

C Reference Card (ANSI)

Program Structure/Functions

| | |
|--|--------------------------------|
| <i>type fnc(type₁,...)</i> | function declarations |
| <i>type name</i> | external variable declarations |
| <i>main()</i> { | main routine |
| <i>declarations</i> | local variable declarations |
| <i>statements</i> | |
| } | |
| <i>type fnc(arg₁,...)</i> { | function definition |
| <i>declarations</i> | local variable declarations |
| <i>statements</i> | |
| return <i>value</i> ; | |
| } | |
| /* */ | comments |
| main(int argc, char *argv[]) | main with args |
| exit(<i>arg</i>) | terminate execution |

C Preprocessor

| | |
|---|-------------------------------|
| include library file | #include <filename> |
| include user file | #include "filename" |
| replacement text | #define <i>name text</i> |
| replacement macro | #define <i>name(var) text</i> |
| Example. #define max(A,B) ((A)>(B) ? (A) : (B)) | |
| undefine | #undef <i>name</i> |
| quoted string in replace | # |
| concatenate args and rescan | ## |
| conditional execution | #if, #else, #elif, #endif |
| is <i>name</i> defined, not defined? | #ifdef, #ifndef |
| <i>name</i> defined? | defined(<i>name</i>) |
| line continuation char | \ |

Data Types/Declarations

| | |
|--|----------------------------|
| character (1 byte) | char |
| integer | int |
| float (single precision) | float |
| float (double precision) | double |
| short (16 bit integer) | short |
| long (32 bit integer) | long |
| positive and negative | signed |
| only positive | unsigned |
| pointer to int, float,... | *int, *float,... |
| enumeration constant | enum |
| constant (unchanging) value | const |
| declare external variable | extern |
| register variable | register |
| local to source file | static |
| no value | void |
| structure | struct |
| create name by data type | typedef <i>typename</i> |
| size of an object (type is <i>size_t</i>) | sizeof <i>object</i> |
| size of a data type (type is <i>size_t</i>) | sizeof(<i>type name</i>) |

Initialization

| | |
|------------------------|--|
| initialize variable | <i>type name=value</i> |
| initialize array | <i>type name</i> []={ <i>value₁,...</i> } |
| initialize char string | char <i>name</i> []{" <i>string</i> "} |

Constants

| | |
|---------------------------------------|---------------------|
| long (suffix) | L or l |
| float (suffix) | F or f |
| exponential form | e |
| octal (prefix zero) | 0 |
| hexadecimal (prefix zero-ex) | 0x or 0X |
| character constant (char, octal, hex) | 'a', '\ooo', '\xhh' |
| newline, cr, tab, backspace | \n, \r, \t, \b |
| special characters | \\, \?, \', \" |
| string constant (ends with '\0') | "abc...de" |

Pointers, Arrays & Structures

| | |
|---|---|
| declare pointer to <i>type</i> | <i>type *name</i> |
| declare function returning pointer to <i>type</i> | <i>type *f()</i> |
| declare pointer to function returning <i>type</i> | <i>type (*pf)()</i> |
| generic pointer type | void * |
| null pointer | NULL |
| object pointed to by <i>pointer</i> | * <i>pointer</i> |
| address of object <i>name</i> | & <i>name</i> |
| array | <i>name[dim]</i> |
| multi-dim array | <i>name[dim₁][dim₂]</i> ... |

Structures

| | |
|---------------------------------------|-----------------------------|
| struct <i>tag</i> { | structure template |
| <i>declarations</i> | declaration of members |
| }; | |
| create structure | struct <i>tag name</i> |
| member of structure from template | <i>name.member</i> |
| member of pointed to structure | <i>pointer -> member</i> |
| Example. (*p).x and p->x are the same | |
| single value, multiple type structure | union |
| bit field with <i>b</i> bits | <i>member : b</i> |

Operators (grouped by precedence)

| | |
|--|---|
| structure member operator | <i>name.member</i> |
| structure pointer | <i>pointer->member</i> |
| increment, decrement | ++, -- |
| plus, minus, logical not, bitwise not | +, -, !, ~ |
| indirection via pointer, address of object | * <i>pointer</i> , & <i>name</i> |
| cast expression to type | (<i>type</i>) <i>expr</i> |
| size of an object | sizeof |
| multiply, divide, modulus (remainder) | *, /, % |
| add, subtract | +, - |
| left, right shift [bit ops] | <<, >> |
| comparisons | >, >=, <, <= |
| comparisons | ==, != |
| bitwise and | & |
| bitwise exclusive or | ^ |
| bitwise or (incl) | |
| logical and | && |
| logical or | |
| conditional expression | <i>expr₁ ? expr₂ : expr₃</i> |
| assignment operators | +=, -=, *=, ... |
| expression evaluation separator | , |

Unary operators, conditional expression and assignment operators group right to left; all others group left to right.

Flow of Control

| | |
|----------------------------------|--------------------|
| statement terminator | ; |
| block delimiters | { } |
| exit from switch, while, do, for | break |
| next iteration of while, do, for | continue |
| go to | goto <i>label</i> |
| label | <i>label</i> : |
| return value from function | return <i>expr</i> |

Flow Constructions

| | |
|------------------|--|
| if statement | if (<i>expr</i>) <i>statement</i> else if (<i>expr</i>) <i>statement</i> else <i>statement</i> |
| while statement | while (<i>expr</i>) <i>statement</i> |
| for statement | for (<i>expr₁; expr₂; expr₃</i>) <i>statement</i> |
| do statement | do <i>statement</i> while(<i>expr</i>); |
| switch statement | switch (<i>expr</i>) { case <i>const₁</i> : <i>statement₁</i> break; case <i>const₂</i> : <i>statement₂</i> break; default: <i>statement</i> } |

ANSI Standard Libraries

| | | | | |
|------------|-----------|------------|------------|------------|
| <assert.h> | <ctype.h> | <errno.h> | <float.h> | <limits.h> |
| <locale.h> | <math.h> | <setjmp.h> | <signal.h> | <stdarg.h> |
| <stddef.h> | <stdio.h> | <stdlib.h> | <string.h> | <time.h> |

Character Class Tests <ctype.h>

| | |
|--|-------------|
| alphanumeric? | isalnum(c) |
| alphabetic? | isalpha(c) |
| control character? | iscntrl(c) |
| decimal digit? | isdigit(c) |
| printing character (not incl space)? | isgraph(c) |
| lower case letter? | islower(c) |
| printing character (incl space)? | isprint(c) |
| printing char except space, letter, digit? | ispunct(c) |
| space, formfeed, newline, cr, tab, vtab? | isspace(c) |
| upper case letter? | isupper(c) |
| hexadecimal digit? | isxdigit(c) |
| convert to lower case? | tolower(c) |
| convert to upper case? | toupper(c) |

String Operations <string.h>

| | |
|--|---------------------------|
| <i>s,t</i> are strings, <i>cs,ct</i> are constant strings | |
| length of <i>s</i> | strlen(<i>s</i>) |
| copy <i>ct</i> to <i>s</i> | strcpy(<i>s,ct</i>) |
| up to <i>n</i> chars | strncpy(<i>s,ct,n</i>) |
| concatenate <i>ct</i> after <i>s</i> | strcat(<i>s,ct</i>) |
| up to <i>n</i> chars | strncat(<i>s,ct,n</i>) |
| compare <i>cs</i> to <i>ct</i> | strcmp(<i>cs,ct</i>) |
| only first <i>n</i> chars | strncmp(<i>cs,ct,n</i>) |
| pointer to first <i>c</i> in <i>cs</i> | strchr(<i>cs,c</i>) |
| pointer to last <i>c</i> in <i>cs</i> | strrchr(<i>cs,c</i>) |
| copy <i>n</i> chars from <i>ct</i> to <i>s</i> | memcpy(<i>s,ct,n</i>) |
| copy <i>n</i> chars from <i>ct</i> to <i>s</i> (may overlap) | memmove(<i>s,ct,n</i>) |
| compare <i>n</i> chars of <i>cs</i> with <i>ct</i> | memcmp(<i>cs,ct,n</i>) |
| pointer to first <i>c</i> in first <i>n</i> chars of <i>cs</i> | memchr(<i>cs,c,n</i>) |
| put <i>c</i> into first <i>n</i> chars of <i>cs</i> | memset(<i>s,c,n</i>) |

C Reference Card (ANSI)

Input/Output <stdio.h>

Standard I/O

| | |
|-------------------------------------|---|
| standard input stream | <code>stdin</code> |
| standard output stream | <code>stdout</code> |
| standard error stream | <code>stderr</code> |
| end of file | <code>EOF</code> |
| get a character | <code>getchar()</code> |
| print a character | <code>putchar(chr)</code> |
| print formatted data | <code>printf("format", arg1, ...)</code> |
| print to string s | <code>sprintf(s, "format", arg1, ...)</code> |
| read formatted data | <code>scanf("format", &name1, ...)</code> |
| read from string s | <code>sscanf(s, "format", &name1, ...)</code> |
| read line to string s (< max chars) | <code>gets(s, max)</code> |
| print string s | <code>puts(s)</code> |

File I/O

| | |
|--|---|
| declare file pointer | <code>FILE *fp</code> |
| pointer to named file | <code>fopen("name", "mode")</code> |
| modes: r (read), w (write), a (append) | |
| get a character | <code>getc(fp)</code> |
| write a character | <code>putc(chr, fp)</code> |
| write to file | <code>fprintf(fp, "format", arg1, ...)</code> |
| read from file | <code>fscanf(fp, "format", arg1, ...)</code> |
| close file | <code>fclose(fp)</code> |
| non-zero if error | <code>ferror(fp)</code> |
| non-zero if EOF | <code>feof(fp)</code> |
| read line to string s (< max chars) | <code>fgets(s, max, fp)</code> |
| write string s | <code>fputs(s, fp)</code> |

Codes for Formatted I/O: "%-+ 0w.pmc"

| | |
|-------|--|
| - | left justify |
| + | print with sign |
| space | print space if no sign |
| 0 | pad with leading zeros |
| w | min field width |
| p | precision |
| m | conversion character: |
| h | short, l long, L long double |
| c | conversion character: |
| d,i | integer u unsigned |
| c | single char s char string |
| f | double e,E exponential |
| o | octal x,X hexadecimal |
| p | pointer n number of chars written |
| g,G | same as f or e,E depending on exponent |

Variable Argument Lists <stdarg.h>

| | |
|---|--------------------------------------|
| declaration of pointer to arguments | <code>va_list name;</code> |
| initialization of argument pointer | <code>va_start(name, lastarg)</code> |
| lastarg is last named parameter of the function | |
| access next unnamed arg, update pointer | <code>va_arg(name, type)</code> |
| call before exiting function | <code>va_end(name)</code> |

Standard Utility Functions <stdlib.h>

| | |
|---|---------------------------|
| absolute value of int n | <code>abs(n)</code> |
| absolute value of long n | <code>labs(n)</code> |
| quotient and remainder of ints n,d | <code>div(n,d)</code> |
| returns structure with <code>div_t.quot</code> and <code>div_t.rem</code> | |
| quotient and remainder of longs n,d | <code>ldiv(n,d)</code> |
| returns structure with <code>ldiv_t.quot</code> and <code>ldiv_t.rem</code> | |
| pseudo-random integer [0,RAND_MAX] | <code>rand()</code> |
| set random seed to n | <code>srand(n)</code> |
| terminate program execution | <code>exit(status)</code> |
| pass string s to system for execution | <code>system(s)</code> |

Conversions

| | |
|--------------------------------------|----------------------------------|
| convert string s to double | <code>atof(s)</code> |
| convert string s to integer | <code>atoi(s)</code> |
| convert string s to long | <code>atol(s)</code> |
| convert prefix of s to double | <code>strtod(s, endp)</code> |
| convert prefix of s (base b) to long | <code>strtol(s, endp, b)</code> |
| same, but unsigned long | <code>strtoul(s, endp, b)</code> |

Storage Allocation

| | |
|-----------------------|---|
| allocate storage | <code>malloc(size), calloc(nobj, size)</code> |
| change size of object | <code>realloc(pts, size)</code> |
| deallocate space | <code>free(ptr)</code> |

Array Functions

| | |
|----------------------------|--|
| search array for key | <code>bsearch(key, array, n, size, cmp())</code> |
| sort array ascending order | <code>qsort(array, n, size, cmp())</code> |

Time and Date Functions <time.h>

| | |
|---|-------------------------------------|
| processor time used by program | <code>clock()</code> |
| Example. <code>clock()/CLOCKS_PER_SEC</code> is time in seconds | |
| current calendar time | <code>time()</code> |
| <code>time2-time1</code> in seconds (double) | <code>difftime(time2, time1)</code> |
| arithmetic types representing times | <code>clock_t, time_t</code> |
| structure type for calendar time comps | <code>tm</code> |
| tm_sec | seconds after minute |
| tm_min | minutes after hour |
| tm_hour | hours since midnight |
| tm_mday | day of month |
| tm_mon | months since January |
| tm_year | years since 1900 |
| tm_wday | days since Sunday |
| tm_yday | days since January 1 |
| tm_isdst | Daylight Savings Time flag |

| | |
|---|--|
| convert local time to calendar time | <code>mktime(tp)</code> |
| convert time in tp to string | <code>asctime(tp)</code> |
| convert calendar time in tp to local time | <code>ctime(tp)</code> |
| convert calendar time to GMT | <code>gmtime(tp)</code> |
| convert calendar time to local time | <code>localtime(tp)</code> |
| format date and time info | <code>strftime(s, smax, "format", tp)</code> |
| tp is a pointer to a structure of type tm | |

Mathematical Functions <math.h>

Arguments and returned values are double

| | |
|-------------------------------|---|
| trig functions | <code>sin(x), cos(x), tan(x)</code> |
| inverse trig functions | <code>asin(x), acos(x), atan(x)</code> |
| arctan(y/x) | <code>atan2(y, x)</code> |
| hyperbolic trig functions | <code>sinh(x), cosh(x), tanh(x)</code> |
| exponentials & logs | <code>exp(x), log(x), log10(x)</code> |
| exponentials & logs (2 power) | <code>ldexp(x, n), frexp(x, *e)</code> |
| division & remainder | <code>modf(x, *ip), fmod(x, y)</code> |
| powers | <code>pow(x, y), sqrt(x)</code> |
| rounding | <code>ceil(x), floor(x), fabs(x)</code> |

Integer Type Limits <limits.h>

The numbers given in parentheses are typical values for the constants on a 32-bit Unix system.

| | | |
|------------------------|-----------------------------|------------------|
| <code>CHAR_BIT</code> | bits in char | (8) |
| <code>CHAR_MAX</code> | max value of char | (127 or 255) |
| <code>CHAR_MIN</code> | min value of char | (-128 or 0) |
| <code>INT_MAX</code> | max value of int | (+32,767) |
| <code>INT_MIN</code> | min value of int | (-32,768) |
| <code>LONG_MAX</code> | max value of long | (+2,147,483,647) |
| <code>LONG_MIN</code> | min value of long | (-2,147,483,648) |
| <code>SCHAR_MAX</code> | max value of signed char | (+127) |
| <code>SCHAR_MIN</code> | min value of signed char | (-128) |
| <code>SHRT_MAX</code> | max value of short | (+32,767) |
| <code>SHRT_MIN</code> | min value of short | (-32,768) |
| <code>UCHAR_MAX</code> | max value of unsigned char | (255) |
| <code>UINT_MAX</code> | max value of unsigned int | (65,535) |
| <code>ULONG_MAX</code> | max value of unsigned long | (4,294,967,295) |
| <code>USHRT_MAX</code> | max value of unsigned short | (65,536) |

Float Type Limits <float.h>

| | | |
|---------------------------|----------------------------------|----------------|
| <code>FLT_RADIX</code> | radix of exponent rep | (2) |
| <code>FLT_ROUNDS</code> | floating point rounding mode | |
| <code>FLT_DIG</code> | decimal digits of precision | (6) |
| <code>FLT_EPSILON</code> | smallest x so $1.0 + x \neq 1.0$ | (10^{-5}) |
| <code>FLT_MANT_DIG</code> | number of digits in mantissa | |
| <code>FLT_MAX</code> | maximum floating point number | (10^{37}) |
| <code>FLT_MAX_EXP</code> | maximum exponent | |
| <code>FLT_MIN</code> | minimum floating point number | (10^{-37}) |
| <code>FLT_MIN_EXP</code> | minimum exponent | |
| <code>DBL_DIG</code> | decimal digits of precision | (10) |
| <code>DBL_EPSILON</code> | smallest x so $1.0 + x \neq 1.0$ | (10^{-9}) |
| <code>DBL_MANT_DIG</code> | number of digits in mantissa | |
| <code>DBL_MAX</code> | max double floating point number | (10^{37}) |
| <code>DBL_MAX_EXP</code> | maximum exponent | |
| <code>DBL_MIN</code> | min double floating point number | (10^{-37}) |
| <code>DBL_MIN_EXP</code> | minimum exponent | |

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