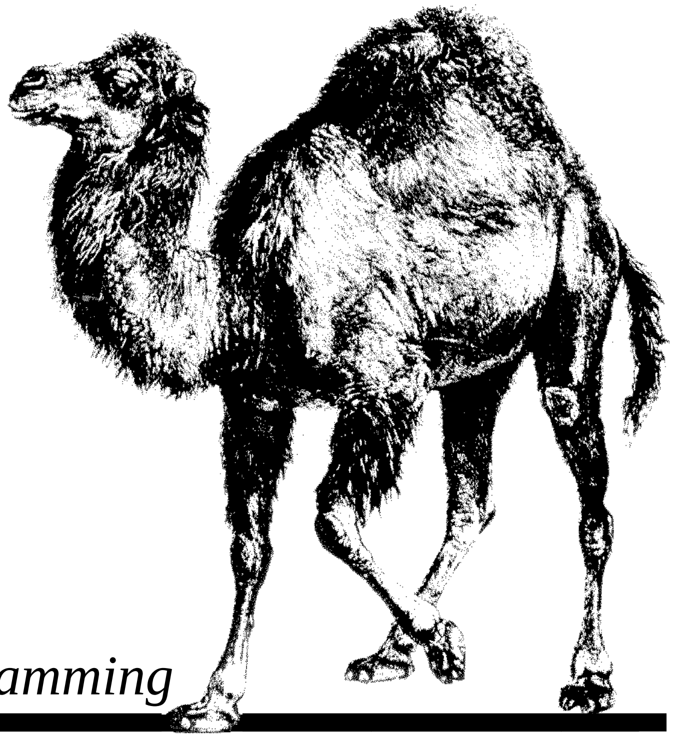
Quick Reference Guide



Programming

Perl

5 004

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Contents

Conventions

`fixed`	denotes text that you enter literally.
THIS	means variable text, i.e. things you must fill in.
THIS†	means that THIS will default to `$_` if omitted.
word	is a keyword, i.e. a word with a special meaning.
$\boxed{\text{RET}}$	denotes pressing a keyboard key.
[. . .]	denotes an optional part.

1. Command line options

−a turns on autosplit mode when used with **−n** or **−p**. Splits to **@F**.

−c checks syntax but does not execute. It does run **BEGIN** and **END** blocks.

−d [**:**DEBUGGER]
runs the script under the debugger. Use '**−de 0**' to start the debugger without a script.

−D NUMBER
sets debugging flags.

−e COMMANDLINE
may be used to enter a single line of script. Multiple **−e** commands may be given to build up a multi-line script.

−F REGEXP
specifies a regular expression to split on if **−a** is in effect.

−h prints the Perl usage summary. Does not execute.

−i EXT
files processed by the **< >** construct are to be edited in-place.

−I DIR with **−P**: tells the C preprocessor where to look for include files. The directory is prepended to **@INC**.

−l [OCTNUM]
enables automatic line ending processing, e.g. **−l013**.

−m MODULE
imports the MODULE before executing the script. MODULE may be followed by a '**=**' and a comma-separated list of items.

−M MODULE
Same as **−m**, but with more trickery.

−n assumes an input loop around the script. Lines are not printed.

−p assumes an input loop around the script. Lines are printed.

−P runs the C preprocessor on the script before compilation by Perl.

−s interprets '**−xxx**' on the command line as a switch and sets the corresponding variable **$xxx** in the script.

−S uses the **PATH** environment variable to search for the script.

−T turns on *taint* checking.

−u dumps core after compiling the script. To be used with the *undump* program (where available).

−U allows Perl to perform unsafe operations.

−v prints the version and patchlevel of your Perl executable.

−V [**:**VAR]
prints Perl configuration information.

−w prints warnings about possible spelling errors and other error-prone constructs in the script.

−x [DIR]
extracts Perl program from the input stream. If DIR is specified, switches to this directory before running the program.

−0 [VAL]
(that's the number zero) designates an initial value for the record separator **$/**. See also **−l**.

Command line options may be specified on the '**#!**' line of the perl script, except for **−M**, **−m** and **−T**.

2. Syntax

Perl is a free-format programming language. This means that in general it does not matter how the Perl program is written with regard to indentation and lines.

An exception to this rule is when the Perl compiler encounters a 'sharp' symbol (**#**) in the input: it then discards this symbol and everything it follows up to the end of the current input line. This can be used to put comments in Perl programs. Real programmers put lots of useful comments in their programs.

There are places where whitespace does matter: within literal texts, patterns and formats.

If the Perl compiler encounters the special token **`__END__`** it discards this symbol and stops reading input. Anything following this token is ignored by the Perl compiler, but can be read by the program when it is run.

3. Variables

`$var`	a simple scalar variable.
`$var[28]`	29th element of array **`@var`**.
`$p = \@var`	now **`$p`** is a reference to array **`@var`**.
`$$p[28]`	29th element of array referenced by **`$p`**. Also: **`$p->[28]`**.
`$var[-1]`	last element of array **`@var`**.
`$var[$i][$j]`	**`$j`**-th element of **`$i`**-th element of array **`@var`**.
`$var{'Feb'}`	a value from 'hash' (associative array) **`%var`**.
`$p = \%var`	now **`$p`** is a reference to hash **`%var`**.
`$$p{'Feb'}`	a value from hash referenced by **`$p`**. Also: **`$p->{'Feb'}`**.
`$#var`	last index of array **`@var`**.
`@var`	the entire array; in a scalar context, the number of elements in the array.
`@var[3,4,5]`	a slice of array **`@var`**.
`@var{'a','b'}`	a slice of **`%var`**; same as **`($var{'a'},$var{'b'})`**.
`%var`	the entire hash; in a scalar context, **true** if the hash has elements.
`$var{'a',1,...}`	emulates a multi-dimensional array.
`('a'..'z')[4,7,9]`	a slice of an array literal.
PKG**`::`**VAR	a variable from a package, e.g. **`$pkg::var`**, **`@pkg::ary`**.
`\`THINGIE	reference to a thingie, e.g. **`\$var`**, **`\%hash`**.
`*`NAME	refers to all thingies represented by NAME. '**`*n1 = *n2`**' makes **`n1`** an alias for **`n2`**. '**`*n1 = \$n2`**' makes **`$n1`** an alias for **`$n2`**.

You can always use a **`{`** BLOCK **`}`** returning the right type of reference instead of the variable identifier, e.g. **`${`**...**`}`**, **`&{`**...**`}`**. **`$$p`** is just a shorthand for **`${$p}`**.

4. Literals

Numeric: **123 1_234 123.4 5E-10 0xff** (hex) **0377** (octal).

String: **'abc'** literal string, no variable interpolation nor escape characters, except **\'** and ****. Also: **q/abc/**. Almost any pair of delimiters can be used instead of **/**.../.

"abc" Variables are interpolated and escape sequences are processed.
Also: **qq/abc/**.
Escape sequences: **\t** (Tab), **\n** (Newline), **\r** (Return), **\f** (Formfeed), **\b** (Backspace), **\a** (Alarm), **\e** (Escape), **\033**(octal), **\x1b**(hex), **\c[** (control).
\l and **\u** lowcase/upcase the following character;
\L and **\U** lowcase/upcase until a **\E** is encountered.
\Q quote regexp characters until a **\E** is encountered.

`**COMMAND**` evaluates to the output of the COMMAND.
Also: **qx/**COMMAND**/**.

Boolean: Perl has no boolean data type. Anything that evaluates to the null string, the number zero or the string **"0"** is considered **false**, everything else is **true** (including strings like **"00"**!).

Array: **(1,2,3)** a three member array. **()** is an empty array.
(1..4) is the same as **(1,2,3,4)**. Likewise **('abc'..'ade')**.
qw/foo bar ... **/** is the same as **('foo','bar',**...**)**.

Array reference: **[1,2,3]**.

Hash (associative array): **(**KEY1**,** VAL1**,** KEY2**,** VAL2**,** ...**)**.
Also: **(**KEY1 **=>** VAL1**,** KEY2 **=>** VAL2**,** ...**)**.

Hash reference: **{**KEY1**,** VAL1**,** KEY2**,** VAL2**,** ...**}**.

Code reference: **sub {** STATEMENTS **}**

Filehandles: **STDIN**, **STDOUT**, **STDERR**, **ARGV**, **DATA**.
User-specified: HANDLE, **$**VAR.

Globs: **<**PATTERN**>** evaluates to all filenames according to the pattern.
Use '**<${**VAR**}>**' or '**glob $**VAR' to glob from a variable.

Here-Is: **<<**IDENTIFIER Shell-style 'here document'.

Special tokens:
__FILE__: filename; **__PACKAGE__**: package; **__LINE__**: line number.
__END__: end of program; remaining lines can be read using filehandle **<**DATA**>**.

5. Operators and precedence

Perl operators have the following associativity and precedence, listed from highest precedence to lowest.

Assoc	Operators	Description
left	terms and list operators	See below.
left	**->**	Infix dereference operator.
	++ **--**	Auto-increment (magical on strings). Auto-decrement.
right	******	Exponentiation.
right right right	**** **! ~** **+ -**	Reference to an object (unary). Unary negation, bitwise complement. Unary plus, minus.
left left	**=~** **!~**	Binds a scalar expression to a pattern match. Same, but negates the result.
left	*** / % x**	Multiplication, division, modulo, repetition.
left	**+ - .**	Addition, subtraction, concatenation.
left	**>> <<**	Bitwise shift right, bitwise shift left.
	named unary operators	E.g. **sin**, **chdir**, **-f**, **-M**.
	< > <= >= **lt gt le ge**	Numerical relational operators. String relational operators.
	== != <=> **eq ne cmp**	Numerical equal, not equal, compare. Stringwise equal, not equal, compare. Compare operators return -1 (less), 0 (equal) or 1 (greater).
left	**&**	Bitwise AND.
left	**| ^**	Bitwise OR, exclusive OR.
left	**&&**	Logical AND.
left	**||**	Logical OR.
	..	In scalar context, range operator. In array context, enumeration.
right	**?:**	Conditional (*if* **?** *then* **:** *else*) operator.
right	**= += -= *=** etc.	Assignment operators.
left left	**,** **=>**	Comma operator, also list element separator. Same, enforces the left operand to be a string.
	list operators (rightward)	See below.
right	**not**	Low precedence logical NOT.
left	**and**	Low precedence logical AND.
left	**or xor**	Low precedence logical OR, exclusive OR.

Parentheses can be used to group an expression into a term.

A ‘list’ is a list of expressions, variables or lists, separated by commas. An array variable or an array slice may always be used instead of a list.

All Perl functions can be used as list operators, in which case they have very high or very low precedence, depending on whether you look at the left side of the operator or at the right side of the operator.
Parentheses can be added around the parameter lists to avoid precedence problems.

The logical operators do not evaluate the right operand if the result is already known after evaluation of the left operand.

6. Statements

Every statement is an expression, optionally followed by a modifier, and terminated with a semicolon. The semicolon may be omitted if the statement is the final one in a BLOCK.

Execution of expressions can depend on other expressions using one of the modifiers **if**, **unless**, **while** or **until**, e.g.:

EXPR1 **if** EXPR2 **;**
EXPR1 **until** EXPR2 **;**

The logical operators **||**, **&&**, or **? :** also allow conditional execution, e.g.:

EXPR1 **||** EXPR2 **;**
EXPR1 **?** EXPR2 **:** EXPR3 **;**

Statements can be combined to form a BLOCK when enclosed in **{}**. BLOCKs may be used to control flow:

if (EXPR**)** BLOCK [[**elsif (**EXPR**)** BLOCK ...] **else** BLOCK]
unless (EXPR**)** BLOCK [**else** BLOCK]
[LABEL**:**] **while (**EXPR**)** BLOCK [**continue** BLOCK]
[LABEL**:**] **until (**EXPR**)** BLOCK [**continue** BLOCK]
[LABEL**:**] **for (** [EXPR] **;** [EXPR] **;** [EXPR] **)** BLOCK
[LABEL**:**] **foreach** VAR† **(**LIST**)** BLOCK [**continue** BLOCK]
[LABEL**:**] BLOCK [**continue** BLOCK]

Program flow can be controlled with:

goto LABEL
: Finds the statement labeled with LABEL and resumes execution there. LABEL may be an expression that evaluates to the name of a label.

last [LABEL]
: Immediately exits the loop in question. Skips continue block.

next [LABEL]
: Starts the next iteration of the loop.

redo [LABEL]
: Restarts the loop block without evaluating the conditional again.

Special forms are:

do BLOCK **while** EXPR **;**
do BLOCK **until** EXPR **;**

which are guaranteed to perform BLOCK once before testing EXPR, and

do BLOCK

which effectively turns BLOCK into an expression.

7. Subroutines, packages and modules

SUBROUTINE [LIST]
: Executes a SUBROUTINE declared by a preceding **sub** declaration, and returns the value of the last expression evaluated in SUBROUTINE . SUBROUTINE can be an expression yielding a reference to code. In this case you can use **&${**EXPR**}** **(**[LIST]**)** or **${**EXPR**}->** **(**[LIST]**)** .

&SUBROUTINE **(** [LIST] **)**
: Executes a SUBROUTINE not neccesarily declared before being used.

bless REF [**,** CLASSNAME]
: Turns the object REF into an object in CLASSNAME. Returns the reference.

caller [EXPR]
Returns an array (**$**package,**$**file,**$**line,...) for a specific subroutine call. '**caller**' returns this info for the current subroutine, '**caller(1)**' for the caller of this subroutine etc.. Returns **false** if no caller.

do SUBROUTINE LIST
Deprecated form of **&**SUBROUTINE .

goto &SUBROUTINE
Substitutes a call to SUBROUTINE for the current subroutine.

import MODULE [VERSION] [LIST]
Imports the named items from MODULE. Checks the module for the required VERSION.

no MODULE [LIST]
Cancels imported semantics. See **use**.

package NAME
Designates the remainder of the current block as a package.

prototype NAME
Returns the prototype for this function.

require EXPR†
If EXPR is numeric, requires Perl to be at least that version. Otherwise EXPR must be the name of a file that is included from the Perl library. Does not include more than once, and yields a fatal error if the file does not evaluate to a **true** value.
If EXPR is a bare word, assumes extension '**.pm**' for the name of the file. This form of loading of modules does not risk altering your namespace.

return EXPR
Returns from a subroutine with the value specified.

sub NAME [**(** PROTO **)**] **{** EXPR **;** ... **}**
Designates NAME as a subroutine. Parameters are passed by reference as array **@_**. Returns the value of the last expression evaluated.
PROTO can be used to define the required parameters.
Without a BLOCK it is a forward declaration, without the NAME it is an anonymous subroutine. Functions that have an empty prototype and do nothing but return a fixed value are inlined.

[**sub**] **BEGIN {** EXPR **;** ... **}**
Defines a setup BLOCK to be called before execution.

[**sub**] **END {** EXPR **;** ... **}**
Defines a cleanup BLOCK to be called upon termination.

tie VAR**,** CLASSNAME**,** [LIST]
Ties a variable to a package class that will handle it. Can be used to bind a dbm or ndbm file to a hash.

tied VAR
Returns a reference to the object underlying VAR, or the undefined value if VAR is not tied to a package class.

untie VAR
Breaks the binding between the variable and the package class.

use VERSION
Requires perl version.

use MODULE [VERSION] [LIST]
Imports semantics from the named module into the current package.

Standard methods

The **UNIVERSAL** package contains the following methods that are inherited by all other classes:

isa CLASS
: Returns **true** if its object is blessed into a subclass of CLASS.

can METHOD
: Returns a reference to the method if its object has it, **undef** otherwise.

VERSION [NEED]
: Returns the version of the class. Checks the version if NEED is supplied.

8. Pragmatic modules

Pragmatic modules affect the compilation of your program. Pragmatic modules can be activated (imported) with **use**, and deactivated with **no**. These are locally scoped.

autouse MODULE **=>** SUBS
: Defers **require** until one of the subs is called.

blib [DIR]
: Used for testing of uninstalled packages.

constant NAME = VALUE
: Defines NAME to have a constant (compile-time) value.

diagnostics
: Force verbose warning diagnostics.

integer
: Compute arithmetic in integer instead of double precision.

less Request less of something from the compiler.

lib Manipulate **`@INC`** at compile time.

locale Enable POSIX locales.

ops Restrict unsafe operations when compiling.

overload
: Package for overloading Perl operators.
Example: **`use overload "+" => \&my_add;`**

sigtrap
: Enable simple signal handling.
Example: **`use sigtrap qw(SEGV TRAP);`**

strict Restrict unsafe constructs.
`use strict "refs"` restricts the use of symbolic references.
`use strict "vars"` requires all variables to be either local or fully qualified.
`use strict "subs"` restricts the use of bareword identifiers that are not subroutines.

subs Predeclare subroutine names, allowing you to use them without parentheses even before they are declared.
Example: **`use subs qw(ding dong);`**

vars Predeclare variable names, allowing you to use them under "use strict".
Example: **`use vars qw($foo @bar);`**

vmsish
: Emulate some VMS behaviour.

9. Object oriented programming

Perl rules of object oriented programming:

- An object is simply a reference that happens to know which class it belongs to. Objects are blessed, references are not.
- A class is simply a package that happens to provide methods to deal with object references.
  If a package fails to provide a method, the base classes as listed in **@ISA** are searched.
- A method is simply a subroutine that expects an object reference (or a package name, for static methods) as the first argument.
  Methods can be applied with:
  METHOD OBJREF PARAMETERS or
  OBJREF->METHOD PARAMETERS

10. Arithmetic functions

abs EXPR†
Returns the absolute value of its operand.

atan2 Y, X
Returns the arctangent of Y/X in the range $-\pi$ to π.

cos EXPR†
Returns the cosine of EXPR (expressed in radians).

exp EXPR†
Returns *e* to the power of EXPR.

int EXPR†
Returns the integer portion of EXPR.

log EXPR†
Returns natural logarithm (base *e*) of EXPR.

rand [EXPR]
Returns a random fractional number between 0 and the value of EXPR. If EXPR is omitted, returns a value between 0 and 1.

sin EXPR†
Returns the sine of EXPR (expressed in radians).

sqrt EXPR†
Returns the square root of EXPR.

srand [EXPR]
Sets the random number seed for the **rand** operator.

time Returns the number of seconds since January 1, 1970. Suitable for feeding to **gmtime** and **localtime**.

11. Conversion functions

chr EXPR†
: Returns the character represented by the decimal value EXPR.

gmtime EXPR†
: Converts a time as returned by the **time** function to a 9-element array (0:$sec, 1:$min, 2:$hour, 3:$mday, 4:$mon, 5:$year, 6:$wday, 7:$yday, 8:$isdst) with the time localized for the standard Greenwich time zone. $mon has the range 0..11 and $wday has the range 0..6.

hex EXPR†
: Returns the decimal value of EXPR interpreted as an hex string.

localtime EXPR†
: Converts a time as returned by the **time** function to *ctime*(3) string. In array context, returns a 9-element array (see **gmtime**) with the time localized for the local time zone.

oct EXPR†
: Returns the decimal value of EXPR interpreted as an octal string. If EXPR starts off with `0x`, interprets it as a hex string instead.

ord EXPR†
: Returns the ASCII value of the first character of EXPR.

vec EXPR, OFFSET, BITS
: Treats string EXPR as a vector of unsigned integers of BITS bits each, and yields the decimal value of the element at OFFSET. BITS must be a power of 2 between 1 and 32. May be assigned to.

12. Structure conversion

pack TEMPLATE, LIST
: Packs the values into a binary structure using TEMPLATE.

unpack TEMPLATE, EXPR
: Unpacks the structure EXPR into an array, using TEMPLATE.

TEMPLATE is a sequence of characters as follows:

`a` / `A`	ASCII string, null / space padded
`b` / `B`	Bit string in ascending / descending order
`c` / `C`	Native / unsigned char value
`f` / `d`	Single / double float in native format
`h` / `H`	Hex string, low / high nybble first.
`i` / `I`	Signed / unsigned integer value
`l` / `L`	Signed / unsigned long value
`n` / `N`	Short / long in network (big endian) byte order
`s` / `S`	Signed / unsigned short value
`u` / `p`	Uuencoded string / pointer to a string
`P`	A pointer to a structure (fixed-length string)
`v` / `V`	Short / long in VAX (little endian) byte order
`w` / `x`	BER compressed integer / null byte
`X` / `@`	Backup a byte / null fill until position

Each character may be followed by a decimal number which will be used as a repeat count, '`*`' specifies all remaining arguments.
If the format is preceded with `%`N, **unpack** returns an N-bit checksum instead.
Spaces may be included in the template for readability purposes.

13. String functions

chomp LIST†
Removes line endings from all elements of the list; returns the (total) number of characters removed.

chop LIST†
Chops off the last character on all elements of the list; returns the last chopped character.

crypt PLAINTEXT**,** SALT
Encrypts a string.

eval EXPR†
EXPR is parsed and executed as if it were a Perl program. The value returned is the value of the last expression evaluated. If there is a syntax error or runtime error, **undef**is returned by **eval**, and **$@** is set to the error message. See also **eval** in section 'Miscellaneous'.

index STR**,** SUBSTR [**,** OFFSET]
Returns the position of SUBSTR in STR at or after OFFSET. If the substring is not found, returns **−1** (but see **$[** in section 'Special variables').

length EXPR†
Returns the length in characters of EXPR.

lc EXPR†
Returns a lower case version of EXPR.

lcfirst EXPR†
Returns EXPR with the first character in lower case.

quotemeta EXPR†
Returns EXPR with all regexp meta-characters quoted.

rindex STR**,** SUBSTR [**,** OFFSET]
Returns the position of the last SUBSTR in STR at or before OFFSET.

substr EXPR**,** OFFSET [**,** LEN]
Extracts a substring out of EXPR and returns it. If OFFSET is negative, counts from the end of the string. If LEN is negative, leaves that many characters off the end of the string. May be assigned to.

uc EXPR†
Returns an upper case version of EXPR.

ucfirst EXPR†
Returns EXPR with the first character in upper case.

14. Array and hash functions

delete $HASH**{**KEY**}**
Deletes the specified value from the specified hash. Returns the deleted value (unless HASH is **tie**d to a package that does not support this).

each %HASH
Returns a 2-element array consisting of the key and value for the next value of the hash. After all values of the hash have been returned, an empty list is returned. The next call to **each** after that will start iterating again.

exists EXPR†
Checks whether the specified hash key exists in its hash array.

grep EXPR, LIST
grep BLOCK LIST

Evaluates EXPR or BLOCK for each element of the LIST, locally setting **$_** to refer to the element. Modifying **$_** will modify the corresponding element from LIST. Returns the array of elements from LIST for which EXPR returned **true**.

join EXPR, LIST

Joins the separate strings of LIST into a single string with fields separated by the value of EXPR, and returns the string.

keys %HASH

Returns an array of all the keys of the named hash.

map EXPR, LIST
map BLOCK LIST

Evaluates EXPR or BLOCK for each element of the LIST, locally setting **$_** to refer to the element. Modifying **$_** will modify the corresponding element from LIST. Returns the list of results.

pop [@ARRAY]

Pops off and returns the last value of the array. If @ARRAY is omitted, pops **@ARGV** in main and **@_** in subroutines.

push @ARRAY, LIST

Pushes the values of the list onto the end of the array.

reverse LIST

In array context: returns the LIST in reverse order.
In scalar context: returns the first element of LIST with bytes reversed.

scalar @ARRAY

Returns the number of elements in the array.

scalar %HASH

Returns a **true** value if the hash has elements defined.

shift [@ARRAY]

Shifts the first value of the array off and returns it, shortening the array by 1 and moving everything down. If @ARRAY is omitted, shifts **@ARGV** in main and **@_** in subroutines.

sort [SUBROUTINE] LIST

Sorts the LIST and returns the sorted array value. If SUBROUTINE is specified, gives the name of a subroutine that returns less than zero, zero, or greater than zero, depending on how the elements of the array, available to the routine as package global variables **$a** and **$b**, are to be ordered. SUBROUTINE may be the name of a user-defined routine, or a BLOCK.

splice @ARRAY, OFFSET [, LENGTH [, LIST]]

Removes the elements of @ARRAY designated by OFFSET and LENGTH, and replaces them with LIST (if specified). Returns the elements removed.

split [PATTERN [, EXPR† [, LIMIT]]]

Splits a string into an array of strings, and returns it. If LIMIT is specified, splits into at most that number of fields. If PATTERN is omitted, splits on whitespace (after skipping any leading whitespace). If not in array context: returns number of fields and splits to **@_**.

unshift @ARRAY, LIST

Prepends list to the front of the array, and returns the number of elements in the new array.

values %HASH

Returns a normal array consisting of all the values of the named hash.

15. Regular expressions

Each character matches itself, unless it is one of the special characters **+?.*^$()[]{}|**. The special meaning of these characters can be escaped using a '****'.

. matches an arbitrary character, but not a newline unless the modifier **/s** is used.

(...**)** groups a series of pattern elements to a single element.

^ matches the beginning of the target. In multi-line mode (see **m//m**) also matches after every newline character.

$ matches the end of the line. In multi-line mode also matches before every newline character.

[...**]** denotes a class of characters to match. **[^**...**]** negates the class.

(...**|**...**|**...**)** matches one of the alternatives.

(?# TEXT **)** Comment.

(?: REGEXP **)** Like **(**REGEXP**)** but does not make back-references.

(?= REGEXP **)** Zero width positive look-ahead assertion.

(?! REGEXP **)** Zero width negative look-ahead assertion.

(? MODIFIER **)** Embedded pattern-match modifier. MODIFIER can be one or more of **i**, **m**, **s** or **x**.

Quantified subpatterns match as many times as possible. When followed with a '**?**' they match the minimum number of times. These are the quantifiers:

+ matches the preceding pattern element one or more times.

? matches zero or one times.

***** matches zero or more times.

{N**,**M**}** denotes the minimum N and maximum M match count. **{**N**}** means exactly N times; **{**N**,}** means at least N times.

A '****' escapes any special meaning of the following character if non-alphanumeric, but it turns most alphanumeric characters into something special:

\w matches alphanumeric, including '**_**', **\W** matches non-alphanumeric.

\s matches whitespace, **\S** matches non-whitespace.

\d matches numeric, **\D** matches non-numeric.

\A matches the beginning of the string, **\Z** matches the end.

\b matches word boundaries, **\B** matches non-boundaries.

\G matches where the previous **m//g** search left off.

\n, **\r**, **\f**, **\t**, etc. have their usual meaning.

\w, **\s** and **\d** may be used within character classes, **\b** denotes a backspace in this context.

Back-references:

\1...**\9** refer to matched sub-expressions, grouped with **()**, inside the match.

\10 and up can also be used if the pattern matches that many sub-expressions.

See also **$1**...**$9**, **$+**, **$&**, **$`** and **$'** in section 'Special variables'.

With modifier **x**, whitespace and comments can be used in the patterns for readability purposes.

16. Search and replace functions

[EXPR **=~**] [**m**] **/**PATTERN**/** [**c g i m o s x**]

Searches EXPR (default: **$_**) for a pattern. If you prepend an **m** you can use almost any pair of delimiters instead of the slashes. If used in array context, an array is returned consisting of the sub-expressions matched by the parentheses in pattern, i.e. **($1,$2,$3,...)**.
Optional modifiers: **c** continues the previous match (use with **g**); **g** matches as many times as possible; **i** searches in a case-insensitive manner; **o** interpolates variables only once.
mlet '**^**' and '**$**' match even at embedded newline characters; **s** let '**.**' match even at embedded newline characters; **x** allows for regular expression extensions.
If PATTERN is empty, the most recent pattern from a previous successful match or replacement is used.
With **g** the match can be used as an iterator in scalar context. The iterator is reset upon failure, unless **c** is also supplied.

?PATTERN**?**

This is just like the **/**PATTERN**/** search, except that it matches only once between calls to the **reset** operator.

[**$**VAR **=~**] **s/**PATTERN**/**REPLACEMENT**/** [**e g i m o s x**]

Searches a string for a pattern, and if found, replaces that pattern with the replacement text. It returns the number of substitutions made, if any, otherwise it returns **false**.
Optional modifiers: **g** replaces all occurrences of the pattern; **e** evaluates the replacement string as a Perl expression; for the other modifiers, see **/**PATTERN**/** matching. Almost any delimiter may replace the slashes; if single quotes are used, no interpolation is done on the strings between the delimiters, otherwise the strings are interpolated as if inside double quotes.
If bracketing delimiters are used, PATTERN and REPLACEMENT may have their own delimiters, e.g. **s(foo)[bar]**.
If PATTERN is empty, the most recent pattern from a previous successful match or replacement is used.

[**$**VAR **=~**] **tr/**SEARCHLIST**/**REPLACEMENTLIST**/** [**c d s**]

Translates all occurrences of the characters found in the search list into the corresponding character in the replacement list. It returns the number of characters replaced. **y** may be used instead of **tr**.
Optional modifiers: **c** complements the SEARCHLIST; **d** deletes all characters found in SEARCHLIST that do not have a corresponding character in REPLACEMENTLIST; **s** squeezes all sequences of characters that are translated into the same target character into one occurrence of this character.

pos [SCALAR†]

Returns the position where the last **m//g** search left off for SCALAR. May be assigned to.

study [**$**VAR†]

Studies the scalar variable **$**VAR in anticipation of performing many pattern matches on its contents before the variable is next modified.

17. File test operators

These unary operators take one argument, either a filename or a filehandle, and test the associated file to see if something is true about it. If the argument is omitted, they test **`$_`** (except for **`-t`**, which tests **`STDIN`**). If the special argument **`_`** (underscore) is passed, they use the info of the preceding test or **stat** call.

`-r -w -x`	File is readable/writable/executable by effective uid/gid.
`-R -W -X`	File is readable/writable/executable by real uid/gid.
`-o -O`	File is owned by effective/real uid.
`-e -z`	File exists / has zero size.
`-s`	File exists and has non-zero size. Returns the size.
`-f -d`	File is a plain file, a directory.
`-l -S -p`	File is a symbolic link, a socket, a named pipe (FIFO).
`-b -c`	File is a block/character special file.
`-u -g -k`	File has setuid/setgid/sticky bit set.
`-t`	Tests if filehandle (**`STDIN`** by default) is opened to a tty.
`-T -B`	File is a text/non-text (binary) file. **`-T`** and **`-B`** return **true** on a null file, or a file at EOF when testing a filehandle.
`-M -A -C`	File modification/access/inode-change time. Measured in days. Value returned reflects the file age at the time the script started. See also **`$^T`** in section 'Special variables'.

18. File operations

Functions operating on a list of files return the number of files successfully operated upon.

chmod LIST
: Changes the permissions of a list of files. The first element of the list must be the numerical mode.

chown LIST
: Changes the owner and group of a list of files. The first two elements of the list must be the numerical uid and gid.

truncate FILE, SIZE
: truncates FILE to SIZE. FILE may be a filename or a filehandle.

link OLDFILE, NEWFILE
: Creates a new filename linked to the old filename.

lstat FILE†
: Like **stat**, but does not traverse a final symbolic link.

mkdir DIR, MODE
: Creates a directory with given permissions. Sets **`$!`** on failure.

readlink EXPR†
: Returns the value of a symbolic link.

rename OLDNAME, NEWNAME
: Changes the name of a file.

rmdir FILENAME†
: Deletes the directory if it is empty. Sets **`$!`** on failure.

stat FILE†
: Returns a 13-element array (0:**$**dev, 1:**$**ino, 2:**$**mode, 3:**$**nlink, 4:**$**uid, 5:**$**gid, 6:**$**rdev, 7:**$**size, 8:**$**atime, 9:**$**mtime, 10:**$**ctime, 11:**$**blksize, 12:**$**blocks). FILE can be a filehandle, an expression evaluating to a filename, or **_** to refer to the last file test operation or **stat** call. Returns an empty list if the **stat** fails.

symlink OLDFILE**,** NEWFILE
: Creates a new filename symbolically linked to the old filename.

unlink LIST†
: Deletes a list of files.

utime LIST
: Changes the access and modification times. The first two elements of the list must be the numerical access and modification times.

19. Input / Output

In input/output operations, FILEHANDLE may be a filehandle as opened by the **open** operator, a pre-defined filehandle (e.g. **STDOUT**) or a scalar variable that evaluates to a reference to or the name of a filehandle to be used.

<FILEHANDLE**>**
: In scalar context: reads a single line from the file opened on FILEHANDLE. In array context: reads the whole file.

< > Reads from the input stream formed by the files specified in **@ARGV**, or standard input if no arguments were supplied.

binmode FILEHANDLE
: Arranges for the file opened on FILEHANDLE to be read or written in *binary* mode as opposed to *text* mode (null-operation on UNIX).

close FILEHANDLE
: Closes the file or pipe associated with the file handle.

dbmclose %HASH
: Deprecated, use **untie** instead.

dbmopen %HASH**,** DBMNAME**,** MODE
: Deprecated, use **tie** instead.

eof FILEHANDLE
: Returns **true** if the next read will return end of file, or if the file is not open.

eof Returns the eof status for the last file read.

eof( ) Indicates eof on the pseudo-file formed of the files listed on the command line.

fcntl FILEHANDLE**,** FUNCTION**,** **$**VAR
: Performs *fcntl*(2) on the file. This function has non-standard return values.

fileno FILEHANDLE
: Returns the file descriptor for a given (open) file.

flock FILEHANDLE**,** OP
: Calls a system-dependent locking routine on the file. OP is formed by adding 1 (shared), 2 (exclusive), 4 (non-blocking) or 8 (unlock).

getc [FILEHANDLE]
: Yields the next character from the file, or an empty string on eof. If FILEHANDLE is omitted, reads from **STDIN**.

ioctl FILEHANDLE**,** FUNCTION**,** **$**VAR
: Performs *ioctl*(2) on the file. This function has non-standard return values.

open FILEHANDLE [**,** FILENAME]

Opens a file and associates it with FILEHANDLE. **open** returns **true** upon success. If FILENAME is omitted, uses the scalar variable of the same name as the FILEHANDLE.

The following filename conventions apply when opening a file.

"FILE**"**	open FILE for input. Also **"<**FILE**"**.
">FILE**"**	open FILE for output, creating it if necessary.
">>FILE**"**	open FILE in append mode.
"+<FILE**"**	open existing FILE with read/write access.
"+>FILE**"**	create new FILE with read/write access.
"+>>FILE**"**	read/write access in append mode.
"|CMD**"**	opens a pipe to command CMD; forks if CMD is '**–**'.
"CMD**|"**	opens a pipe from command CMD; forks if CMD is '**–**'.

FILE may be **&**FILEHND, in which case the new file handle is connected to the (previously opened) filehandle FILEHND. If it is **&=**N, FILE will be connected to the given file descriptor.

pipe READHANDLE**,** WRITEHANDLE

Returns a pair of connected pipes.

print [FILEHANDLE] [LIST†]

Prints the elements of LIST, converting them to strings if needed. If FILEHANDLE is omitted, prints by default to standard output (or to the last selected output channel, see **select**).

printf [FILEHANDLE] [LIST†]

Equivalent to **print** FILEHANDLE **sprintf** LIST.

read FILEHANDLE**, $**VAR**,** LENGTH [**,** OFFSET]

Reads LENGTH binary bytes from the file into the variable at OFFSET. Returns number of bytes actually read.

seek FILEHANDLE**,** POSITION**,** WHENCE

Arbitrarily positions the file. Returns **true** upon success.

select [FILEHANDLE]

Returns the currently selected filehandle. Sets the current default filehandle for output operations if FILEHANDLE is supplied.

select RBITS**,** WBITS**,** NBITS**,** TIMEOUT

Performs a *select*(2) system call with the same parameters.

sprintf FORMAT**,** LIST

Returns a string formatted in the style of *printf*(3) conventions.

sysopen FILEHANDLE**,** PATH**,** MODE [**,** PERMS]

Performs an *open*(2) system call. The possible values and flag bits of MODE are system-dependent; they are available via the standard module **Fcntl**.

sysread FILEHANDLE**, $**VAR**,** LENGTH [**,** OFFSET]

Reads LENGTH bytes into **$**VAR at OFFSET.

sysseek FILEHANDLE**,** POSITION**,** WHENCE

Performs a *seek*(2) system call.

syswrite FILEHANDLE**,** SCALAR**,** LENGTH [**,** OFFSET]

Writes LENGTH bytes from SCALAR at OFFSET.

tell [FILEHANDLE]

Returns the current file position for the file. If FILEHANDLE is omitted, assumes the file last read.

20. Formats

formline PICTURE**,** LIST

Formats LIST according to PICTURE and accumulates the result into **`$^A`**.

write [FILEHANDLE]

Writes a formatted record to the specified file, using the format associated with that file.

Formats are defined as follows:

format [NAME] **=**
FORMLIST
.

FORMLIST pictures the lines, and contains the arguments which will give values to the fields in the lines. NAME defaults to **`STDOUT`** if omitted.
Picture fields are:

`@<<<`...	left adjusted field, repeat the **`<`** to denote the desired width;
`@>>>`...	right adjusted field;
`@|||`...	centered field;
`@#.##`...	numeric format with implied decimal point;
`@*`	a multi-line field.

Use ^ instead of **`@`** for multi-line block filling.

Use ~ at the beginning of a line to suppress unwanted empty lines.

Use ~~ at the beginning of a line to have this format line repeated until all fields are exhausted.

Set **`$-`** to zero to force a page break on the next **write**.

See also **`$^`**, **`$~`**, **`$^A`**, **`$^F`**, **`$-`** and **`$=`** in section ‘Special variables’.

21. Directory reading routines

closedir DIRHANDLE

Closes a directory opened by **opendir**.

opendir DIRHANDLE**,** DIRNAME

Opens a directory on the handle specified.

readdir DIRHANDLE

Returns the next entry (or an array of entries) from the directory.

rewinddir DIRHANDLE

Positions the directory to the beginning.

seekdir DIRHANDLE**,** POS

Sets position for **readdir** on the directory.

telldir DIRHANDLE

Returns the position in the directory.

22. System interaction

alarm EXPR†

Schedules a **`SIGALRM`** to be delivered after EXPR seconds.

chdir [EXPR]

Changes the working directory.
Uses **`$ENV{"HOME"}`** or **`$ENV{"LOGNAME"}`** if EXPR is omitted.

chroot FILENAME†
: Changes the root directory for the process and its children.

die [LIST]
: Prints the value of LIST to **`STDERR`** and exits with the current value of **`$!`** (errno). If **`$!`** is 0, exits with the value of **`($? >> 8)`**. If **`($? >> 8)`** is 0, exits with 255. LIST defaults to **`"Died"`**.
Inside an **eval**, the error message is put into **`$@`**, and the **eval** is terminated with **undef**; this makes **die** the way to raise an exception.

exec LIST
: Executes the system command in LIST; does not return.

exit [EXPR]
: Exits immediately with the value of **`EXPR`**, which defaults to **`0`** (zero). Calls **`END`** routines and object destructors before exiting.

fork Does a *fork*(2) system call. Returns the process ID of the child to the parent process and zero to the child process.

getlogin
: Returns the current login name as known by the system. If it returns **false**, use **getpwuid**.

getpgrp [PID]
: Returns the process group for process PID (0, or omitted, means the current process).

getppid
: Returns the process ID of the parent process.

getpriority WHICH**,** WHO
: Returns the current priority for a process, process group, or user.

glob PAT†
: Returns a list of filenames that match the shell pattern PAT.

kill LIST
: Sends a signal to a list of processes. The first element of the list must be the signal to send (either numeric, or its name as a string). Negative signals kill process groups instead of processes.

setpgrp PID**,** PGRP
: Sets the process group for the PID (0 indicates the current process).

setpriority WHICH**,** WHO**,** PRIO
: Sets the current priority for a process, process group, or a user.

sleep [EXPR]
: Causes the program to sleep for EXPR seconds, or forever if no EXPR. Returns the number of seconds actually slept.

syscall LIST
: Calls the system call specified in the first element of the list, passing the rest of the list as arguments to the call.

system LIST
: Does exactly the same thing as **exec** LIST except that a fork is done first, and the parent process waits for the child process to complete. Returns the exit status of the child process.

times
: Returns a 4-element array (0:**$**user, 1:**$**system, 2:**$**cuser, 3:**$**csystem) giving the user and system times, in seconds, for this process and the children of this process.

umask [EXPR]
: Sets the umask for the process and returns the old one. If EXPR is omitted, returns current umask value.

wait Waits for a child process to terminate and returns the process ID of the deceased process (-1 if none). The status is returned in **`$?`**.

waitpid PID, FLAGS
: Performs the same function as the corresponding system call.

warn [LIST]
: Prints the LIST on **`STDERR`** like **die**, but does not exit.
LIST defaults to **`"Warning: something's wrong"`**.

23. Networking

accept NEWSOCKET, GENERICSOCKET
: Accepts a new socket.

bind SOCKET, NAME
: Binds the NAME to the SOCKET.

connect SOCKET, NAME
: Connects the NAME to the SOCKET.

getpeername SOCKET
: Returns the socket address of the other end of the SOCKET.

getsockname SOCKET
: Returns the name of the socket.

getsockopt SOCKET, LEVEL, OPTNAME
: Returns the socket options.

listen SOCKET, QUEUESIZE
: Starts listening on the specified SOCKET.

recv SOCKET, SCALAR, LENGTH, FLAGS
: Receives a message on SOCKET.

send SOCKET, MSG, FLAGS [, TO]
: Sends a message on the SOCKET.

setsockopt SOCKET, LEVEL, OPTNAME, OPTVAL
: Sets the requested socket option.

shutdown SOCKET, HOW
: Shuts down a SOCKET.

socket SOCKET, DOMAIN, TYPE, PROTOCOL
: Creates a SOCKET in DOMAIN with TYPE and PROTOCOL.

socketpair SOCKET1, SOCKET2, DOMAIN, TYPE, PROTOCOL
: As socket, but creates a pair of bi-directional sockets.

24. SystemV IPC

Depending on your system configuration, certain system files need to be **require**d to access the message and semaphore specific facilities.

msgctl ID, CMD, ARGS
: Calls *msgctl*(2). If CMD is **`IPC_STAT`** then ARGS must be a single variable. See the manual for details on the non-standard return values of this function.

msgget KEY, FLAGS
: Creates a message queue for KEY. Returns the message queue identifier.

msgsnd ID, MSG, FLAGS
: Sends MSG to queue ID.

msgrcv ID, **$**VAR, SIZE, TYPE, FLAGS
: Receives a message from queue ID into VAR.

semctl ID, SEMNUM, CMD, ARG
: Calls *semctl*(2).
If CMD is **`IPC_STAT`** or **`GETALL`** then ARG must be a variable.

semget KEY, NSEMS, SIZE, FLAGS
: Creates a set of semaphores for KEY. Returns the message semaphore identifier.

semop KEY, ...
: Performs semaphore operations.

shmctl ID, CMD, ARG
: Calls *shmctl*(2). If CMD is **`IPC_STAT`** then ARG must be a single variable.

shmget KEY, SIZE, FLAGS
: Creates shared memory. Returns the shared memory segment identifier.

shmread ID, **$**VAR, POS, SIZE
: Reads at most SIZE bytes of the contents of shared memory segment ID starting at offset POS into VAR.

shmwrite ID, STRING, POS, SIZE
: Writes at most SIZE bytes of STRING into the contents of shared memory segment ID at offset POS.

25. Miscellaneous

defined EXPR†
: Tests whether the EXPR has an actual value.

do FILENAME
: Executes FILENAME as a Perl script. See also **require** in section ‘Subroutines, packages and modules’.

dump [LABEL]
: Immediate core dump. When reincarnated, starts at LABEL.

eval { EXPR**;** . . . **}**
: Executes the code between **{** and **}**. Traps run-time errors as described with **eval(**EXPR**)**, section ‘String functions’.

local VAR
: Creates a scope for VAR local to the enclosing block, subroutine or **eval**.

my VAR
: Creates a scope for the variable lexically local to the enclosing block, subroutine or **eval**.

ref EXPR†
: Returns a **true** value if EXPR is a reference. Returns the package name if EXPR has been blessed into a package.

reset [EXPR]
: Resets **`??`** searches so that they work again. EXPR is a list of single letters. All variables and arrays beginning with one of those letters are reset to their pristine state. Only affects the current package.

scalar EXPR
: Forces evaluation of EXPR in scalar context.

undef [LVALUE]
: Undefines the LVALUE. Always returns the undefined value.

wantarray
: Returns **true** if the current context expects an list value. **undef** if the current context does not expect a value at all, **false** otherwise.

26. Information from system files

See the manual about return values in scalar context.

passwd

Returns ($name, $passwd, $uid, $gid, $quota, $comment, $gcos, $dir, $shell).

endpwent	Ends look-up processing.
getpwent	Gets next user information.
getpwnam NAME	Gets information by name.
getpwuid UID	Gets information by user ID.
setpwent	Resets look-up processing.

group

Returns ($name, $passwd, $gid, $members).

endgrent	Ends look-up processing.
getgrgid GID	Gets information by group ID.
getgrnam NAME	Gets information by name.
getgrent	Gets next group information.
setgrent	Resets lookup processing.

hosts

Returns ($name, $aliases, $addrtype, $length, @addrs).

endhostent	Ends look-up processing.
gethostbyaddr ADDR**,** ADDRTYPE	Gets information by IP address.
gethostbyname NAME	Gets information by host name.
gethostent	Gets next host information.
sethostent STAYOPEN	Resets look-up processing.

networks

Returns ($name, $aliases, $addrtype, $net).

endnetent	Ends look-up processing.
getnetbyaddr ADDR**,** TYPE	Gets information by address and type.
getnetbyname NAME	Gets information by network name.
getnetent	Gets next network information.
setnetent STAYOPEN	Resets look-up processing.

services

Returns ($name, $aliases, $port, $proto).

endservent	Ends look-up processing.
getservbyname NAME**,** PROTO	Gets information by service name.
getservbyport PORT**,** PROTO	Gets information by service port.
getservent	Gets next service information.

setservent STAYOPEN	Resets look-up processing.

protocols

Returns (**$**name, **$**aliases, **$**proto).

endprotoent	Ends look-up processing.
getprotobyname NAME	Gets information by protocol name.
getprotobynumber NUMBER	Gets information by protocol number.
getprotoent	Gets next protocol information.
setprotoent STAYOPEN	Resets look-up processing.

27. Special variables

The following variables are global and should be localized in subroutines:

$_	The default input and pattern-searching space.
$.	The current input line number of the last filehandle that was read. Reset only when the filehandle is closed explicitly.
$/	The input record separator, newline by default. May be multi-character.
$,	The output field separator for the print operator.
$"	The separator which joins elements of arrays interpolated in strings.
$	The output record separator for the print operator.
$#	The output format for printed numbers. Deprecated.
$*	Set to 1 to do multiline matching within strings. Deprecated, see the **m** and **s** modifiers in section ‘Search and replace functions’.
$?	The status returned by the last `` `...` `` command, pipe **close** or **system** operator.
$]	The Perl version number, e.g. **5.004**.
$[	The index of the first element in an array, and of the first character in a substring. Default is 0. Deprecated.
$;	The subscript separator for multi-dimensional array emulation. Default is **"\034"**.
$!	If used in a numeric context, yields the current value of **errno**. If used in a string context, yields the corresponding error string.
$@	The Perl error message from the last **eval** or **do** EXPR command.
$:	The set of characters after which a string may be broken to fill continuation fields (starting with ‘**^**’) in a format.
$0	The name of the file containing the Perl script being executed. May be assigned to.
$$	The process ID of the Perl interpreter running this script. Altered (in the child process) by **fork**.
$<	The real user ID of this process.
$>	The effective user ID of this process.
$(	The real group ID of this process.
$)	The effective group ID and groups of this process.
$^A	The accumulator for **formline** and **write** operations.
$^D	The debug flags as passed to Perl using ‘**-D**’.
$^E	Extended error message on some platforms.
$^F	The highest system file descriptor, ordinarily 2.
$^H	Set of syntax checks enabled by ‘**use strict**’.

`$^I` In-place edit extension as passed to Perl using '**`-i`**'.

`$^L` Formfeed character used in formats.

`$^M` Out-of-memory emergency pool.

`$^P` Internal debugging flag.

`$^T` The time (as delivered by **time**) when the program started. This value is used by the file test operators '**`-M`**', '**`-A`**' and '**`-C`**'.

`$^W` The value of the '**`-w`**' option as passed to Perl.

`$^X` The name by which this Perl interpreter was invoked.

The following variables are context dependent and need not be localized:

`$%` The current page number of the currently selected output channel.

`$=` The page length of the current output channel. Default is 60 lines.

`$-` The number of lines remaining on the page.

`$~` The name of the current report format.

`$^` The name of the current top-of-page format.

`$|` If set to nonzero, forces a flush after every write or print on the output channel currently selected. Default is 0.

`$ARGV` The name of the current file when reading from **`<>`** .

The following variables are always local to the current block:

`$&` The string matched by the last successful pattern match.

`` $` `` The string preceding what was matched by the last successful match.

`$'` The string following what was matched by the last successful match.

`$+` The last bracket matched by the last search pattern.

`$1`...**`$9`**... Contain the subpatterns from the corresponding sets of parentheses in the last pattern successfully matched. **`$10`** and up are only available if the match contained that many subpatterns.

28. Special arrays

`@ARGV` Contains the command line arguments for the script (not including the command name).

`@EXPORT`
Names the methods a package exports by default.

`@EXPORT_OK`
Names the methods a package can export upon explicit request.

`@INC` Contains the list of places to look for Perl scripts to be evaluated by the **do** FILENAME, **use** and **require** commands.
Do not modify directly, but use the '**`use lib`**' pragma or **`-I`** command line option instead.

`@ISA` List of base classes of a package.

`@_` Parameter array for subroutines. Also used by **split** if not in array context.

`%ENV` Contains the current environment.

`%INC` List of files that have been included with **use**, **require** or **do**.

`%SIG` Used to set signal handlers for various signals.
`__WARN__` and **`__DIE__`** are pseudo-signals to attach handlers to Perl warnings and exceptions.

29. Standard modules

AnyDBM_File
: Provides a framework for multiple dbm files.

AutoLoader
: Load functions only on demand.

AutoSplit
: Split a package for autoloading.

Benchmark
: Benchmark running times of code.

CGI
: Web server Common Gateway Interface.

CGI::Apache
: Support for Apache's Perl module.

CGI::Carp
: Log server errors with helpful context.

CGI::Fast
: Support for FastCGI (persistent server process).

CGI::Push
: Support for server push.

CGI::Switch
: Simple interface for multiple server types.

CPAN
: Interface to Comprehensive Perl Archive Network.

CPAN::FirstTime
: Utility for creating CPAN configuration file.

CPAN::Nox
: Run CPAN while avoiding compiled extensions.

Carp
: Warn of errors.

Class::Struct
: Declare struct-like datatypes as Perl classes.

Config
: Access to Perl configuration information.

Cwd
: Get the pathname of current working directory.

DB_File
: Access to Berkeley DB files.

Devel::SelfStubber
: Generate stubs for a SelfLoading module.

Dirhandle
: Supplies object methods for directory handles.

DynaLoader
: Dynamically loads C libraries into Perl code.

English
: Use long English names for punctuation variables.

Env
: Imports environment variables.

Exporter
: Implements default import method for modules.

ExtUtils::Embed
: Utilities for embedding Perl in C/C++ applications.

ExtUtils::Install
Install files from here to there.

ExtUtils::Liblist
Determine libraries to use and how to use them.

ExtUtils::MakeMaker
Create an extension Makefile.

ExtUtils::Manifest
Utilities to write and check a MANIFEST file.

ExtUtils::Miniperl
Write the C code for **`perlmain.c`**.

ExtUtils::Mkbootstrap
Make a bootstrap file for use by DynaLoader.

ExtUtils::Mksymlists
Write linker options files for dynamic extension.

ExtUtils::MM_OS2
Methods to override Unix behaviour in ExtUtils::MakeMaker.

ExtUtils::MM_Unix
Methods used by ExtUtils::MakeMaker.

ExtUtils::MM_VMS
Methods to override Unix behaviour in ExtUtils::MakeMaker.

ExtUtils::testlib
Adds **`blib/*`** directories to **`@INC`**.

Fatal Replaces functions with equivalents which succeed or die.

Fcntl Loads the C **`fcntl.h`** defines.

File::Basename
Parse file specifications.

FileCache
Keep more files open than the system permits.

File::CheckTree
Run many filetest checks on a tree.

File::Copy
Copy files or filehandles.

File::Find
Traverse a file tree.

FileHandle
Supplies object methods for filehandles.

File::Path
Create or remove a series of directories.

File::stat
By-name interface to Perl's builtin **stat**.

FindBin
Locate the directory of the original Perl script.

GDBM_File
Access to the gdbm library.

Getopt::Long
Extended handling of command line options. Suits all needs.

Getopt::Std
Process single-character switches with switch clustering.

I18N::Collate
    Compare 8-bit scalar data according to the current locale.

IO   Loads various IO modules.

IO::File
    Supplies object methods for filehandles.

IO::Handle
    Supplies object methods for I/O handles.

IO::Pipe
    Supplies object methods for pipes.

IO::Seekable
    Supplies seek based methods for I/O objects.

IO::Select
    Object interface to the **select** system call.

IO::Socket
    Object interface to socket communications.

IPC::Open2
    Open a pipe to a process for both reading and writing.

IPC::Open3
    Open a pipe to a process for reading, writing, and error handling.

Math::BigFloat
    Arbitrary length float math package.

Math::BigInt
    Arbitrary size integer math package.

Math::Complex
    Complex numbers and associated mathematical functions.

Math::Trig
    Trigoniometric functions.

NDBM_File
    Tied access to ndbm files.

Net::hostent
    By-name interface to Perl's builtin gethost functions.

Net::netent
    By-name interface to Perl's builtin getnet functions.

Net::Ping
    Check a host for upness.

Net::protoent
    By-name interface to Perl's builtin getproto functions.

Net::servent
    By-name interface to Perl's builtin getserv functions.

Opcode
    Disable named opcodes when compiling Perl code.

Pod::Text
    Convert POD data to formatted ASCII text.

POSIX
    Interface to IEEE Std 1003.1.

Safe   Compile and execute code in restricted compartments.

SDBM_File
    Tied access to sdbm files.

Search::Dict
: Search for key in dictionary file.

SelectSaver
: Save and restore a selected file handle.

SelfLoader
: Load functions only on demand.

Shell
: Run shell commands transparently within Perl.

Socket
: Load the C **`socket.h`** defines and structure manipulators.

Symbol
: Manipulate Perl symbols and their names.

Sys::Hostname
: Try every conceivable way to get the name of this system.

Sys::Syslog
: Interface to the Unix *syslog*(3) calls.

Term::Cap
: Perl interface to Unix *termcap*(3).

Term::Complete
: Word completion module.

Term::ReadLine
: Interface to various readline packages.

Test::Harness
: Run Perl standard test scripts with statistics.

Text::Abbrev
: Create an abbreviation table from a list.

Text::ParseWords
: Parse text into an array of tokens.

Text::Soundex
: Implementation of the Soundex Algorithm as described by Donald Knuth.

Text::Tabs
: Expand and unexpand tabs.

Text::Wrap
: Line wrapping to form simple paragraphs.

Tie::Hash
: Base class definitions for tied hashes.

Tie::RefHash
: Base class for tied hashes with references as keys.

Tie::StdHash
: Basic methods for tied hashes.

Tie::Scalar
: Base class definitions for tied scalars.

Tie::StdScalar
: Basic methods for tied scalars.

Tie::SubstrHash
: Fixed table-size, fixed key-length hashing.

Time::gmtime
: By-name interface to Perl's builtin **gmtime**.

Time::Local
: Efficiently compute time from local and GMT time.

Time::localtime
  By-name interface to Perl's builtin **localtime**.

Time::tm
  Internal object for Time::gmtime and Time::localtime.

UNIVERSAL
  Base class for all classes (blessed references).

User::grent
  By-name interface to Perl's builtin getgroup functions.

User::pwent
  By-name interface to Perl's builtin getpasswd functions.

30. Environment variables

Perl uses the following environment variables.

HOME Used if **chdir** has no argument.

LOGDIR
  Used if **chdir** has no argument and **HOME** is not set.

PATH Used in executing subprocesses, and in finding the Perl script if '**-S**' is used.

PERL5LIB
  A colon-separated list of directories to look in for Perl library files before looking in the standard library and the current directory.

PERL5DB
  The command to get the debugger code.
  Defaults to **BEGIN { require 'perl5db.pl' }**.

PERLLIB
  Used instead of **PERL5LIB** if the latter is not defined.

PERL5OPT
  Used to set initial (command line) options for perl.

31. The perl debugger

The Perl symbolic debugger is invoked with '**perl -d**'.

h	Prints out a long help message.
h CMD	Prints out help for the command CMD.
h h	Prints out a concise help message.
T	Prints a stack trace.
s [EXPR]	Single steps.
n [EXPR]	Single steps around subroutine call.
RET	Repeats last '**s**' or '**n**'.
r	Returns from the current subroutine.
c [LINE]	Continues (until LINE, or another breakpoint, or exit).
p EXPR†	Prints EXPR.
l [RANGE]	Lists a range of lines. RANGE may be a number, start–end, start+amount, or a subroutine name. If RANGE is omitted, lists next window.
w [LINE]	Lists window around the specified line.

-	Lists previous window.
.	Returns to the executed line.
f FILE	Switches to FILE and starts listing it.
l SUB	Lists the named subroutine.
S [**!**]PATTERN	Lists the names of all subroutines [not] matching the pattern.
/PATTERN**/**	Searches forwards for PATTERN.
?PATTERN**?**	Searches backwards for PATTERN.
b [LINE [CONDITION]]	Sets breakpoint at LINE, default is the current line.
b SUB [CONDITION]	Sets breakpoint at the named subroutine.
d [LINE]	Deletes breakpoint at the given line.
D	Deletes all breakpoints.
L	Lists lines that have breakpoints or actions.
a [LINE] COMMAND	Sets an action for line.
A	Deletes all line actions.
< COMMAND	Sets an action to be executed before every debugger prompt.
> COMMAND	Sets an action to be executed after every debugger prompt.
V [PACKAGE [PATTERN]]	Lists variables matching PATTERN in a package. Default package is **main**.
X [PATTERN]	Like '**V**', but assumes the current package.
! [[-]NUMBER]	Re-executes a command. Default is the previous command.
! [PATTERN]	Re-executes the last command that started with PATTERN.
!! [COMMAND]	Runs COMMAND in a sub-process.
H [-NUMBER]	Displays the last -NUMBER commands.
| CMD	Runs debugger command CMD through the current pager.
|| CMD	Same, temporarily **select**s **DB::OUT** as well.
t	Toggles trace mode.
t EXPR	Traces through execution of EXPR.
x EXPR	Evals EXPR in list context, dumps the result.
O [OPT [**=**VAL]]	Sets or queries values of debugger options.
= [ALIAS VALUE]	Sets alias, or lists current aliases.
R	Restarts the debugger.
q	Quits. You may also use your $\boxed{\text{EOF}}$ character.
COMMAND	Executes COMMAND as a Perl statement.