

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

C Preprocessor

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

Data Types/Declarations

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

Initialization

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

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

Structures

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

Operators (grouped by precedence)

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

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

Flow of Control

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

Flow Constructions

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

ANSI Standard Libraries

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

Character Class Tests <ctype.h>

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

String Operations <string.h>

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

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Input/Output <stdio.h>

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

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

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 `va_list name;`
 initialization of argument pointer `va_start(name, lastarg)`
lastarg is last named parameter of the function
 access next unnamed arg, update pointer `va_arg(name, type)`
 call before exiting function `va_end(name)`

Standard Utility Functions <stdlib.h>

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

Conversions
 convert string s to double `atof(s)`
 convert string s to integer `atoi(s)`
 convert string s to long `atol(s)`
 convert prefix of s to double `strtod(s, endp)`
 convert prefix of s (base b) to long `strtol(s, endp, b)`
 same, but unsigned long `strtoul(s, endp, b)`

Storage Allocation

allocate storage `malloc(size), calloc(nobj, size)`
 change size of object `realloc(pts, size)`
 deallocate space `free(ptr)`

Array Functions

search array for key `bsearch(key, array, n, size, cmp())`
 sort array ascending order `qsort(array, n, size, cmp())`

Time and Date Functions <time.h>

processor time used by program `clock()`
Example. `clock()/CLOCKS_PER_SEC` is time in seconds
 current calendar time `time()`
 time₂-time₁ in seconds (double) `difftime(time2, time1)`
 arithmetic types representing times `clock_t, time_t`
 structure type for calendar time comps `tm`
 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 `mktime(tp)`
 convert time in tp to string `asctime(tp)`
 convert calendar time in tp to local time `ctime(tp)`
 convert calendar time to GMT `gmtime(tp)`
 convert calendar time to local time `localtime(tp)`
 format date and time info `strftime(s, smax, "format", tp)`
 tp is a pointer to a structure of type tm

Mathematical Functions <math.h>

Arguments and returned values are double

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

Integer Type Limits <limits.h>

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

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

Float Type Limits <float.h>

`FLT_RADIX` radix of exponent rep (2)
`FLT_ROUNDS` floating point rounding mode
`FLT_DIG` decimal digits of precision (6)
`FLT_EPSILON` smallest x so 1.0 + x ≠ 1.0 (10⁻⁵)
`FLT_MANT_DIG` number of digits in mantissa
`FLT_MAX` maximum floating point number (10³⁷)
`FLT_MAX_EXP` maximum exponent
`FLT_MIN` minimum floating point number (10⁻³⁷)
`FLT_MIN_EXP` minimum exponent
`DBL_DIG` decimal digits of precision (10)
`DBL_EPSILON` smallest x so 1.0 + x ≠ 1.0 (10⁻⁹)
`DBL_MANT_DIG` number of digits in mantissa
`DBL_MAX` max double floating point number (10³⁷)
`DBL_MAX_EXP` maximum exponent
`DBL_MIN` min double floating point number (10⁻³⁷)
`DBL_MIN_EXP` minimum exponent

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