A string is a series of characters, such as "hello, world" or "albatross".

The Swift **String** type is used to represent a string.

A computer only understands numbers.

One bit, can be on or off.

```
0
1
```

So with one bit, you can represent two values.

If you have 2 bits:

```
00  => decimal 0
01  => decimal 1
10  => decimal 2
11  => decimal 3
```

With two bits, you can represent four values.

If you have 3 bits:

binary	*decimal*
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

With three bits, you can represent eight values.

If you have 4 bits:

binary	*decimal*	*hexadecimal*
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

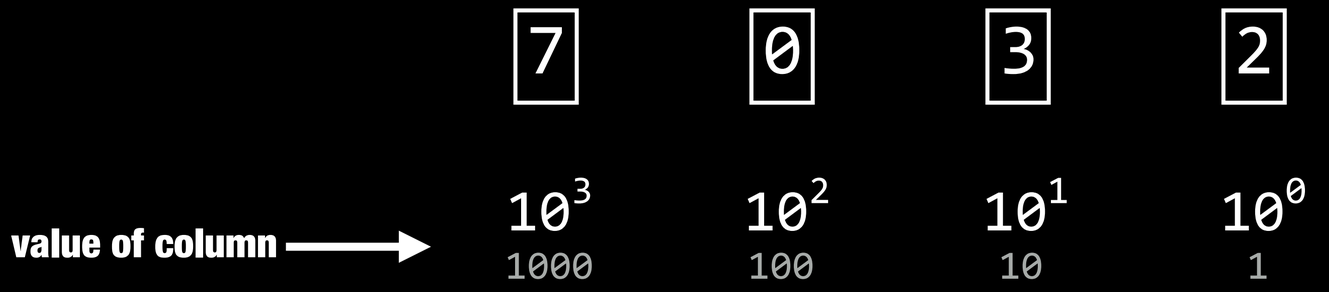
With four bits, you can represent sixteen values.

Binary

The base-2 numeral system uses only two values - zero and one.

Number Systems

Base 10

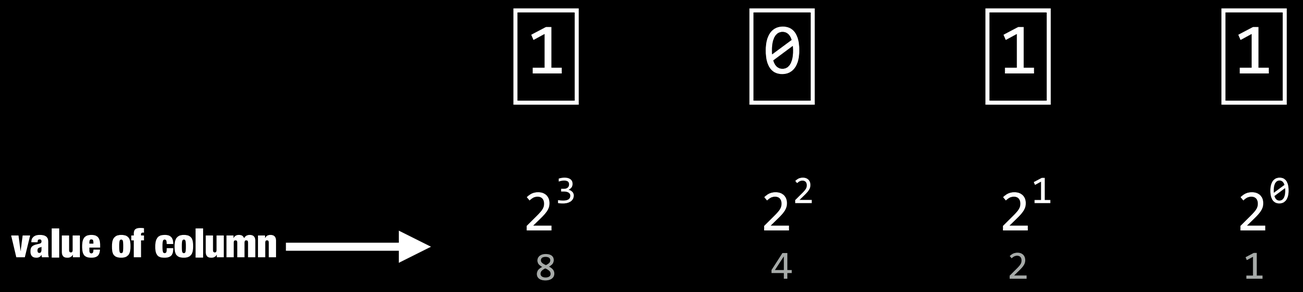


$$(7 \times 1000) + (0 \times 100) + (3 \times 10) + (2 \times 1) = 7032$$

“decimal”

Number Systems

Base 2



$(1 \times 8) + (0 \times 4) + (1 \times 2) + (1 \times 1) = 11$

“binary”

Number Systems

Base 16

A	0	F	2
16^3	16^2	16^1	16^0
4096	256	16	1

value of column →

(10 x 4096) + (0 x 256) + (15 x 16) + (2 x 1) = 41202

“hexadecimal”

8 bits
256 values

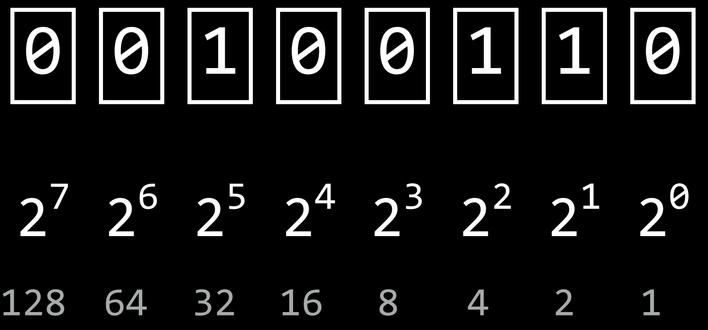
0-15	16-31	32-47	48-63	64-79	80-95	96-111	112-127
00000000	00010000	00100000	00110000	01000000	01010000	01100000	01110000
00000001	00010001	00100001	00110001	01000001	01010001	01100001	01110001
00000010	00010010	00100010	00110010	01000010	01010010	01100010	01110010
00000011	00010011	00100011	00110011	01000011	01010011	01100011	01110011
00000100	00010100	00100100	00110100	01000100	01010100	01100100	01110100
00000101	00010101	00100101	00110101	01000101	01010101	01100101	01110101
00000110	00010110	00100110	00110110	01000110	01010110	01100110	01110110
00000111	00010111	00100111	00110111	01000111	01010111	01100111	01110111
00001000	00011000	00101000	00111000	01001000	01011000	01101000	01111000
00001001	00011001	00101001	00111001	01001001	01011001	01101001	01111001
00001010	00011010	00101010	00111010	01001010	01011010	01101010	01111010
00001011	00011011	00101011	00111011	01001011	01011011	01101011	01111011
00001100	00011100	00101100	00111100	01001100	01011100	01101100	01111100
00001101	00011101	00101101	00111101	01001101	01011101	01101101	01111101
00001110	00011110	00101110	00111110	01001110	01011110	01101110	01111110
00001111	00011111	00101111	00111111	01001111	01011111	01101111	01111111

128-143	144-159	160-175	176-191	192-207	208-223	224-239	240-255
10000000	10010000	10100000	10110000	11000000	11010000	11100000	11110000
10000001	10010001	10100001	10110001	11000001	11010001	11100001	11110001
10000010	10010010	10100010	10110010	11000010	11010010	11100010	11110010
10000011	10010011	10100011	10110011	11000011	11010011	11100011	11110011
10000100	10010100	10100100	10110100	11000100	11010100	11100100	11110100
10000101	10010101	10100101	10110101	11000101	11010101	11100101	11110101
10000110	10010110	10100110	10110110	11000110	11010110	11100110	11110110
10000111	10010111	10100111	10110111	11000111	11010111	11100111	11110111
10001000	10011000	10101000	10111000	11001000	11011000	11101000	11111000
10001001	10011001	10101001	10111001	11001001	11011001	11101001	11111001
10001010	10011010	10101010	10111010	11001010	11011010	11101010	11111010
10001011	10011011	10101011	10111011	11001011	11011011	11101011	11111011
10001100	10011100	10101100	10111100	11001100	11011100	11101100	11111100
10001101	10011101	10101101	10111101	11001101	11011101	11101101	11111101
10001110	10011110	10101110	10111110	11001110	11011110	11101110	11111110
10001111	10011111	10101111	10111111	11001111	11011111	11101111	11111111

An ***unsigned*** 8-bit integer can store values 0 to 255.

An ***signed*** 8-bit integer can store values -128 to 127.

Unsigned 8-bit number



(1 x 32) + (1 x 4) + (1 x 2) = 38

(or 26 hexadecimal)

Unsigned 8-bit number

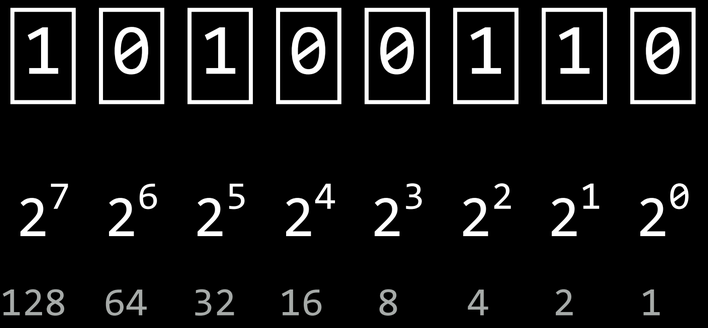
1	0	1	0	0	1	1	0
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

(1 x 128) + (1 x 32) + (1 x 4) + (1 x 2) = 166

(or A6 hexadecimal)

Signed 8-bit number

two's complement



$$(1 \times 32) + (1 \times 4) + (1 \times 2) - (1 \times 128) = -90$$

How to represent a character, using a number.

Decide on a “character encoding” - a table of codes in which you can identify each character with a number. For example:

```
65 represents ‘A’
66 represents ‘B’
67 represents ‘C’
and so on …
```

1960 - ASCII

American Standard Code for Information Interchange

Originally based on telegraph codes, and only used 7-bit values. Some of the characters made sense in the era of teletype machines, but are archaic today - for example Bell, Form Feed, Carriage Return

Originally based on the English alphabet, ASCII encodes 128 specified characters into seven-bit integers. The characters encoded are numbers 0 to 9, lowercase letters a to z, uppercase letters A to Z, basic punctuation symbols, control codes that originated with Teletype machines, and a space.

ASCII

Character set [edit]

Legend:

- Alphabetic
- Control character
- Numeric digit
- Punctuation
- Extended punctuation
- Graphic character
- International
- Undefined

ASCII (1977/1986)

	_0	_1	_2	_3	_4	_5	_6	_7	_8	_9	_A	_B	_C	_D	_E	_F
0_	NUL 0000 *0*	SOH 0001 *1*	STX 0002 *2*	ETX 0003 *3*	EOT 0004 *4*	ENQ 0005 *5*	ACK 0006 *6*	BEL 0007 *7*	BS 0008 *8*	HT 0009 *9*	LF 000A *10*	VT 000B *11*	FF 000C *12*	CR 000D *13*	SO 000E *14*	SI 000F *15*
1_	DLE 0010 *16*	DC1 0011 *17*	DC2 0012 *18*	DC3 0013 *19*	DC4 0014 *20*	NAK 0015 *21*	SYN 0016 *22*	ETB 0017 *23*	CAN 0018 *24*	EM 0019 *25*	SUB 001A *26*	ESC 001B *27*	FS 001C *28*	GS 001D *29*	RS 001E *30*	US 001F *31*
2_	SP 0020 *32*	! 0021 *33*	" 0022 *34*	# 0023 *35*	$ 0024 *36*	% 0025 *37*	& 0026 *38*	' 0027 *39*	(0028 *40*	) 0029 *41*	* 002A *42*	+ 002B *43*	, 002C *44*	- 002D *45*	. 002E *46*	/ 002F *47*
3_	0 0030 *48*	1 0031 *49*	2 0032 *50*	3 0033 *51*	4 0034 *52*	5 0035 *53*	6 0036 *54*	7 0037 *55*	8 0038 *56*	9 0039 *57*	: 003A *58*	; 003B *59*	< 003C *60*	= 003D *61*	> 003E *62*	? 003F *63*
4_	@ 0040 *64*	A 0041 *65*	B 0042 *66*	C 0043 *67*	D 0044 *68*	E 0045 *69*	F 0046 *70*	G 0047 *71*	H 0048 *72*	I 0049 *73*	J 004A *74*	K 004B *75*	L 004C *76*	M 004D *77*	N 004E *78*	O 004F *79*
5_	P 0050 *80*	Q 0051 *81*	R 0052 *82*	S 0053 *83*	T 0054 *84*	U 0055 *85*	V 0056 *86*	W 0057 *87*	X 0058 *88*	Y 0059 *89*	Z 005A *90*	[005B *91*	\ 005C *92*	] 005D *93*	^ 005E *94*	_ 005F *95*
6_	` 0060 *96*	a 0061 *97*	b 0062 *98*	c 0063 *99*	d 0064 *100*	e 0065 *101*	f 0066 *102*	g 0067 *103*	h 0068 *104*	i 0069 *105*	j 006A *106*	k 006B *107*	l 006C *108*	m 006D *109*	n 006E *110*	o 006F *111*
7_	p 0070 *112*	q 0071 *113*	r 0072 *114*	s 0073 *115*	t 0074 *116*	u 0075 *117*	v 0076 *118*	w 0077 *119*	x 0078 *120*	y 0079 *121*	z 007A *122*	{ 007B *123*	| 007C *124*	} 007D *125*	~ 007E *126*	DEL 007F *127*

1987 - Unicode

A modern attempt at consistent encoding and representation of text.

Not US centric. The latest version (9) contains more than 128,000 characters, from 135 scripts.

Unicode has multiple character encodings.

UTF-8 - uses 8-bit byte, and is backward compatible with ASCII.

UTF-16 - uses 16-bit unit, OR two 16 bit values.

String

```
let city = “Tempe”
var name = “Jane Doe”

var message = “Hello ” + name
```

String

```
let count = 17

var message = “value of count is \(count)”
```

String interpolation

```
let count = 17
var message = “value of count is \(count)”
```

String interpolation is a way to construct a new String value from a mix of constants, variables, literals, and expressions by including their values from inside a string literal.

In this example, the placeholder \(count) will be replaced with the actual value of the count constant, when the string interpolation is evaluated.

String

```
let count = 17


var message = "I 💙 NY"
var blueHeart = "\u{1F499}"
```