USABLE MACHINE CODE FROM ASSEMBLY LANGUAGE

www.reallygreatsite.com

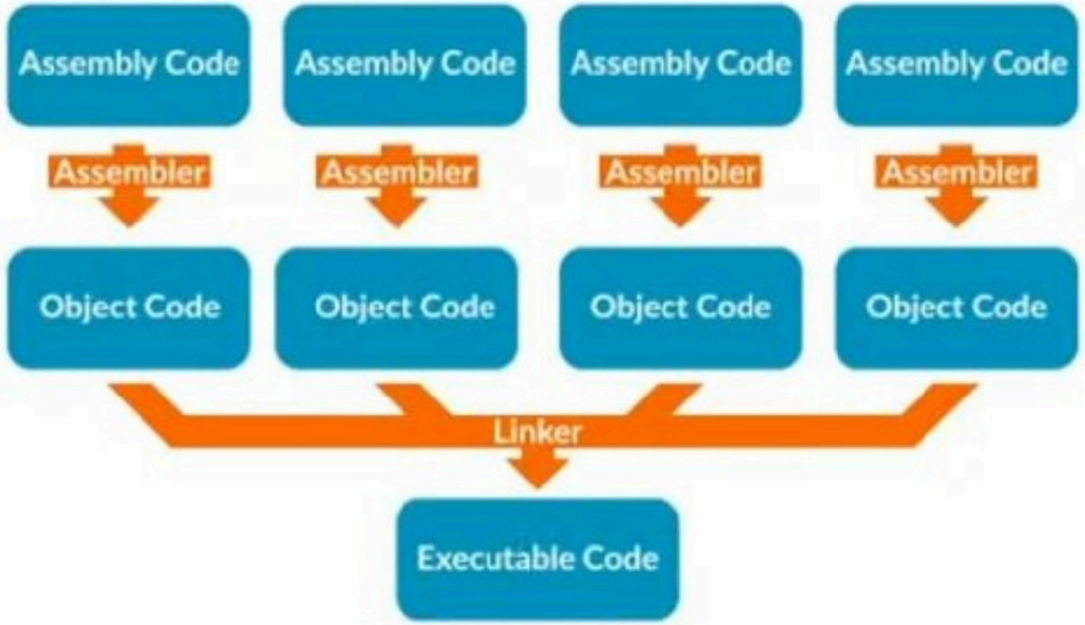

Figure 1.14.

The relationship between assembly code and machine code is a lot closer than between,
say, Python and machine code. It still takes at least two stages to convert assembly code into
something which is directly executable.

First of all, the assembly code, written in an assembly code editor, goes through a piece of software called assembler. This produces object code: machine code which is almost executable But is not quite finished yet. In fact, this happens a few times, with each module or library needed being converted into object code. Another program called a linker then takes all of these object files and combines them into a single executable file: machine code. In Windows, this is a .exe file. For general-purpose computers, this is all that is needed. However, for a lot of microcontrollers the programs are stored on a ROM, or EEPROM. (electronically erasable programmable read-only memory).

Example:

1. First, we need to try to read a character from the console and move it into register x0.

```
1  echo_loop:
2          mrs x0,console      // read next character from console
3          cbz x0,echo_loop    // busy wait if no character present
4          msr console,x0      // echo character to the console - there must be a character now
5          b switch_case       // jump to switch case to do thexor
6  switch_case:
7          eor x1, x0, #32     // xor with 32 (the space character)
8          msr console,x1      // echo to console
9          mov x0, #0          // clear the input character
10         b echo_loop         //jump back to echo_loop
```

CII	Decimal	Binary	Octal	Hex	ASCII	Decimal	Binary	Octal	Hex	ASCII
	64	01000000	100	40	@	96	01100000	140	60	`
	65	01000001	101	41	A	97	01100001	141	61	a
	66	01000010	102	42	B	98	01100010	142	62	b
	67	01000011	103	43	C	99	01100011	143	63	c
	68	01000100	104	44	D	100	01100100	144	64	d
	69	01000101	105	45	E	101	01100101	145	65	e
	70	01000110	106	46	F	102	01100110	146	66	f
	71	01000111	107	47	G	103	01100111	147	67	g
	72	01001000	110	48	H	104	01101000	150	68	h
	73	01001001	111	49	I	105	01101001	151	69	i
	74	01001010	112	4A	J	106	01101010	152	6A	j
	75	01001011	113	4B	K	107	01101011	153	6B	k
	76	01001100	114	4C	L	108	01101100	154	6C	l
	77	01001101	115	4D	M	109	01101101	155	6D	m
	78	01001110	116	4E	N	110	01101110	156	6E	n
	79	01001111	117	4F	O	111	01101111	157	6F	o
	80	01010000	120	50	P	112	01110000	160	70	p
	81	01010001	121	51	Q	113	01110001	161	71	q
	82	01010010	122	52	R	114	01110010	162	72	r
	83	01010011	123	53	S	115	01110011	163	73	s
	84	01010100	124	54	T	116	01110100	164	74	t
	85	01010101	125	55	U	117	01110101	165	75	u
	86	01010110	126	56	V	118	01110110	166	76	v
	87	01010111	127	57	W	119	01110111	167	77	w
	88	01011000	130	58	X	120	01111000	170	78	x
	89	01011001	131	59	Y	121	01111001	171	79	y
	90	01011010	132	5A	Z	122	01111010	172	7A	z
	91	01011011	133	5B	[	123	01111011	173	7B	{
	92	01011100	134	5C	\	124	01111100	174	7C	|
	93	01011101	135	5D	]	125	01111101	175	7D	}
	94	01011110	136	5E	^	126	01111110	176	7E	~
	95	01011111	137	5F	_	127	01111111	177	7F	DEL

THANK YOU