

C Reference Card (ANSI)

Program Structure/Functions

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

C Preprocessor

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

Data Types/Declarations

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

Initialization

initialize variable	<i>type name=value</i>
initialize array	<i>type name[]={value₁,...}</i>
initialize char string	<i>char name[]="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	<i>void *</i>
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	
<i>struct tag {</i> <i>declarations</i> };	structure template declaration of members
create structure	<i>struct tag name</i>
member of structure from template	<i>name.member</i>
member of pointed to structure	<i>pointer -> member</i>
Example. <i>(*p).x</i> and <i>p->x</i> are the same	
single value, multiple type structure	<i>union</i>
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	<i>++, --</i>
plus, minus, logical not, bitwise not	<i>+, -, !, ~</i>
indirection via pointer, address of object	<i>*pointer, &name</i>
cast expression to type	<i>(type) expr</i>
size of an object	<i>sizeof</i>
multiply, divide, modulus (remainder)	<i>*, /, %</i>
add, subtract	<i>+, -</i>
left, right shift [bit ops]	<i><<, >></i>
comparisons	<i>>, >=, <, <=</i>
comparisons	<i>==, !=</i>
bitwise and	<i>&</i>
bitwise exclusive or	<i>^</i>
bitwise or (incl)	<i> </i>
logical and	<i>&&</i>
logical or	<i> </i>
conditional expression	<i>expr₁ ? expr₂ : expr₃</i>
assignment operators	<i>+=, -=, *=, ...</i>
expression evaluation separator	<i>,</i>

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

Flow of Control

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

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

ANSI Standard Libraries

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

Character Class Tests *<ctype.h>*

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

String Operations *<string.h>*

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

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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(<i>chr</i>)</code>
print formatted data	<code>printf("format", <i>arg</i>₁,...)</code>
print to string <i>s</i>	<code>sprintf(<i>s</i>, "format", <i>arg</i>₁,...)</code>
read formatted data	<code>scanf("format", &<i>name</i>₁,...)</code>
read from string <i>s</i>	<code>sscanf(<i>s</i>, "format", &<i>name</i>₁,...)</code>
read line to string <i>s</i> (< <i>max</i> chars)	<code>gets(<i>s</i>, <i>max</i>)</code>
print string <i>s</i>	<code>puts(<i>s</i>)</code>

File I/O

declare file pointer	<code>FILE *<i>fp</i></code>
pointer to named file	<code>fopen("name", "mode")</code>
modes: <i>r</i> (read), <i>w</i> (write), <i>a</i> (append)	
get a character	<code>getc(<i>fp</i>)</code>
write a character	<code>putc(<i>chr</i>, <i>fp</i>)</code>
write to file	<code>fprintf(<i>fp</i>, "format", <i>arg</i>₁,...)</code>
read from file	<code>fscanf(<i>fp</i>, "format", <i>arg</i>₁,...)</code>
close file	<code>fclose(<i>fp</i>)</code>
non-zero if error	<code>ferror(<i>fp</i>)</code>
non-zero if EOF	<code>feof(<i>fp</i>)</code>
read line to string <i>s</i> (< <i>max</i> chars)	<code>fgets(<i>s</i>, <i>max</i>, <i>fp</i>)</code>
write string <i>s</i>	<code>fputs(<i>s</i>, <i>fp</i>)</code>

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

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

Variable Argument Lists <stdarg.h>

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

Standard Utility Functions <stdlib.h>

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

Conversions

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

Storage Allocation

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

Array Functions

search array for key	<code>bsearch(<i>key</i>, <i>array</i>, <i>n</i>, <i>size</i>, <i>cmp</i>())</code>
sort array ascending order	<code>qsort(<i>array</i>, <i>n</i>, <i>size</i>, <i>cmp</i>())</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>
<i>time</i> ₂ - <i>time</i> ₁ in seconds (double)	<code>difftime(<i>time</i>₂, <i>time</i>₁)</code>
arithmetic types representing times	<code>clock_t, time_t</code>
structure type for calendar time comps	<code>tm</code>
<i>tm_sec</i>	seconds after minute
<i>tm_min</i>	minutes after hour
<i>tm_hour</i>	hours since midnight
<i>tm_mday</i>	day of month
<i>tm_mon</i>	months since January
<i>tm_year</i>	years since 1900
<i>tm_wday</i>	days since Sunday
<i>tm_yday</i>	days since January 1
<i>tm_isdst</i>	Daylight Savings Time flag

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

Mathematical Functions <math.h>

Arguments and returned values are double

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