX 1.20 -3       733342            20.33               1.95
LZX 1.20 -2       738318            18.08               1.95
LZX 1.20 -1       751036            16.54               1.97
Shrink 1.1        865286            55.06              61.58
Zip -9            900980            38.20               6.63
LhA 1.38e -2      909071            25.57               2.69
```

1.110 Development Plan

DEVELOPMENT PLAN

Over the past 4 months we have developed a compression algorithm far

superior to that currently in LZX. This new algorithm is appropriately
called "LZX-2", and is currently undergoing optimisation and fine tuning.
The Amiga release date of LZX-2 is 2 to 3 months away. However,
preliminary compression figures appear in the single file benchmarks
section.

We elected to not release a PC version using the currently available
LZX algorithm, but to instead wait for LZX-2 before doing so, to ensure
that when LZX debuts on the PC, it is far ahead of its competitors. The
PC version will therefore be released close to the end of the year.

1.111   Compatibility

COMPATIBILITY

Almost without exception, the output of any new compression algorithm will
be incompatible with that of existing algorithms. In some cases it is
possible to retain output compatibility by simply using a faster search
algorithm or more intelligent parser while retaining the older output
format, but the savings from doing so are generally very slight (less than
a percent). In other words, it is not possible to improve the LZH (-lh1-)
and LHA (-lh5-) algorithms to anywhere near the degree of compression
provided by LZX - in this respect, compatibility cannot be preserved.

To truly advance the state of the art, a new, incompatible compression
format must be used. LZX advances the state of the art by providing a
combination of degree of compression and speed not seen on either the
Amiga or MS-DOS platforms.

Rather than let LZX languish as an Amiga-only niche product, it is our
intent to push LZX to be the new cross-platform compression standard by
providing both a PC version and a UNIX version. (It should be possible
for a third party to port the UNIX version to the Macintosh platform,
since neither Tomi nor Jonathan has Macintosh programming experience).

1.112   Decompression of LHA and LZH files

Decompression of LHA and LZH files

[REGISTERED VERSION ONLY]

As of version 1.10r (the registered version of 1.10), LZX can decompress
".lha" and ".lzh" archives. In fact, due to its faster decompression
algorithm and asynchronous disk i/o, LZX decompresses ".lha" and ".lzh"
files 25-35% faster than LhA.

As always, the speed improvement is dependent on the CPU and hard drive
speed; your mileage will vary.