C-STRING FUNCTIONS

Library or API Functions

#include <cstring>

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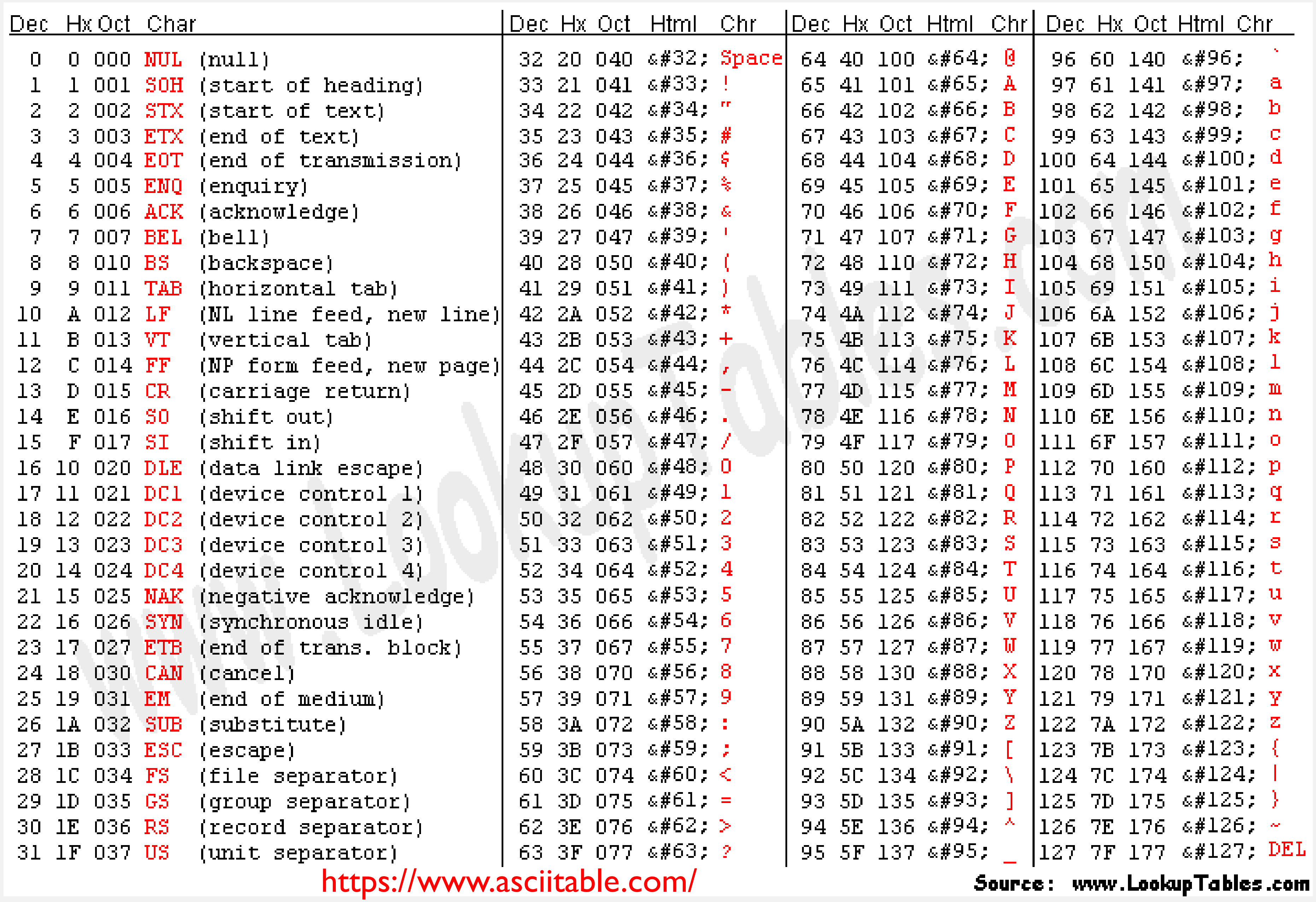
C-STRINGS ARE PRIMITIVE

- C-Strings are based on arrays and pointers: they are a primitive data type
  - Header file only needed when using the C-string functions
  - `#include <cstring>`
  - `#include <string.h>`

ASCII ENCODING

- Individual characters are encoded as integer values
  - ‘0’ – ‘9’ as 48 – 57
  - ‘A’ – ‘Z’ as 65 – 90
  - ‘a’ – ‘z’ as 97 – 122
  - punctuation characters are mixed in
  - control characters are 0 – 31
  - 128 – 255 are the extended ASCII



Dec	Hx	Oct	Char		Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL	(null)	32	20	040	&#32;	Space	64	40	100	&#64;	@	96	60	140	&#96;	`
1	1	001	SOH	(start of heading)	33	21	041	&#33;	!	65	41	101	&#65;	A	97	61	141	&#97;	a
2	2	002	STX	(start of text)	34	22	042	&#34;	"	66	42	102	&#66;	B	98	62	142	&#98;	b
3	3	003	ETX	(end of text)	35	23	043	&#35;	#	67	43	103	&#67;	C	99	63	143	&#99;	c
4	4	004	EOT	(end of transmission)	36	24	044	&#36;	$	68	44	104	&#68;	D	100	64	144	&#100;	d
5	5	005	ENQ	(enquiry)	37	25	045	&#37;	%	69	45	105	&#69;	E	101	65	145	&#101;	e
6	6	006	ACK	(acknowledge)	38	26	046	&#38;	&	70	46	106	&#70;	F	102	66	146	&#102;	f
7	7	007	BEL	(bell)	39	27	047	&#39;	'	71	47	107	&#71;	G	103	67	147	&#103;	g
8	8	010	BS	(backspace)	40	28	050	&#40;	(	72	48	110	&#72;	H	104	68	150	&#104;	h
9	9	011	TAB	(horizontal tab)	41	29	051	&#41;	)	73	49	111	&#73;	I	105	69	151	&#105;	i
10	A	012	LF	(NL line feed, new line)	42	2A	052	&#42;	*	74	4A	112	&#74;	J	106	6A	152	&#106;	j
11	B	013	VT	(vertical tab)	43	2B	053	&#43;	+	75	4B	113	&#75;	K	107	6B	153	&#107;	k
12	C	014	FF	(NP form feed, new page)	44	2C	054	&#44;	,	76	4C	114	&#76;	L	108	6C	154	&#108;	l
13	D	015	CR	(carriage return)	45	2D	055	&#45;	-	77	4D	115	&#77;	M	109	6D	155	&#109;	m
14	E	016	SO	(shift out)	46	2E	056	&#46;	.	78	4E	116	&#78;	N	110	6E	156	&#110;	n
15	F	017	SI	(shift in)	47	2F	057	&#47;	/	79	4F	117	&#79;	O	111	6F	157	&#111;	o
16	10	020	DLE	(data link escape)	48	30	060	&#48;	0	80	50	120	&#80;	P	112	70	160	&#112;	p
17	11	021	DC1	(device control 1)	49	31	061	&#49;	1	81	51	121	&#81;	Q	113	71	161	&#113;	q
18	12	022	DC2	(device control 2)	50	32	062	&#50;	2	82	52	122	&#82;	R	114	72	162	&#114;	r
19	13	023	DC3	(device control 3)	51	33	063	&#51;	3	83	53	123	&#83;	S	115	73	163	&#115;	s
20	14	024	DC4	(device control 4)	52	34	064	&#52;	4	84	54	124	&#84;	T	116	74	164	&#116;	t
21	15	025	NAK	(negative acknowledge)	53	35	065	&#53;	5	85	55	125	&#85;	U	117	75	165	&#117;	u
22	16	026	SYN	(synchronous idle)	54	36	066	&#54;	6	86	56	126	&#86;	V	118	76	166	&#118;	v
23	17	027	ETB	(end of trans. block)	55	37	067	&#55;	7	87	57	127	&#87;	W	119	77	167	&#119;	w
24	18	030	CAN	(cancel)	56	38	070	&#56;	8	88	58	130	&#88;	X	120	78	170	&#120;	x
25	19	031	EM	(end of medium)	57	39	071	&#57;	9	89	59	131	&#89;	Y	121	79	171	&#121;	y
26	1A	032	SUB	(substitute)	58	3A	072	&#58;	:	90	5A	132	&#90;	Z	122	7A	172	&#122;	z
27	1B	033	ESC	(escape)	59	3B	073	&#59;	;	91	5B	133	&#91;	[	123	7B	173	&#123;	{
28	1C	034	FS	(file separator)	60	3C	074	&#60;	<	92	5C	134	&#92;	\	124	7C	174	&#124;	|
29	1D	035	GS	(group separator)	61	3D	075	&#61;	=	93	5D	135	&#93;	]	125	7D	175	&#125;	}
30	1E	036	RS	(record separator)	62	3E	076	&#62;	>	94	5E	136	&#94;	^	126	7E	176	&#126;	~
31	1F	037	US	(unit separator)	63	3F	077	&#63;	?	95	5F	137	&#95;	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

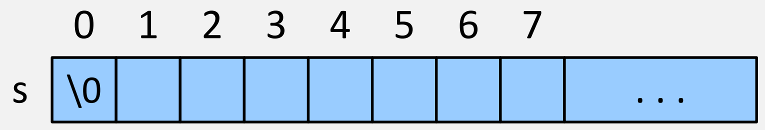
https://www.asciitable.com/

nullptr

- First introduced in chapter 4, nullptr indicates when a pointer variable isn’t pointing to anything (C++ also allows NULL and the numeral 0)
  - `char* p;`
  - `p = nullptr;`
  - `if (p == nullptr) . . .`
  - `if (p != nullptr) . . .`
- Function arguments and return values can be nullptr

EMPTY C-STRINGS

- An empty C-string is not the same as a null C-string
- Null C-strings do not have allocated memory
- Empty C-strings have memory but do not have data
- Must have the null-termination character
  - `char s[100] = "";`
  - `char s[100];  s[0] = '\0';`



PSEUDO DATA TYPES

- Pseudo data types are
  - aliases created as symbolic constants
  - converted to real types at compile time
  - used to improve code portability
  - typically named end with a "_t" at the end

- `size_t`
  - an integer suitable for hold a data size
- `errno_t`
  - an integer that encodes an error number

C-STRING FUNCTION ARGUMENTS

- The C-string arguments for the C-string functions(`<cstring>`) are shown as char*
- `char* strcpy(char* destination, const char* source);`
- Pointers must point to allocated memory
  - character array: `char s1[100];`
  - dynamic: `char* s2 = new char[100];`
  - `strcpy(s2, s1);`

CHARACTER POINTER RETURN VALUES

- Many C-string functions return a character pointer
  - `char* strcpy(char* destination, const char* source);`
  - The pointer is often one of the arguments; `return destination;`
  - This a convenience that allows embedding the call in a larger context:
  - `cout << strcpy(s2, s1) endl;`

MICROSOFT VISUAL STUDIO

- Microsoft replaces many of the standard C-string functions with secure versions whose names end with "_s"
  - One additional argument
  - Integer return type
  - Suppress with: `#define _CRT_SECURE_NO_WARNINGS`

  -
    ```
    errno_t strcpy_s(char *strDestination,
        size_t numberOfElements,
        const char *strSource);
    ```