

BLOCKCHAIN TUTORIAL I

Binary, decimal and hexadecimal

10101001 10001101 10101011 01011010 00110010 10111110 01000010 01101000 00000111

01001011 10000100 11101010 01101011 10110000 01101101 10000101 01101101 10110011

71 42 191 25 72 142 176 170 106 124 97 216, 249 223 70 103 27 104 154 154 255 181 200 157

123 64 3 111 29 214 133 236 189 231 139 172 212 42 210 78 123 3 205 99 184 68 199

A98DAB5A32BE4268074B84EA6BB06D856DB33E6B68579463034F04D3AC6803D8472ABF19488EB0AA6A

7C61D8F9DF46671B689A9AFFB5C89D7B40036F1DD685EC2BE4268074B84EA6BB06D856DB33E6

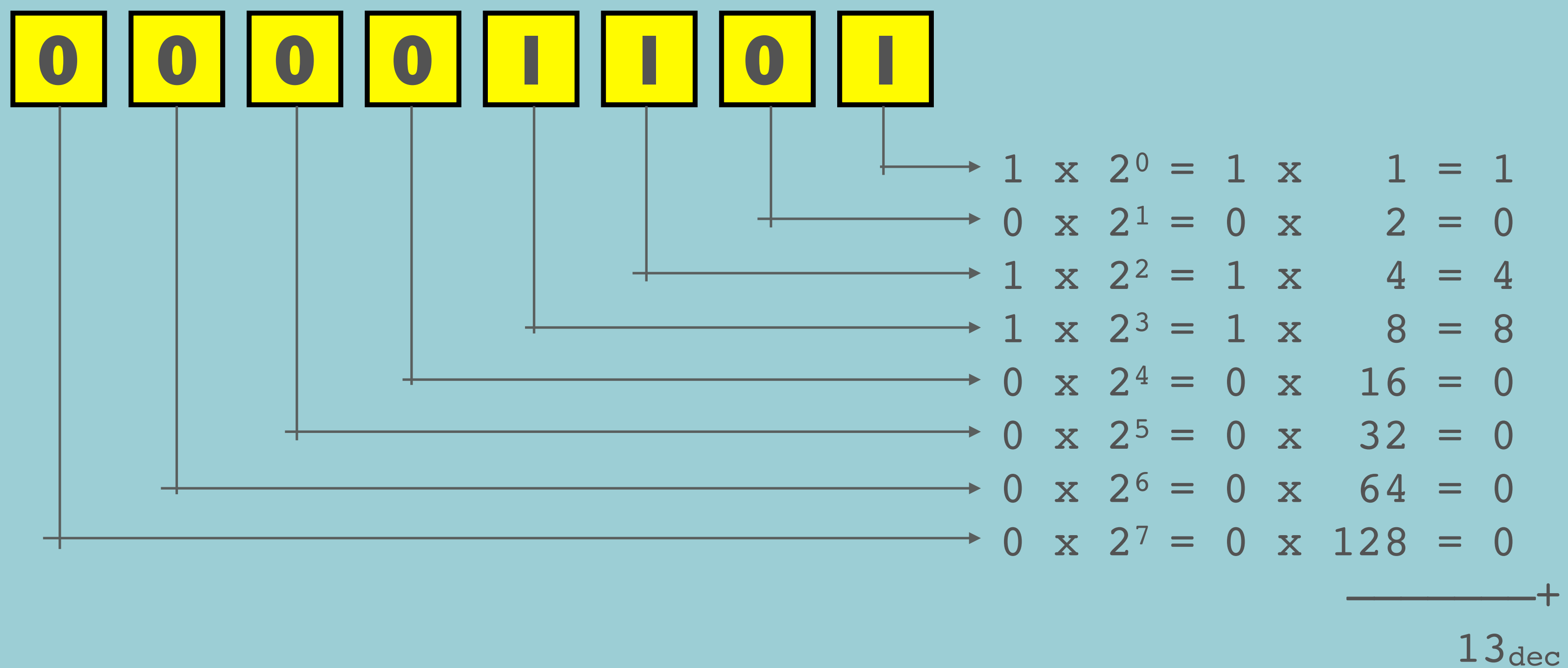
BLOCKCHAIN TUTORIAL I

Binary, decimal and hexadecimal numbers

BINARY NUMBERS

- Binary numbers consists of two symbols: 0 and 1
- A zero (0) or a one (1) is called a bit (**binary digit**)
- A binary number of 8 bits is called a byte: 10110111
- Two bytes has 16 bits, three bytes has 24 bits,
- Binary numbers are used in computers
- A binary system is called a base-2 numeral system

BINARY NUMBERS



BINARY NUMBERS

1 0 1 0

What is the decimal value of this binary number?

- Answer: 10

DECIMAL NUMBERS

- Decimal numbers consists of ten symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9
- Decimal numbers are used by humans
- Decimal comes from the Latin word decimus meaning 10
- A decimal system is called a base-10 numeral system

DECIMAL NUMBERS

The diagram illustrates the expansion of the decimal number 7905. The digits 7, 9, 0, and 5 are shown in yellow boxes. Arrows point from each digit to its corresponding place value calculation:

- 5 $\times 10^0 = 5 \times 1 = 5$
- 0 $\times 10^1 = 0 \times 10 = 0$
- 9 $\times 10^2 = 9 \times 100 = 900$
- 7 $\times 10^3 = 7 \times 1000 = 7000$

The results are summed to give the final value:

$$\begin{array}{r} 7000 \\ + 900 \\ + 0 \\ + 5 \\ \hline 7905_{\text{dec}} \end{array}$$

HEXADECIMAL NUMBERS

- Hexadecimal numbers consists of 16 symbols: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e and f
- Hexadecimal numbers are used in computers and by humans
- The Latin word hexa means 6, decimal comes from the Latin word decimus meaning 10, together it means 16
- Few hexadecimal numbers: 57aa, 57AA, bb89ff, ff, 9486
- Hexadecimal numbers are often prefixed by “0x”, for example 0x9486, to avoid to be mistaken to be a decimal number
- A hexadecimal system is called a base-16 numeral system

HEXADECIMAL NUMBERS

$$\begin{array}{r} \boxed{8} \quad \boxed{a} \quad \boxed{0} \quad \boxed{f} \\ \begin{array}{l} \longrightarrow f \times 16^0 = f \times 1 = 15 \times 1 = 15 \\ \longrightarrow 0 \times 16^1 = 0 \times 16 = 0 \times 16 = 0 \\ \longrightarrow a \times 16^2 = a \times 256 = 10 \times 256 = 2560 \\ \longrightarrow 8 \times 16^3 = 8 \times 4096 = 8 \times 4096 = 32768 \end{array} \\ \hline + \\ 35343_{\text{dec}} \end{array}$$

$$a = 10$$

$$b = 11$$

$$c = 12$$

$$d = 13$$

$$e = 14$$

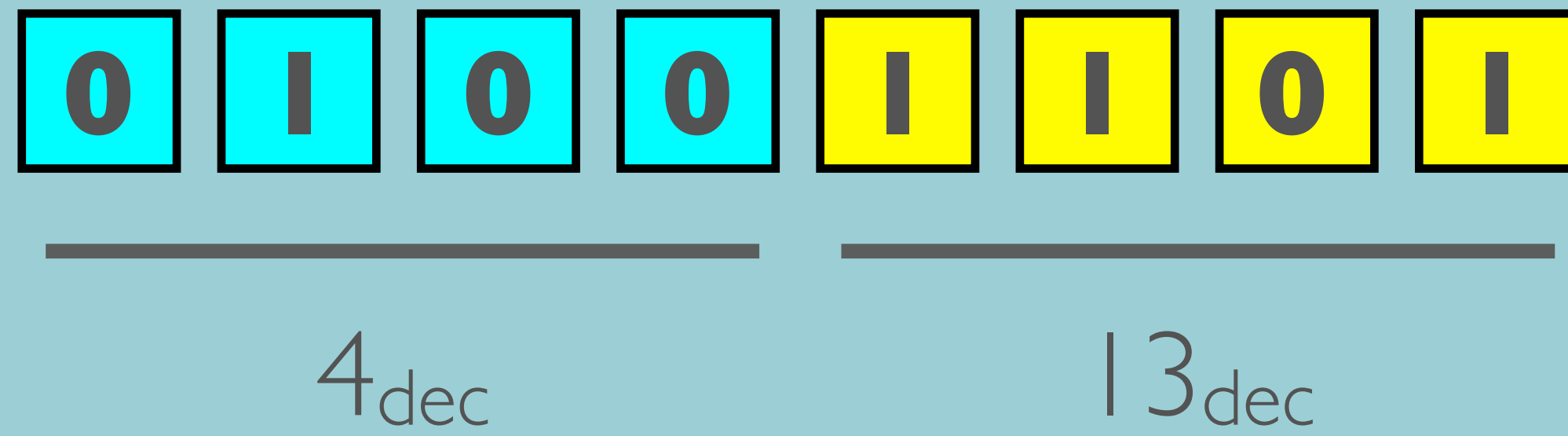
$$f = 15$$

HEXADECIMAL NUMBERS

- A binary number with a length 4 bits has in total 16 combinations

Binary	Decimal	Hex	Binary	Decimal	Hex
0000	0	0	1000	8	8
0001	1	1	1001	9	9
0010	2	2	1010	10	a
0011	3	3	1011	11	b
0100	4	4	1100	12	c
0101	5	5	1101	13	d
0110	6	6	1110	14	e
0111	7	7	1111	15	f

HEXADECIMAL NUMBERS



What is the hexadecimal value of this binary number?

- Answer: 0x4d
- Remember: every 4 bits is represented by 1 hexadecimal symbol