

Computer Programming 1

Laboratory 05

(fundamental data types – instructions – part 2)

ASCII encoding

ASCII Table

Dec	Hex	Oct	Char	Dec	Hex	Oct	Char	Dec	Hex	Oct	Char	Dec	Hex	Oct	Char
0	0	0		32	20	40	[space]	64	40	100	@	96	60	140	`
1	1	1		33	21	41	!	65	41	101	A	97	61	141	a
2	2	2		34	22	42	"	66	42	102	B	98	62	142	b
3	3	3		35	23	43	#	67	43	103	C	99	63	143	c
4	4	4		36	24	44	\$	68	44	104	D	100	64	144	d
5	5	5		37	25	45	%	69	45	105	E	101	65	145	e
6	6	6		38	26	46	&	70	46	106	F	102	66	146	f
7	7	7		39	27	47	'	71	47	107	G	103	67	147	g
8	8	10		40	28	50	(	72	48	110	H	104	68	150	h
9	9	11		41	29	51	)	73	49	111	I	105	69	151	i
10	A	12		42	2A	52	*	74	4A	112	J	106	6A	152	j
11	B	13		43	2B	53	+	75	4B	113	K	107	6B	153	k
12	C	14		44	2C	54	,	76	4C	114	L	108	6C	154	l
13	D	15		45	2D	55	-	77	4D	115	M	109	6D	155	m
14	E	16		46	2E	56	.	78	4E	116	N	110	6E	156	n
15	F	17		47	2F	57	/	79	4F	117	O	111	6F	157	o
16	10	20		48	30	60	0	80	50	120	P	112	70	160	p
17	11	21		49	31	61	1	81	51	121	Q	113	71	161	q
18	12	22		50	32	62	2	82	52	122	R	114	72	162	r
19	13	23		51	33	63	3	83	53	123	S	115	73	163	s
20	14	24		52	34	64	4	84	54	124	T	116	74	164	t
21	15	25		53	35	65	5	85	55	125	U	117	75	165	u
22	16	26		54	36	66	6	86	56	126	V	118	76	166	v
23	17	27		55	37	67	7	87	57	127	W	119	77	167	w
24	18	30		56	38	70	8	88	58	130	X	120	78	170	x
25	19	31		57	39	71	9	89	59	131	Y	121	79	171	y
26	1A	32		58	3A	72	:	90	5A	132	Z	122	7A	172	z
27	1B	33		59	3B	73	;	91	5B	133	[	123	7B	173	{
28	1C	34		60	3C	74	<	92	5C	134	\	124	7C	174	|
29	1D	35		61	3D	75	=	93	5D	135	]	125	7D	175	}
30	1E	36		62	3E	76	>	94	5E	136	^	126	7E	176	~
31	1F	37		63	3F	77	?	95	5F	137	_	127	7F	177	

3

Example 3.1(a): implication

Write a program that calculates the truth table of the implication operator ($P \rightarrow Q$). The Program receives the value of P and Q as input from the user

P	Q	$P \rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

Variant: if possible, without using additional libraries

Example 3.1(b): implication

Write a program that calculates the truth table of the implication operator ($P \rightarrow Q$). The Program receives the value of P and Q as input from the user

P	Q	$P \rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

Variant: if possible, without using additional libraries and if-then-else statements

Example 3.2: absolute value

Write a program that, given two numbers as input, a and b, calculates the result, in absolute value, of the operation (a-b).

Three variants of the implementation:

1. implementation using the function `abs` in the library `<cmath>`
2. implementation without the `<cmath>` functions but with if-then-else statements
3. implementation without using `<cmath>` functions and without then-else statements

```
#include <cmath>
float absolute = abs(-5.0) // 5.0
```

Reference to the library `<cmath>`

<http://www.cplusplus.com/reference/cmath/>

Example 3.3: max-min

Write a program that, given two numbers as input, a and b, stores them in two distinct variables, max and min, in which the first will contain the greater number of the two and the second the smaller. Then print these variables on the screen.

Three variants of the implementation:

1. implementation using the functions max/min in the library <cmath>
2. implementation without the <cmath> functions but with if-else statements
3. implementation without using <cmath> functions and without if-else statements

```
#include <cmath>  
max(a,b)  
min(a,b)
```

Reference to the library <cmath>

<http://www.cplusplus.com/reference/cmath/>

4

Example 4.1: Fibonacci

Write a program that, given in input an integer value n , prints on the screen the sequence of Fibonacci up to the n -th digit.

Constraint: use only the main function, no other functions

$$F_0 = 0,$$

$$F_1 = 1,$$

$$F_n = F_{n-1} + F_{n-2} \quad (\text{for each } n > 1)$$

Example 4.2: Binary to decimal conversion

Write a program that reads in input a binary number and prints on the screen the decimal value corresponding to the binary number

Constraint: do not use libraries or automatic conversion, rather implement the following computation:

Input: 10010 => 18

$$\begin{aligned} 10010 &= 1 \cdot 2^4 + 0 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 \\ &= 1 \cdot 16 + 0 \cdot 8 + 0 \cdot 4 + 1 \cdot 2 + 0 \cdot 1 \\ &= 18 \end{aligned}$$

Example 4.3: ASCII bis

Write a program that prints the ASCII value of all lowercase and uppercase letters of the alphabet on the screen

Example 4.4: ASCII three

Write a program that prints on the screen the character corresponding to the ASCII values between a range a and b defined by the input of the user.

Add also a check to verify that the interval entered by the user is valid, otherwise terminate the program.

Example 4.5: ASCII Art

Write a program that draws on the terminal a triangle whose lines must be composed of an odd number of asterisks. The height of this triangle is given in input by the user.

E.g., A=4

```
  *  
 ***  
*****  
*****
```

Example 4.6: Guess the number

Write a program that:

1. generates a number between 1 and 10 by using the *rand* function presented below
2. then, the program asks the user to enter a number (for guessing the generated number)
3. the program checks the entered number and compares it with the generated one
4. if the numbers are equal, then the program end (go to step 6) since the generated number has been guessed
5. otherwise, the program gives a suggestion to the user (e.g., “the number is too big/small”) and re-executes from step.2
6. the program print a message with the numbers of tentative done by the user, and conclude the execution

```
#include <cstdlib>
```

```
srand(time(NULL));
```

```
int random_number = rand() % 10 + 1
```

For additional information:

<https://cplusplus.com/reference/cstdlib/srand/>

Example 4.7: Harmonic Series

Calculate the result of the harmonic series till an integer N value provided by the user.

$$\sum_{i=1}^N \frac{1}{i} = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{N}$$

Example 4.8: Sum among prime number

Write a program that, given in input a number by the user, returns to the screen if this number can be expressed as the sum of two prime numbers. Also print the corresponding prime numbers on the screen

Input: 22 => Output: 17 + 5