

C Reference Card (ANSI)

Program Structure/Functions

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

C Preprocessor

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

Data Types/Declarations

character (1 byte)	<code>char</code>
integer	<code>int</code>
real number (single, double precision)	<code>float, double</code>
short (16 bit integer)	<code>short</code>
long (32 bit integer)	<code>long</code>
double long (64 bit integer)	<code>long long</code>
positive or negative	<code>signed</code>
non-negative modulo 2 ^m	<code>unsigned</code>
pointer to int, float,...	<code>int*, float*,...</code>
enumeration constant	<code>enum tag {name₁=value₁,...};</code>
constant (read-only) value	<code>type const name;</code>
declare external variable	<code>extern</code>
internal to source file	<code>static</code>
local persistent between calls	<code>static</code>
no value	<code>void</code>
structure	<code>struct tag {...};</code>
create new name for data type	<code>typedef type name;</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)</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

suffix: long, unsigned, float	65536L, -1U, 3.0F
exponential form	4.2e1
prefix: octal, hexadecimal	0, 0x or 0X
<code>Example. 031 is 25, 0x31 is 49 decimal</code>	
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 <code>type</code>	<code>type *name;</code>
declare function returning pointer to <code>type</code>	<code>type *f();</code>
declare pointer to function returning <code>type</code>	<code>type (*pf)();</code>
generic pointer type	<code>void *</code>
null pointer constant	<code>NULL</code>
object pointed to by <code>pointer</code>	<code>*pointer</code>
address of object <code>name</code>	<code>&name</code>
array	<code>name[dim]</code>
multi-dim array	<code>name[dim₁][dim₂]...</code>

Structures

<code>struct tag {</code>	structure template
<code>declarations</code>	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>
<code>Example. (*p).x and p->x are the same</code>	
single object, multiple possible types	<code>union</code>
bit field with <code>b</code> bits	<code>unsigned member: b;</code>

Operators (grouped by precedence)

struct member operator	<code>name.member</code>
struct member through 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>
relational comparisons	<code>>, >=, <, <=</code>
equality comparisons	<code>==, !=</code>
and [bit op]	<code>&</code>
exclusive or [bit op]	<code>^</code>
or (inclusive) [bit op]	<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 <code>switch</code> , <code>while</code> , <code>do</code> , <code>for</code>	<code>break;</code>
next iteration of <code>while</code> , <code>do</code> , <code>for</code>	<code>continue;</code>
go to	<code>goto label;</code>
label	<code>label: statement</code>
return value from function	<code>return expr</code>

Flow Constructions

if statement	<code>if (expr₁) statement₁</code> <code>else if (expr₂) statement₂</code> <code>else statement₃</code>
while statement	<code>while (expr)</code> <code>statement</code>
for statement	<code>for (expr₁; expr₂; expr₃)</code> <code>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>isctrl(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>

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

C Reference Card (ANSI)

Input/Output <stdio.h>

Standard I/O

standard input stream	stdin
standard output stream	stdout
standard error stream	stderr
end of file (type is int)	EOF
get a character	getchar()
print a character	putchar(<i>chr</i>)
print formatted data	printf("format", <i>arg</i> ₁ , ...)
print to string <i>s</i>	sprintf(<i>s</i> , "format", <i>arg</i> ₁ , ...)
read formatted data	scanf("format", &name ₁ , ...)
read from string <i>s</i>	sscanf(<i>s</i> , "format", &name ₁ , ...)
print string <i>s</i>	puts(<i>s</i>)

File I/O

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

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 (printf) e, E exponential
f	float (scanf) lf double (scanf)
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 <i>ap</i> ;
initialization of argument pointer	va_start(<i>ap</i> , <i>lastarg</i>);
<i>lastarg</i> is last named parameter of the function	
access next unnamed arg, update pointer	va_arg(<i>ap</i> , <i>type</i>)
call before exiting function	va_end(<i>ap</i>);

Standard Utility Functions <stdlib.h>

absolute value of int <i>n</i>	abs(<i>n</i>)
absolute value of long <i>n</i>	labs(<i>n</i>)
quotient and remainder of ints <i>n, d</i>	div(<i>n, d</i>)
returns structure with <i>div_t.quot</i> and <i>div_t.rem</i>	
quotient and remainder of longs <i>n, d</i>	ldiv(<i>n, d</i>)
returns structure with <i>ldiv_t.quot</i> and <i>ldiv_t.rem</i>	
pseudo-random integer [0, RAND_MAX]	rand()
set random seed to <i>n</i>	srand(<i>n</i>)
terminate program execution	exit(<i>status</i>)
pass string <i>s</i> to system for execution	system(<i>s</i>)
Conversions	
convert string <i>s</i> to double	atof(<i>s</i>)
convert string <i>s</i> to integer	atoi(<i>s</i>)
convert string <i>s</i> to long	atol(<i>s</i>)
convert prefix of <i>s</i> to double	strtod(<i>s</i> , &endp)
convert prefix of <i>s</i> (base <i>b</i>) to long	strtoul(<i>s</i> , &endp, <i>b</i>)
same, but unsigned long	

Storage Allocation

allocate storage	malloc(<i>size</i>), calloc(<i>nobj</i> , <i>size</i>)
change size of storage	newptr = realloc(<i>ptr</i> , <i>size</i>);
deallocate storage	free(<i>ptr</i>);

Array Functions

search array for key	bsearch(<i>key</i> , <i>array</i> , <i>n</i> , <i>size</i> , <i>cmpf</i>)
sort array ascending order	qsort(<i>array</i> , <i>n</i> , <i>size</i> , <i>cmpf</i>)

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()
time ₂ -time ₁ in seconds (double)	difftime(time ₂ , time ₁)
arithmetic types representing times	clock_t, time_t
structure type for calendar time comps	struct 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(<i>tp</i>)
convert time in <i>tp</i> to string	asctime(<i>tp</i>)
convert calendar time in <i>tp</i> to local time	ctime(<i>tp</i>)
convert calendar time to GMT	gmtime(<i>tp</i>)
convert calendar time to local time	localtime(<i>tp</i>)
format date and time info	strftime(<i>s</i> , <i>smax</i> , "format", <i>tp</i>)
<i>tp</i> 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(<i>y/x</i>)	atan2(<i>y, x</i>)
hyperbolic trig functions	sinh(x), cosh(x), tanh(x)
exponentials & logs	exp(x), log(x), log10(x)
exponentials & logs (2 power)	ldexp(x, <i>n</i>), frexp(x, & <i>e</i>)
division & remainder	modf(x, <i>ip</i>), fmod(x, <i>y</i>)
powers	pow(x, <i>y</i>), 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, followed by minimum required values (if significantly different).

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

Float Type Limits <float.h>

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

FLT_RADIX	radix of exponent rep	(2)
FLT_ROUNDS	floating point rounding mode	
FLT_DIG	decimal digits of precision	(6)
FLT_EPSILON	smallest <i>x</i> so 1.0f + <i>x</i> ≠ 1.0f	(1.1E - 7)
FLT_MANT_DIG	number of digits in mantissa	
FLT_MAX	maximum float number	(3.4E38)
FLT_MAX_EXP	maximum exponent	
FLT_MIN	minimum float number	(1.2E - 38)
FLT_MIN_EXP	minimum exponent	
DBL_DIG	decimal digits of precision	(15)
DBL_EPSILON	smallest <i>x</i> so 1.0 + <i>x</i> ≠ 1.0	(2.2E - 16)
DBL_MANT_DIG	number of digits in mantissa	
DBL_MAX	max double number	(1.8E308)
DBL_MAX_EXP	maximum exponent	
DBL_MIN	min double number	(2.2E - 308)
DBL_MIN_EXP	minimum exponent	

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