THE ASCII CODE

In any computing system, data – of any type – is stored as numbers. Moreover, they are represented in base 2. Consequently, in order to store characters in the computer, it is necessary to use a representation of **characters** by numbers. One such representation is **the ASCII Code**.

Introduction

ASCII is a form of computer **representation of characters** used in all programming languages studied in high school, possibly alongside other representations.

The standard ASCII code encodes characters using 7 bits, so it allows 27=128 characters to be encoded. There aren't too many! In fact, only the letters of the English alphabet, the numbers 0 to 9, punctuation marks and operators, and other symbols are encoded. The letters specific to other Latin alphabets (so-called letters with **diacritics**, such as ă Ă Î â Âș Ş Ș ș Ş ţ Ş Ș Ş Ș Ř Ř are completely missing (we note that there are two types of Ș and two types of Ţ), as well as letters from other alphabets: Cyrillic, Hebrew, Arabic, Chinese, etc. The Extended ASCII code, or the code, can be used to memorize these letters **UNICODE**.

Through the ASCII code, each character represented in this code is associated with a number. These numbers (also called ASCII codes) are found in the range 0 .. 127. ASCII characters are divided into two categories:

- printable characters – those with ASCII codes in the range 32 126, including heads: all characters that have a well-defined graphic representation are found here:
  - capital letters: A ... Z,
  - lowercase letters: a ... z,
  - the numbers 0 .. 9,
  - the punctuation marks .,:;!?'"
  - characters representing arithmetic or other operations: + - / * <> = (){}[]
  - other characters: ~`@#$%^&_\|
  - **space character**
- unprintable, or control characters – with the codes 0 .. 31 and 127. They were used earlier to control data transmission. Non-printable characters do not have a well-defined graphical representation – depending on the operating system used, the graphical representations of these characters can be very different, or even missing altogether. Among these characters, we mention two, of greater importance in the studied programming languages:

  - the character with the code 0, also called the **null character**, denoted in C++ with '\0' - represents the end of a string of characters in memory
  - character with code 10, called **Line Feed**, denoted in C++ with '\n' – produces a newline when displayed on the screen or in a file.

Useful observations

- uppercase letters and lowercase letters are different – they have different ASCII codes
- the ASCII codes of the uppercase (or lowercase) letters are in order: 'A' has the code 65, 'B' has the code 66, .. , 'Z' has the code 90. Two consecutive characters in the alphabet have consecutive ASCII codes! Also, the letter 'a' has the code 97, etc.
- the ASCII codes of lowercase letters are greater than the ASCII codes of uppercase letters ('a' > 'Z') and the difference between the ASCII codes of two letters (lowercase – uppercase) is 32.
- the digits have consecutive codes: the character '0' has the code 48, the character '1' has the code 49, etc. *We note that the character '0' does not have the ASCII code 0, but 48.
- the space character is a printable character. **Space** has ASCII code 32.

ASCII TABLE

Decimal	Hexadecimal	Binary	Octal	Char
0	0	0	0	[NULL]
1	1	1	1	[START OF HEADING]
2	2	10	2	[START OF TEXT]
3	3	11	3	[END OF TEXT]
4	4	100	4	[END OF TRANSMISSION]
5	5	101	5	[ENQUIRY]
6	6	110	6	[ACKNOWLEDGE]
7	7	111	7	[BELL]
8	8	1000	10	[BACKSPACE]
9	9	1001	11	[HORIZONTAL TAB]
10	A	1010	12	[LINE FEED]
11	B	1011	13	[VERTICAL TAB]
12	C	1100	14	[FORM FEED]
13	D	1101	15	[CARRIAGE RETURN]
14	E	1110	16	[SHIFT OUT]
15	F	1111	17	[SHIFT IN]
16	10	10000	20	[DATA LINK ESCAPE]
17	11	10001	21	[DEVICE CONTROL 1]
18	12	10010	22	[DEVICE CONTROL 2]
19	13	10011	23	[DEVICE CONTROL 3]
20	14	10100	24	[DEVICE CONTROL 4]
21	15	10101	25	[NEGATIVE ACKNOWLEDGE]
22	16	10110	26	[SYNCHRONOUS IDLE]
23	17	10111	27	[END OF TRANS. BLOCK]
24	18	11000	30	[CANCEL]
25	19	11001	31	[END OF MEDIUM]
26	1A	11010	32	[SUBSTITUTE]
27	1B	11011	33	[ESCAPE]
28	1C	11100	34	[FILE SEPARATOR]
29	1D	11101	35	[GROUP SEPARATOR]
30	1E	11110	36	[RECORD SEPARATOR]
31	1F	11111	37	[UNIT SEPARATOR]
32	20	100000	40	[SPACE]
33	21	100001	41	!
34	22	100010	42	"
35	23	100011	43	#
36	24	100100	44	$
37	25	100101	45	%
38	26	100110	46	&
39	27	100111	47	'
40	28	101000	50	(
41	29	101001	51	)
42	2A	101010	52	*
43	2B	101011	53	+
44	2C	101100	54	,
45	2D	101101	55	-
46	2E	101110	56	.
47	2F	101111	57	/
48	30	110000	60	0
49	31	110001	61	1
50	32	110010	62	2
51	33	110011	63	3
52	34	110100	64	4
53	35	110101	65	5
54	36	110110	66	6
55	37	110111	67	7
56	38	111000	70	8
57	39	111001	71	9
58	3A	111010	72	:
59	3B	111011	73	;
60	3C	111100	74	<
61	3D	111101	75	=
62	3E	111110	76	>
63	3F	111111	77	?
64	40	1000000	100	@
65	41	1000001	101	A
66	42	1000010	102	B
67	43	1000011	103	C
68	44	1000100	104	D
69	45	1000101	105	E
70	46	1000110	106	F
71	47	1000111	107	G
72	48	1001000	110	H
73	49	1001001	111	I
74	4A	1001010	112	J
75	4B	1001011	113	K
76	4C	1001100	114	L
77	4D	1001101	115	M
78	4E	1001110	116	N
79	4F	1001111	117	O
80	50	1010000	120	P
81	51	1010001	121	Q
82	52	1010010	122	R
83	53	1010011	123	S
84	54	1010100	124	T
85	55	1010101	125	U
86	56	1010110	126	V
87	57	1010111	127	W
88	58	1011000	130	X
89	59	1011001	131	Y
90	5A	1011010	132	Z
91	5B	1011011	133	[
92	5C	1011100	134	\
93	5D	1011101	135	]
94	5E	1011110	136	^
95	5F	1011111	137	_
96	60	1100000	140	`
97	61	1100001	141	a
98	62	1100010	142	b
99	63	1100011	143	c
100	64	1100100	144	d
101	65	1100101	145	e
102	66	1100110	146	f
103	67	1100111	147	g
104	68	1101000	150	h
105	69	1101001	151	i
106	6A	1101010	152	j
107	6B	1101011	153	k
108	6C	1101100	154	l
109	6D	1101101	155	m
110	6E	1101110	156	n
111	6F	1101111	157	o
112	70	1110000	160	p
113	71	1110001	161	q
114	72	1110010	162	r
115	73	1110011	163	s
116	74	1110100	164	t
117	75	1110101	165	u
118	76	1110110	166	v
119	77	1110111	167	w
120	78	1111000	170	x
121	79	1111001	171	y
122	7A	1111010	172	z
123	7B	1111011	173	{
124	7C	1111100	174	|
125	7D	1111101	175	}
126	7E	1111110	176	~
127	7F	1111111	177	[DEL]