

Representing Information*

You are given a set of 5 cards, as in Figure 1. The backside of each card is empty (white).

Task 1 Flip some of the cards so that the number of visible dots becomes

- (a) 5 (b) 3 (c) 17.

Can you find multiple ways to obtain the same number of dots? <

Task 2 What is the largest number that can be represented with the cards? The smallest? Is there any number between the smallest and the largest that can not be represented? Argument your answer. <

Task 3 Find a(n efficient) way to represent all numbers 1,2, ..., 31. <

We will now use 0 and 1 to represent whether a card is hidden (face down) or not (face up). We write 0 for a hidden card and 1 for a card that is face up. For example, the pattern in Figure 1 represents 11111 as no card

*This class material follows Section I.1 from the book Computer Science Unplugged by Tim Bell, Ian H. Witten, and Mike Fellows

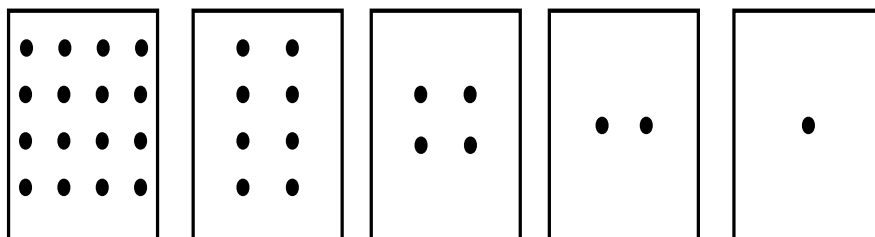


Figure 1: Cards with dots

is hidden. We call this representation *binary representation* of the number of shown dots.

Task 4 What is the binary representation for

(a) 5 (b) 3 (c) 17 ? (Recall Task 1 !)

Which number (of dots) is represented by the binary representation:

(a) 01100 (b) 10111 (c) 00101 (d) 111001 ?

Can you find multiple ways to represent the same number? ◀

- If we were to add a sixth card, how many dots would it have? You probably answered this question in Task 4(d).
- How can we represent any number in binary representation?
- How can we obtain the number that a given binary representation represents?

Binary representation is the way to store information on a computer. The value 0 or 1 is called a *bit*, for binary digit. Bits are grouped together to represent larger numbers. For example, with 8 bits (called *byte*) we can represent the numbers 0 to 255. Letters can also be given binary representation as follows: First, letters are translated to numbers as in the table below. Then the numbers are represented in binary representation.

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
q	r	s	t	u	v	w	x	y	z						
17	18	19	20	21	22	23	24	25	26						

Task 5 Work out the message written with the following letters in binary representation (where 0 represented in binary by 00000 denotes the empty space):

10111 00101 01100 01100 00000 00100 01111 01110 00101.

Task 6*

- (a) Find a procedure to add 1 to a number in binary representation. (Think of Task 3)
- (b) Find a procedure to multiply a number in binary representation by 2.

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