Checksum for the Macintosh

User's Manual

Version 1.3

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Introduction

Welcome to Checksum for the Macintosh, a complete file checksum program. Checksum is a program that allows anyone to quickly and easily calculate file checksums. Briefly, a checksum is a number calculated for a file by performing some operation on all the characters in the file, such as adding up all the character values and generating a total. A checksum is useful for testing the integrity of a file — the calculated checksum can either be compared against a previously calculated checksum, or the checksum can be compared against a checksum for a file on another computer. **Checksum is the easiest way to compare two files on Macintosh computers (either on the same machine or different ones), to tell if they are identical or not!** If the checksum values match, there is an extremely good chance the files are identical. The choice of checksum algorithm affects the chance that two files are identical if their checksums match.

Some of the key features of Checksum are:

- Most popular checksum algorithms are supported

- Checksum is compatible with most checksum programs on other systems, e.g., the Unix "sum" program and the POSIX.2 "cksum"

- Checksum can specially treat 'TEXT' file end-of-line characters to be compatible with Unix or MS-DOS systems

- Checksum is fully System 7 and 32 bit addressing compatible, including Apple Events, balloon help and "drag and drop"

- Checksum can calculate checksums for files, folders, volumes and even alias files

- Checksum is business-ware — free for individuals and for education, but organizations must pay if they use it

The results from Checksum are displayed in a window on the screen. Results can be copied to the Clipboard to use in other applications.

System Requirements

Checksum will run on a Mac Plus or later. System 6 or System 7 is required.

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The Status Window Display

The status window is used to display the checksum results. The status window is fully movable and resizable. The display can be scrolled if more information is present than will fit within the window. The status window can only be written by the checksum program — the keyboard cannot add to or modify its contents. However, any information in the status display window can be selected and copied to the Macintosh clipboard.

The status window will appear like:
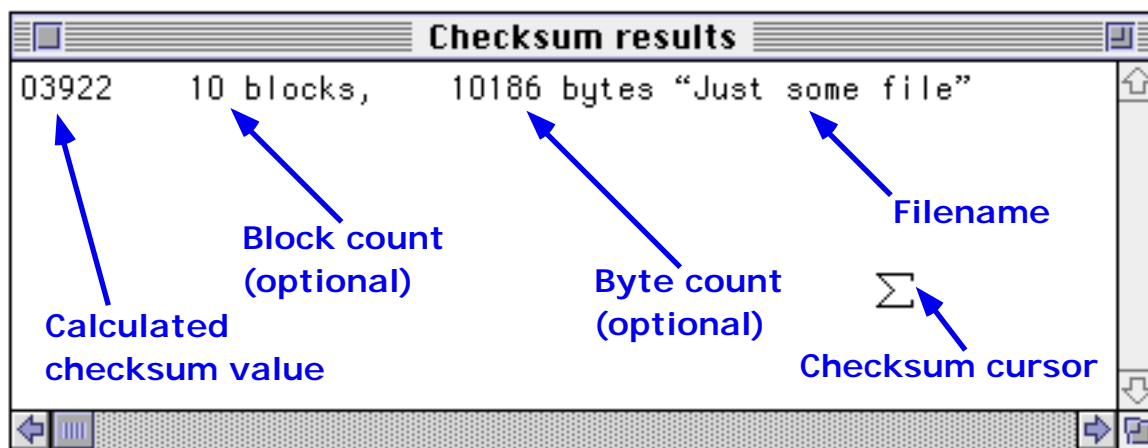
The calculated checksum value is the result as a decimal number. This is what the Checksum application calculates when a file is opened. If a CRC algorithm is used, the result is also shown as a hexadecimal (base 16) value in parentheses.

The block count is the number of blocks in the file. This field is mostly for compatibility with the Unix sum program. If the **System V** checksum algorithm is used, the block size is 512 bytes; for all other checksum algorithms, the block size is 1024 bytes.

The byte count is the number of bytes processed during the checksum calculation. Note that this may not be the same as the number of bytes in the file, depending on which file forks are selected and whether 'TEXT' file end-of-line translation is set to MS-DOS.

The file name is simply the name of the file opened.

Usage

Here are some possible ways to use Checksum:

1. Compare 2 files to determine whether they are the same or not.

Calculate the checksum for each file and compare the results. The files can be on the same system, on different disks, or on two totally different machines (possibly even in different countries). If the checksum for each file is the same, the files are probably the same.

Make sure the same checksum algorithm is used on both files. For best results, use any one of the 32-bit CRC options. Also, make sure that both **Data fork** and **Resource fork** options are selected.

Both files don't even have to be on Macintosh systems. For example, if one of the files is on a Unix system, the "sum" command can be used to calculate a checksum for one of the files.

2. Determine whether a file has changed over time.

If there is a file which may change over time, calculate the checksum for the file and permanently record the results (e.g., with the **Save As**… option). When you need to determine whether the file has changed, re-calculate the checksum for the file and compare the two calculated values.

3. Calculate the checksum for an entire directory

In the Standard File selection dialog which appears when **Open**… is selected, press the shift key. The default **Open** button will change to **Select**. A folder, volume or alias file can be selected. If a folder or volume is selected, a checksum will be calculated for every file contained in the folder or volume.

System 7 users can also drag the folder or volume icon to the Checksum application icon in the Finder. **If you have used an earlier version of Checksum, you will need to rebuild the desktop file for this feature to work.** Press the command and option keys when you restart your Macintosh to rebuild the desktop file.
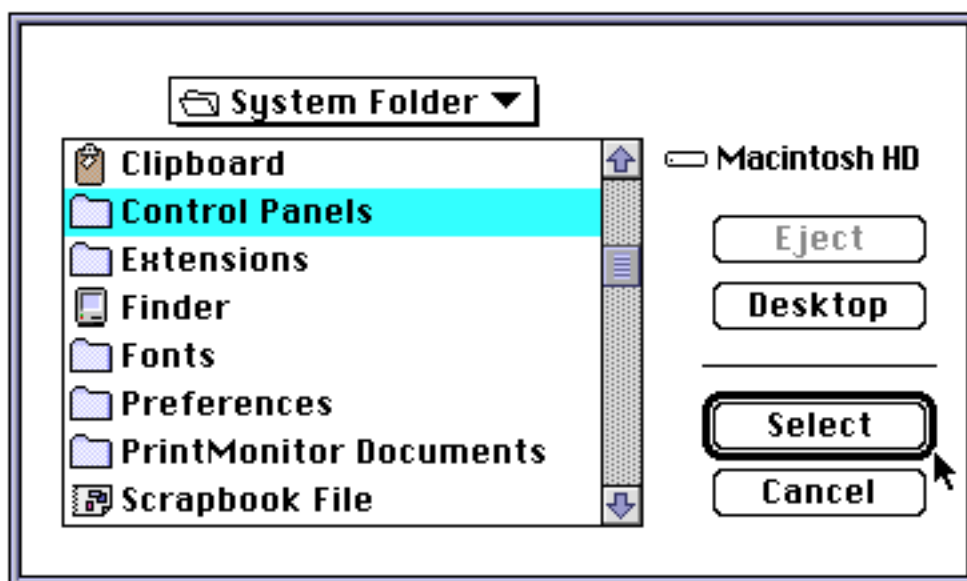
Menus

File

New ⌘N
Open... ⌘O

Close ⌘W
Save As... ⌘S
Results...

Page Setup...
Print...

Quit ⌘Q

The **File** menu contains all the commands usually associated with opening and saving files:

New will open a new status display window. Only one status display window can be open at a time.

Open… will open a file and calculate a checksum. Results are presented in the status window. A status window must be active in order to open files to calculate checksums.

Pressing the shift key will let you select a folder, volume or alias instead of the normal open action. The **Open** button will change to **Select** and allow you to select any special type of file.

📁 System Folder ▼

📋 Clipboard
📁 **Control Panels**
📁 Extensions
📲 Finder
📁 Fonts
📁 Preferences
📁 PrintMonitor Documents
📰 Scrapbook File

💾 Macintosh HD

Eject

Desktop

Select

Cancel

Close will close the status window.

Save As… will save the results in the status window to a file. The file will be a text file which can be opened by an application such as TeachText.

Results… will present a dialog which lets you determine the location and format of calculated results. Results can be saved as either reported text as in previous version, or formatted for input to spreadsheet applications.
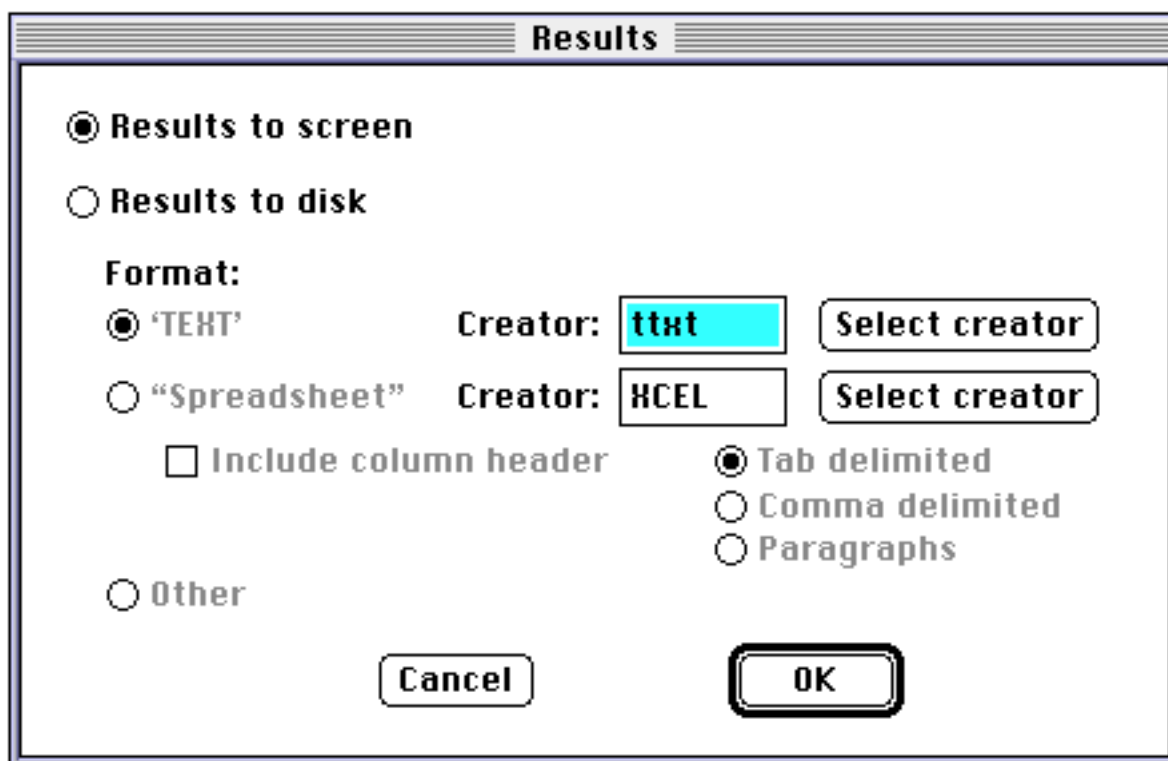
The default operation is for results to display on the screen, as in earlier versions. When "Results to disk" is selected, all calculated checksum information is saved directly to a disk file; a log of selected items is displayed on the screen. Note that there is still a 32K limit on the size of the on-screen log, which should be adequate for most applications.

Results can be save to disk in either 'TEXT' format, which is the same as in earlier versions, or in delimited fields suitable for input to a spreadsheet application. Spreadsheet column delimiters can be either tab, comma or carriage return characters.

The file creator can be specified for text and spreadsheet formatted files. The default creator for 'TEXT' files is TeachText/SimpleText (as in previous versions). The default creator for "Spreadsheet" formatted files is Microsoft Excel. The creator can be specified by either typing the 4 character creator string, or by selecting the creator application using the standard file dialog. The file type will be 'TEXT' for all files created.

The "Include column header" is not yet implemented. The "Other" disk format option is not yet implemented. They are reserved for future capabilities.

Quit will quit the Checksum application. Unsaved changes to the on-screen window can be saved before the application quits.

Page Setup… and **Print**… aren't implemented in this version of Checksum. If you need to print Checksum results, **Copy** the status window display to the clipboard, **Paste** into TeachText, a word processor or text editor, and print. Alternatively, the saved results file can be printed from another application.
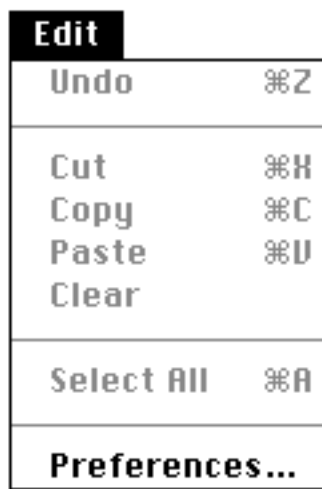
The **Edit** menu contains the commands associated with the Macintosh clipboard.

Copy will copy the selected text to the clipboard.

Select All will select all the results in the status window. The **Copy** command must still be used to copy all the text to the clipboard.

The **Preferences**… menu option provides a dialog which lets you choose specific options depending on your needs. The default settings match earlier Checksum versions.
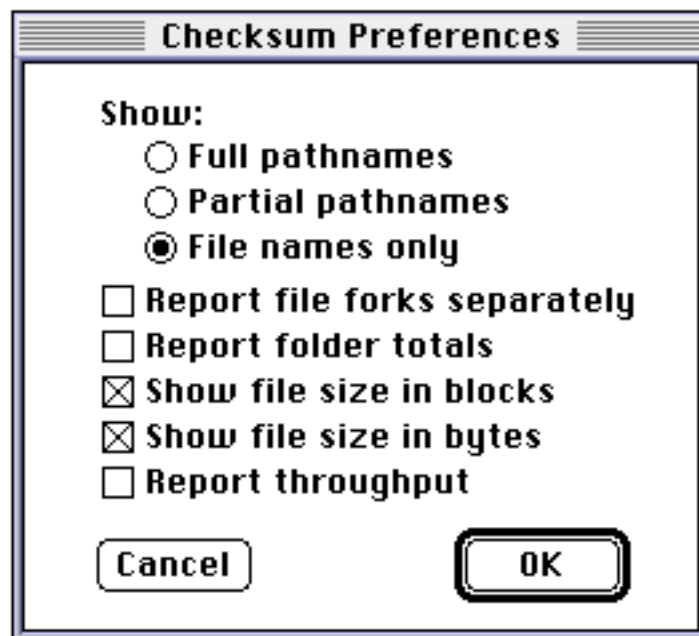
Show Full pathnames will provide the complete path description for a file, instead of just the base filename. **Partial pathnames** will display path names relative to the folder selected. **File names only** will only show the base filename as it appears in the standard open file dialog box.

Report file forks separately will calculate checksums for each file fork independently and report two separate values. Note that if **'TEXT' special** has been selected, both file forks will be reported, but only the data fork will have its end-of-line character optionally translated. The data fork is calculated before the resource fork.

Report folder totals will calculate an additional checksum for all the files in the folder as if they were concatenated together. The are combined in the order they are shown in the results.

Show file size in blocks will optionally report the block count. Similarly, **Show file size in bytes** will optionally report the number of bytes in the file. If **Report file forks separately** is selected, separate block and/or byte counts will be reported for each file fork.

Report throughput will report the approximate performance of the checksum algorithm for your system. Many factors will affect checksum throughput: processor speed, disk I/O performance, operating system and extensions, and disk cache settings. For best results, very large files will give the most accurate measurements of actual performance, but results should be averaged over a large number of files to get a meaningful measure for comparison purposes. The value reported has little worth on its own.

Undo, **Cut**, **Paste** and **Clear** are not valid menu options, but are included for compatibility with desk accessories.

```
┌─────────────────────────────┐
│ Options                     │
│   System V                  │
│ ✓ BSD                       │
│   CRC                       │
│   CRC Options        ▶      │
│   RSA MD5                   │
│ ─────────────────────────── │
│ ✓ Data fork                 │
│ ✓ Resource fork             │
│ ─────────────────────────── │
│ ✓ 'TEXT' special            │
│   End-of-line mode   ▶      │
└─────────────────────────────┘
```

The **Options** menu controls how the checksum is calculated. The default settings should provide maximum compatibility with the Unix "sum" utility.

System V will use the original AT&T Bell Labs checksum algorithm. This is not a very "strong" checksum method, i.e., the chance of identical checksums for different files is greater than for other algorithms. This algorithm is provided mainly for compatibility with System V Unix implementations.

BSD will use the checksum algorithm traditionally found on Berkeley 4.x based Unix systems (e.g., Sun OS/Solaris). On System V Unix implementations, the "**sum -r**" command will usually produce the same values as this option.

CRC will use a stronger algorithm than either the System V or BSD options. Cyclic Redundancy Check (CRC) checksums are a family of algorithms. The "**CRC Options**" submenu is active only when CRC is selected. The "**CRC Options**" submenu determines which CRC algorithm is used.
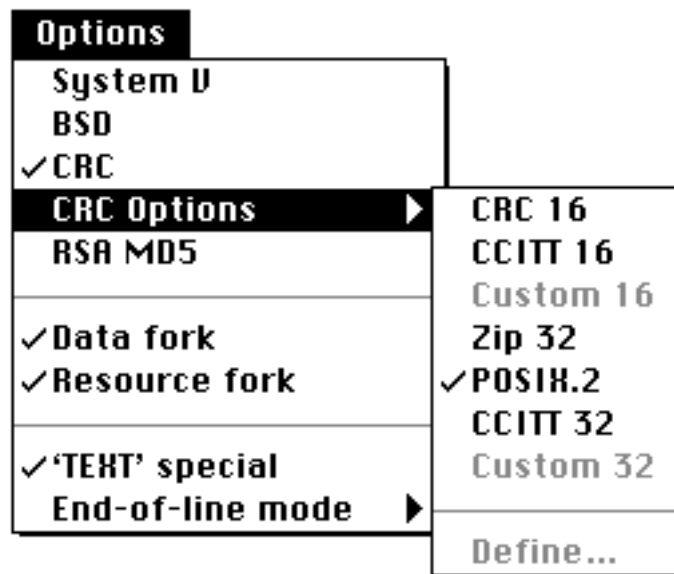
The **RSA MD5** checksum option is a complete implementation of the RSA Data Security, Inc. MD5 Message-Digest Algorithm. A message digest algorithm is a cryptographic checksum that ensures even a small change in the input file results in a large change in the calculated checksum. MD5 generates a 128-bit (16 byte) "signature" for any given file. MD5 is near the state of the art for cryptographic checksum algorithms. It is conjectured that it is computationally infeasible to produce two messages having the same message digest, or to produce any message having a given prespecified target message digest. A complete technical description of the MD5 algorithm can be found in Internet RFC 1321.

Data Fork will calculate a checksum value which includes the file's data fork.

Resource Fork will calculate a checksum value which includes the file's resource fork. For consistency between files, the Finder Information portion of the resource fork (bytes 16 to 127) is ignored in the checksum calculation.

Note: when both **"Data Fork"** and **"Resource Fork"** are selected, the file is treated as one contiguous file, with the file's data fork immediately followed by the file's resource fork. This is **not** the same as MacBinary format.

'TEXT' special determines whether files of type 'TEXT' will be treated specially. If **'TEXT' special** is selected, the Macintosh end-of-line character (carriage return, ASCII value 13, hexadecimal value 0D) will possibly be treated special for 'TEXT' files and only the data fork will be used, even if **"Resource Fork"** is selected. The end-of-line character will be treated as selected in the **"End-of-line mode"** submenu.

```
Options
  System V
  BSD
✓ CRC
  CRC Options        ▶    CRC 16
  RSA MD5                 CCITT 16
                          Custom 16
✓ Data fork               Zip 32
✓ Resource fork        ✓ POSIX.2
                          CCITT 32
✓ 'TEXT' special          Custom 32
  End-of-line mode   ▶
                          Define...
```

The **CRC Options** submenu determines which CRC algorithm is used when **CRC** is selected from the **Options** menu. Although the 32 bit CRC methods use the same polynomial, initial values are different, which accounts for different results.

CRC 16 is the 16 bit CRC algorithm found in applications such as ARC. The CRC polynomial used is: $x^{16} + x^{15} + x^2 + 1$.

CCITT 16 is the 16 bit CRC algorithm defined by the CCITT international standards group. (CCITT is the Consultive Committee for International Telephone and Telegraph — a standards organization that sets standards for worldwide voice and data communications.) The CRC polynomial used is: $x^{16} + x^{12} + x^5 + 1$.

Zip 32 is the 32 bit CRC algorithm used in the Zip, Compact Pro and Brik applications. The CRC polynomial used is:
$x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$.

POSIX.2 is the 32 bit CRC algorithm defined for use in the POSIX.2 "cksum" utility. The CRC polynomial used is:
$x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$.
The POSIX.2 CRC algorithm is slightly different from the other CRC algorithms, although the CRC polynomial is the same.

CCITT 32 is the 32 bit CRC algorithm defined by the CCITT international standards group. The CRC polynomial used is:
$x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$.

The **Custom 16**, **Custom 32** and **Define**… commands aren't implemented in this version. When implemented, they will support custom CRC calculations.

Many people has asked about the CRC calculation algorithms used in Checksum. For any CRC polynomial, four values define the calculation: the CRC polynomial

coefficients, the initial value, the byte ordering, and number of bits in the result. The following table shows the information that describes the algorithms in Checksum:

Name	Coefficients	Initial Value	Byte ordering	No. of bits
CRC 16	0xA001	0	swapped	16
CCITT 16	0x1021	-1	normal	16
Zip 32	0xEDB88320	-1	swapped	32
POSIX.2	0x04C11DB7	-1	normal	32
CCITT 32	0x04C11DB7	-1	normal	32

Coefficients is the polynomial coefficients represented as a bit-map (in hexadecimal). For example, 0xA001 is the polynomial $x^{16} + x^{15} + x^2 + 1$ (note the "+1" is always implied).

Note that the POSIX.2 algorithm differs slightly from the CCITT algorithm, even though the polynomials are the same.
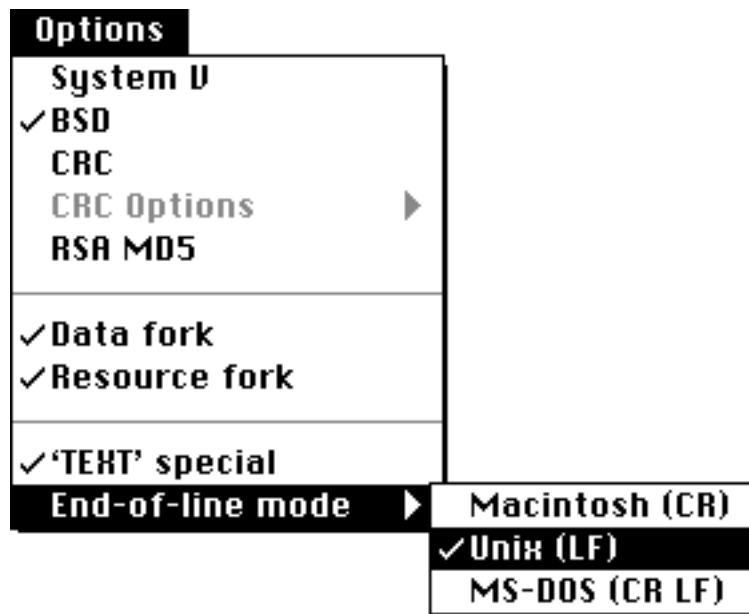
The **End-of-line mode** submenu determines how the end-of-line character (carriage return) will be treated when a 'TEXT' file is opened if "**'TEXT' special**" has been selected from the **Options** menu. This will allow 'TEXT' files transferred from another operating system to give the same checksum on the Macintosh, even though some end-of-line conversion may have taken place.

Macintosh (CR) treats the end-of-line character as is, i.e., there is no conversion.

Unix (LF) treats end-of-line characters as a newline character (decimal 10, hexadecimal 0A), instead of as a carriage return. The normal Unix end-of-line character is a line feed.

MS-DOS (CR LF) treats end-of-line characters as a carriage return and line feed pair. This is the normal MS-DOS end-of-line convention.

Version History

Version 1.0 released March 1993. Initial release.

Version 1.1 released March 1994. RDA MD5 added, Preferences for display added, improved performance slightly, all known bugs (minor) fixed, and more keyboard functions supported. There are many changes internally to support future upgrades.

Version 1.1.1 released June 1994. Two minor bugs fixed: version 1.0 preferences are now read correctly, and the application now quits properly when settings have been changed.

Version 1.2 released January 1995. This version now supports Apple Events and the ability to select folders, volumes and alias files. Several minor usability and performance improvements have been made. It now runs on System 6.0.2 and 6.0.3; the Preferences dialog now works on the Mac Plus and SE. Documentation now in PDF format.

Version 1.3 released January 1996. New features include the ability to calculate summary checksums for folders and volumes, formatted output suitable for input to spreadsheet applications, no restriction on size of results, and support for background processing.

Future enhancements

This is version 1.3 of Checksum. Depending on support and user feedback, it will be enhanced and maintained. This is still very much a work in progress and the priorities for new features depend on user feedback and support.

Some of the planned enhancements include:

PowerMac native version

Printing

Custom CRC definition and calculation

Improved user interface for results display

Better support for AppleScript

Saving calculated checksums in a reference file for automated comparison to validate file integrity.

Please send suggestions for improvements you would like to see.

If you use this software and want to see these future enhancements, please consider becoming a registered user.

Questions or Problems?

Verify that you have a good copy of the program. When you receive Checksum and do **Get Info** from the Finder's **File** menu, you should see:
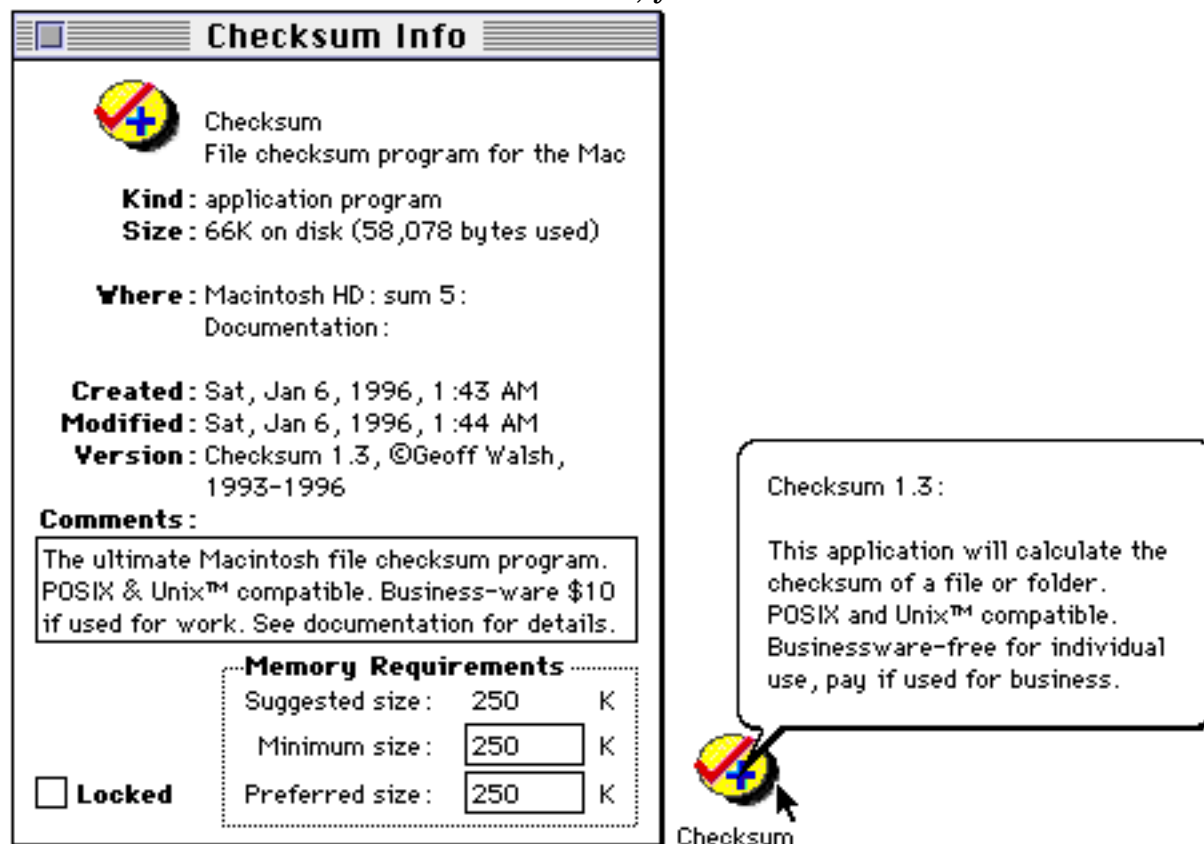
In its default configuration, Checksum version 1.3 will calculate a checksum for itself which should be:

```
41556     57 blocks,     58078 bytes "Checksum"
```

If your results don't match this, your copy has been modified and is not valid.

If you have already been using the checksum program, make sure you are using the correct configuration. Remove the "Checksum Preferences" file in your System Folder (System 6) or System Folder's Preferences folder (System 7). **Be sure to rebuild the desktop file on your Macintosh.**

Checksum has been tested on most Macintosh models running both System 6 and System 7 and is 32-bit clean. If you encounter problems, try restarting your computer will all INITs and Extensions disabled. If the problem persists, please contact me. For correspondence by U.S. mail, use:

> Geoff Walsh
> P. O. Box 10
> Malibu, CA 90265-0010

For electronic correspondence through the Internet, use: **gpw@cerf.net.**
If you want extensive support, please register your software.

Registration
Checksum for the Macintosh
Version 1.3

Thank you for your support. Be sure to register Checksum if you use it. Print this page and return with the appropriate businessware fees to: Geoff Walsh
P. O. Box 10
Malibu, CA 90265-0010

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