ASCII and Other Data Types

Let's move from numbers to text. In particular, we will look at the American Standard Code for Information Exchange, or ASCII. ASCII is one standard for mapping characters to a binary value. ASCII has seven bits which provides us with 128 total characters (2 to the 7th).

Here is a table of ASCII values (image from Appendix E Introduction to Computing Systems, 2/e).

Table E.2 The Standard ASCII Table

ASCII			ASCII			ASCII			ASCII		
Character	Dec	Hex	Character	Dec	Hex	Character	Dec	Hex	Character	Dec	Hex
nul	0	00	sp	32	20	@	64	40	`	96	60
soh	1	01	!	33	21	A	65	41	a	97	61
stx	2	02	"	34	22	B	66	42	b	98	62
etx	3	03	#	35	23	C	67	43	c	99	63
eot	4	04	$	36	24	D	68	44	d	100	64
enq	5	05	%	37	25	E	69	45	e	101	65
ack	6	06	&	38	26	F	70	46	f	102	66
bel	7	07	'	39	27	G	71	47	g	103	67
bs	8	08	(	40	28	H	72	48	h	104	68
ht	9	09	)	41	29	I	73	49	i	105	69
lf	10	0A	*	42	2A	J	74	4A	j	106	6A
vt	11	0B	+	43	2B	K	75	4B	k	107	6B
ff	12	0C	,	44	2C	L	76	4C	l	108	6C
cr	13	0D	-	45	2D	M	77	4D	m	109	6D
so	14	0E	.	46	2E	N	78	4E	n	110	6E
si	15	0F	/	47	2F	O	79	4F	o	111	6F
dle	16	10	0	48	30	P	80	50	p	112	70
dc1	17	11	1	49	31	Q	81	51	q	113	71
dc2	18	12	2	50	32	R	82	52	r	114	72
dc3	19	13	3	51	33	S	83	53	s	115	73
dc4	20	14	4	52	34	T	84	54	t	116	74
nak	21	15	5	53	35	U	85	55	u	117	75
syn	22	16	6	54	36	V	86	56	v	118	76
etb	23	17	7	55	37	W	87	57	w	119	77
can	24	18	8	56	38	X	88	58	x	120	78
em	25	19	9	57	39	Y	89	59	y	121	79
sub	26	1A	:	58	3A	Z	90	5A	z	122	7A
esc	27	1B	;	59	3B	[	91	5B	{	123	7B
fs	28	1C	<	60	3C	\	92	5C	|	124	7C
gs	29	1D	=	61	3D	]	93	5D	}	125	7D
rs	30	1E	>	62	3E	^	94	5E	~	126	7E
us	31	1F	?	63	3F	_	95	5F	del	127	7F

In this table hex numbers are shown to the right and the ASCII character that's being represented to the left. For instance, '38' in hex represents the number '8,' '55' represents upper case 'U,' and '29' represents the closed parenthesis.

We also have both printable characters, such as those just described, and nonprintable characters, such as 'escape' and 'delete' and other similar keys that you would find on your keyboard.

You should note a few properties of ASCII code. Note the relationship between a decimal digit such as '0' or '1' -- and its ASCII code. Note the difference between an upper-case letter -- capital 'A', capital 'B' -- and its lower-case equivalent -- small 'a', small 'b' -- for instance.

You can also use the table to determine which of two ASCII characters would come first in alphabetical order.

Note that we are not introducing any new operations with ASCII. Instead, we will use normal integer arithmetic and logic operations, just as we do for numbers.

Finally, we should consider some other data types that we won't get a chance to talk about in this course, but may be covered in other courses:

• Text strings: a sequence of characters which is terminated with the ASCII value for NULL ('00').

• Pixels: in a black and white display you just need one bit to represent black, but in a color display you have a number of binary values: one for red, one for green, and one for blue. So for instance, if you have eight binary values for each of those three colors, you have 24

total bits. Two to the 24th equals over 16 million colors that you can represent.

• Floating point: used for real numbers, it is the equivalent of scientific notation. Floating point is a very important topic, but one we won't be able to cover that in this particular course.

Help

Click here to open ASCII Table in new window

When viewing the table in a new windown you can print out by right clicking on your mouse.

1. CHECK YOUR UNDERSTANDING (1/1 point)

How do we get the ASCII code equivalent of a decimal digit ('0', '1', ...)?

- ( ) Subtract decimal 30 from the digit to get the ASCII code.
- ( ) Add decimal 30 to the digit to get the ASCII code.
- (•) Add binary 00110000 to the digit in binary to get the ASCII code. ✔

EXPLANATION

From the ASCII table, we see that we need to add hex 30, or binary 00110000, to the digit.

Hide Answer *You have used 2 of 2 submissions*

2. CHECK YOUR UNDERSTANDING (1/1 point)

How do we convert from the ASCII code for a lower case letter ('a', 'b', ...) to the ASCII code for its upper case equivalent ('A', 'B', ...)?

- ( ) Subtract decimal 20 from the lower case letter ASCII code.
- (•) Subtract hexadecimal 20 from the lower case letter ASCII code. ✔
- ( ) Subtract binary 00110000 from the lower case letter ASCII code.

EXPLANATION

From the ASCII table, we see that we need to subtract hex 20 from the digit.

Final Check **Save** Hide Answer *You have used 1 of 2 submissions*

3. CHECK YOUR UNDERSTANDING (1/1 point)

Given the ASCII codes for two characters, which of the following methods will find the one that comes first in alphabetical order?

Compare the two hexadecimal values and pick the larger of the two.

Compare the two hexadecimal values and pick the smaller of the two.

First, convert both values to upper case. Then compare the two hexadecimal values and pick the larger of the two.

First, convert both values to lower case. Then compare the two hexadecimal values and pick the smaller of the two. ✔

Help

EXPLANATION

We need to convert to either upper or lower case first. If we compare an upper case with a lower case number, in come cases the upper case will be larger and in others the opposite will be true. Once we convert, the smaller of the two will be the one that comes first in alphabetical order.

Final Check | **Save** | **Hide Answer** *You have used 1 of 2 submissions*